CAST Food-Animal Agriculture Symposium

Sustaining Animal Agriculture: Balancing Bioethical, Economic, and Social Issues

United States Department of Agriculture
Jefferson Auditorium, South Agriculture Building
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Edited by

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and

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Preface

Recognizing the fact that food-animal agriculture is rapidly evolving through inputs from diverse sectors, the Council for Agricultural Science and Technology (CAST) in cooperation with the United States Department of Agriculture (USDA) developed and hosted a symposium for discussion of these issues. Titled Sustaining Animal Agriculture: Balancing Bioethical, Economic, and Social Issues, the meeting was held on June 8 – 10, 2010 at the Jefferson Auditorium, South Agriculture Building, Washington, D. C.

The meaning of "sustainable animal agriculture" differs among the many groups involved in agriculture: to some, the term represents the status quo; to others, the same words express a need for change. The goal of CAST and the USDA in organizing this symposium was to bring together a highly qualified steering committee to identify a diverse group of speakers who could explore the many aspects of food-animal agriculture and its interaction with crops, land utilization, and society. That goal was met when thirty-two experts participated as speakers, panelists, or moderators during the 3-day event.

The symposium objectives were to (1) discuss the impacts of legal mandates, such as ballot initiatives or regulations, on food-animal agriculture at all levels including economics of production, rural demographics, animal welfare, and societal and global effects; and (2) analyze the intended and unintended consequences of voluntary and involuntary changes in food-animal management. The symposium, which was free to all attendees, was intended for an audience of decision makers and legislators in local, state, and federal offices, as well as industry personnel, consumers, students, and members of the media.

Many sources today are delivering widely varying messages about agriculture, often with an agenda rather than factual information. CAST's mission, which it has carried out for 38 years, is to assemble, interpret, and communicate credible science-based information regionally, nationally, and internationally to legislators, regulators, policymakers, the media, the private sector, and the public. Through the support of its stakeholders, speakers, and the USDA, CAST was able to develop this meeting and deliver the information on a very timely, important subject. Two of CAST's recent publications that are relevant to the symposium discussions were presented during the meeting: *Agricultural Productivity Strategies for the Future: Addressing U.S. and Global Challenges*, and *Ethical Implications of Animal Biotechnology: Considerations for Animal Welfare Decision Making*. These and other relevant CAST publications are available at the CAST website: www.cast-science.org.

On behalf of CAST and the USDA, we thank the steering committee members for their assistance, those persons who showed interest by attending, and all speakers and moderators who contributed their time and expertise to make presentations and provide other material for the proceedings.

John M. Bonner
Executive Vice President, CEO
CAST

Richard D. Reynnells
National Program Leader,
Animal Production Systems USDA/NIFA

Symposium Sponsors

The organizing committee gratefully acknowledges support from:

All speakers for their significant time and effort, with most waiving the requirement for reimbursement of expenses;

Financial support of the USDA Animal and Plant Health Inspection Service for providing the hearing impaired translator, extra security, and the publicity posters.

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Welcome

John Ferrell
USDA Deputy Under Secretary for Marketing and Regulatory Programs

Mr. Ferrell, Deputy Under Secretary for Marketing and Regulatory Programs, most recently served as a majority staff member on the Senate Agriculture, Nutrition, and Forestry Committee under Chairman Tom Harkin (D-IA). During his eight years with the Committee, he oversaw implementation of the 2002 Farm Bill and helped develop the 2008 Farm Bill. His priorities included improving organic research and transition assistance, providing new direct-to-consumer marketing opportunities, and strengthening livestock market competition laws.

Mr. Ferrell was raised on a farm in Iowa that produced cattle, hogs, corn, and soybeans. He received his bachelor's degree in agricultural science and horticulture from Northwest Missouri State University and his Master's degree from the University of Missouri-Columbia. Mr. Ferrell and Ann Wright are the two Deputy Under Secretaries for Marketing and Regulatory Programs.

Welcome from CAST

Todd A. Peterson
President of CAST
Winfield Solutions LLC

It is my pleasure to welcome you to this symposium on behalf of CAST, the Council for Agricultural Science and Technology. CAST was established in 1972 with the goal of assembling and communicating sound scientific information on topics related to food and agriculture. CAST was created by visionary leaders in ag-related scientific disciplines, leaders who recognized the need to evaluate big cross-functional issues that affect everyone; at least everyone who eats. Forty years ago, we wondered if we could produce enough food to feed a growing population…..we still debate that today. We wondered about the long-term implications of our agricultural production systems and safety and sustainability of the inputs we use in plant and animal production systems……still an issue today. And, in 1972, we called on the best science available to provide feedback on the role of the public policy and investment on regulating how our food is, or should be produced. You see the pattern here; we still have a need for sound science-based solutions to society's questions…which brings us to the reason CAST helped launch this symposium.

I want to highlight yesterday's release of the most recent CAST publication relevant to our topic at this meeting: *Ethical Implications of Animal Biotechnology: Considerations for Animal Welfare Decision Making* This is the 9th and final publication of a series of CAST publications called: Animal Agriculture's Future through Biotechnology. The entire series and many more related publications are available for download at no charge at www.CAST-Science.org. I encourage you to visit the CAST website, check out and download the many topical publications available, and learn more about CAST in the annual report under the "About CAST" tab. Most importantly, I encourage you to look at the "Forthcoming Publications" section and check out the significant and relevant topics teams of scientists are currently addressing; you can look forward to reading these in the near future. Additional information about CAST and CAST publications is included in Appendix C.

Integration of competing concepts surrounding the ethical use of food animals

Wes Jamison
Palm Beach Atlantic University

Introduction

Contemporary animal agriculture is typified by conflict and competition, not only for scarce resources and market share, but over the very nature of the production practices themselves. Increasingly, ethical considerations are raised as animal production assumptions and systems are questioned: can the confinement of animals to maximize the economies of size and scale be justified? This paper intends to provide a preliminary speculative discussion of the disintegration of consensus in animal agriculture, what is required to achieve consensus, and a discussion of alternative potential futures given the highly contested ethics of animal production.

Disintegration

The disintegration of consensus surrounding animal production practices may be traced to at least five distinct forces, each of which arguably has had a profound impact on cohesive and socially legitimate production practices: urbanization, philosophical and practical pluralism, a collapse of a relatively unified worldview concerning the animal-human relationship, delegitimization of optimistic scientific humanism, and the collapse of the "two standards" ethos regarding animal treatment.

Urbanization is commonly fingered as a culprit for the waning support, or certainly the increased ambivalence, for modern confinement animal production systems. The argument goes that people have lost contact with their food supply, e.g., "my bread comes from a supermarket!" Although a truism at a superficial level, urbanization leads to something more pervasive and therefore far more impactful: the development of an urban epistemology. It is true that people's experiences with animals have changed, transforming from the day-to-day experience of animals on the farm as food supply or tool, to experiences of animals as companions. But more importantly, sociologists argue that mediating institutions and structures help organize and interpret reality. Thus not only has urbanization changed contact with animals, but it has also changed the interpretation of animals. Urbanites and suburbanites view animal treatment and animal production through the prism of pet ownership and treatment, and images of animals are mediated through media and social structures that heavily anthropomorphize animals.

Secondly, since the 1960s the rise and legitimacy of philosophical and practical pluralism has strengthened the critique of animal agriculture. Pluralism can best be described as a belief that accepts the legitimacy of multiple perspectives and of multiple ethical and moral viewpoints and seeks to reconcile them in a system that elevates no single perspective to a place of privilege. This implies that there are no sacred cows when it comes to ethics, that all systems can be argued as legitimate, and that all perspectives should be considered when making policy. Practically, this means that relatively exclusive policy mechanisms and processes that once were captured by the interests most directly impacted by them now have become inclusive. For example, cattle grazing policy and rates that were once the exclusive domain of the Bureau of

Land Management and the western ranchers have increasingly been challenged and been attacked. This is to say that pluralism increases the quantity of viewpoints represented in policy decisions, and therefore diminishes the policy sway held by agricultural interests.

Interestingly, pluralism was foreseen by the Bill of Rights and reflected in the First Amendment's right of free association. Madison realized in Federalist #10 that limiting free speech and free association was impossible, so he proposed a system whereby interest groups and their increasing replication would be encouraged, and conflict, rather than being avoided, would be encouraged through freedom of association---with all worldviews and ethical perspectives free to associate together with other like-minded individuals, and free to contest others. Each would serve as a check so that no one dominant interest would for long hold power. Thus, structurally, the legitimacy and rise of pluralism insured that agricultural policy and practices would be removed from the exclusive domain of farmers.

The first force, urbanization, led to an urban epistemology, a unique way of seeing nature and animals, which was heavily mediated by pet ownership and anthropomorphic images of animals. And the second force, pluralism, removed the realm of agricultural practices and policy from the exclusive control of farmers. Thirdly, prior to the 1950s it can be argued that Americans enjoyed a relatively cohesive and consensual worldview regarding animals. What can be called anthropocentric consumptive instrumentalism (ACI) dominated the accepted treatment of animals. ACI accepted the presuppositional right of humans to use animals as tools and commodities for human consumptive benefit as long as wanton pain and suffering were minimized. And it is no mistake that the collapse of ACI was concurrent with the growth of pet ownership. For reasons discussed previously, an urbanized culture whose experience with animals came as pets and heavily mediated images unrelated to confinement and slaughter has become increasingly receptive to ethics that propose protection for farm animals, that advocate for different production regimes, and that emphasize a different animal care ethos.

Fourth, the profound delegitimization of optimistic scientific humanism has limited empirical agriculture's ability to respond to production challenges. Any cursory review of literature from the early 1960s and reaching back to the 1930s illuminates a socially accepted faith in science and technology. There was a widespread consensus that science was basically unlimited in its ability to innovate and in its ability to confront and overcome problems. As one reads the popular and disciplinary literature, a striking optimism is seen regarding the human endeavor and humanity's ability to overcome almost any obstacle: indeed, scientists could overcome almost any problem, and this optimism led to a social license to vastly increase agricultural productivity through science and technology. But equally striking is the contemporary erosion of that faith. Few observers of the social context of science would believe that such an unfettered, or uncritical, fiat now exists.

Largely derived from the pessimism of the social upheavals of the 1960s and 1970s (e.g. Civil Rights, Environmentalism, the Vietnam War), ecological catastrophes such as the Cuyahoga River blaze and the Deepwater Horizon oil spill, and the increasing complexity and incomprehensibility of modern science and technology, social attitudes regarding the ability of science to solve problems changed. It can be argued that American agriculture has been facing a rapid erosion of faith in agricultural science and technology, indeed a transmogrification from the mid-century narrative of scientific cornucopia to an early twenty-first century narrative of "genie-out-of-the-bottle" involving ambivalence and antipathy toward unintended consequences,

unknown effects, and the general uncertainty of science. All this leads to a profound skepticism among elites and a receptivity for caution among the general public.

Lastly, and most significantly from an animal welfare perspective, is the collapse of the "two standards" ethos for the treatment of animals. Prior to the industrial revolution, a single dominant ethos guided Anglo-Saxon attitudes toward animals. As previously discussed, an anthropocentric consumptive instrumentalism predominated. A majority of people lived on farms or in spatial or cultural proximity to farming, and thus consumptive instrumentalism was natural. But with the advent of industrialization and massive population relocation from farms to cities, and with the growth of disposable income among the middle class, animals went from the barnyard into the home: pet ownership took root in the industrial age, and with it a newly emergent animal treatment ethos. First advancing in fits and starts with rural-urban boundary issues such as dog-fighting, baiting, and beasts of burden, then spreading to generalized urban animal treatment, a new ethos derived from middle class sensibilities regarding both humane treatment and pet ownership took hold. This model can be called the "two standards" ethos. Pet animals and animals in mediated urban contexts were expected to be treated by one set of standards (more closely aligned with how a suburban middle class treated its pets), while society accepted that farm animals would be treated differently. In other words, people came to see a separate and unequal treatment regime driven by human utility: they could have their pets and eat animals too. As long as the egregious practices that offended the urban/suburban population's sensibilities, and the large-scale but highly efficient production of animals were "out-of-sight, out-of-mind," then the two standards approach fulfilled the social function of providing surrogate companionship as well as cheap, high-quality and safe animal products. In effect, two "uses" of animals emerged in the post-industrial revolution west: anthropocentric consumptive instrumentalism and anthropocentric aesthetic instrumentalism. People used animals for human benefit and for human pleasure in both systems, but the consumptive system involved the highly intensive consumption of animals and animal products, while the aesthetic system involved animal use for entertainment, companionship, etc. The former involved the termination of animal life, while the latter involved its perpetuation.

Integration

Nevertheless, with the advent of modern agenda building as a public policy strategy coupled to modern mass media, interest groups dominated by urban epistemology could publicize the incongruence between how animals were treated on farms and how consumers expected them to be treated as pets. This inarguably has had a sublime impact on social expectations of animal treatment and the social legitimacy of high-intensity animal confinement systems. In effect, groups such as People for the Ethical Treatment of Animals (PETA) and the Humane Society of the United States (HSUS) use modern mass and social media to tell a story of animal exploitation tailored to the sensibilities of the urban American consumers. They ask "Why do you love one [a dog] and eat the other [a pig]?" They advocate legislating the ability of farm animals to stand up, turn around, express natural behaviors, and have full lateral recumbency, all of which fits the expectations of the pet owning, animal-consuming public. But the very same public that openly supports the changing ethos of farm animal treatment as advocated by the HSUS tacitly supports the high-intensity, economically efficient production of animal products wrought by animal agriculture. Hence, American society is in the midst of the collapse of the two standards ethos in favor of an expansive, modified aesthetic ethos: gone are the days when farmers could justify separate and unequal treatment of animals as "that's how pigs are raised"

or as “the smell of money” or more crudely, “it’s just a stupid chicken.” Instead, advanced by astute agenda-setting media campaigns of animal rights and welfare advocates that illuminated the incongruence between the two standards of animal treatment, American animal agriculture is in transition toward a profoundly unsettled and ill-defined future.

Thus far, several causes of the disintegration of ethics regarding animal agriculture have been proposed: these include urban populations with a different understanding of animals and different uses for them who have become receptive to efforts of various non-agrarian interests to reframe and challenge the anthropocentric consumptive instrumentalism accepted by agriculture. Pluralism grants social legitimacy to those groups’ perspective and encourages alternative advocacy growth, and the delegitimization of boundless faith in agricultural science and technology to solve problems has led to skepticism and caution. Hence, the narrative that “science will get us out of this” is eroding. The old model may be replaced by a greatly expansive anthropocentric aesthetic instrumentalism.

But if this is true, then what does integration require? Basically put, integration of competing concepts regarding the ethical treatment of animals requires either shared values or shared experiences. Shared values involve ontological presuppositions about the nature of people and animals, and the relationship between them; shared values also involve practical interpretation of the acceptability of animal production practices. Shared experiences involve not only practical experience but a frame of reference informed by the experiences themselves, e.g. the epistemological concerns previously discussed. In other words, for integration to take place politically and socially, the contesting parties must share the same core values or the same core experiences. In the absence of such commonalities, intractable conflict is to be expected because compromise would require one or more of the parties to forgo their core definitional values. Likewise, intractable conflict is expected because of the widely disparate experiences of animals held by rural producers of animal products and the urban pet-oriented consumers. Simply put, competing and conflicting perspectives regarding the ethical treatment of animals are intractable exactly because they involve values, morals, ethics, and experiences, and our pluralistic society neither elevates one set of values above another nor denigrates marginal ones. And more important, moral arguments about the rightness and wrongness of animal treatment tend to be intractable because they carry with them the implicit assumption that opponents are not just ill-advised but immoral and even evil. Those sets of assumptions are not given to compromise.

Possible Futures

Therefore, ethical perspectives regarding animals have disintegrated, and given this social and political context the ability to resolve values-based policy disputes is problematic at best. Similarly, widely disparate experiences with animals and the differing expectation of their treatment make integration difficult. Nonetheless, what does the future hold for animal agriculture? What might be some potential developments in the widespread production of animal products?

First, coercive isomorphism may rule the day. This phenomenon occurs in advanced socio-political systems and basically results from economic, social, or political pressures exerted by some organizations upon other organizations that may be dependent on those systems. Coercive isomorphism also may result from social expectations within the context in which an

organization exists. In other words, legislative, regulatory and consumer changes faced by American agriculture can be coercive in that they force adaptation. But because such changes raise the cost of production and decrease competitive advantage, production tends to move to areas and societies that minimize those pressures. Thus, off-shoring can be the net effect of economic, social or political pressures as American agriculture off-shores animal production to escape the coercive effects of regulation and changing cultural expectations.

Second, science may indeed do an end-run around the issues raised by high-intensity animal confinement. Unforeseen but theoretically possible breakthroughs coupling food-science and biological engineering may produce animal products sans the animals, e.g. in vitro steaks and milk. This would remove the issue of animal treatment but engender an entire other set of social concerns. But science is a highly pragmatic endeavor, and an optimistic reading of the history of science indicates that oftentimes science, like water, takes the path of least resistance around complex issues. In other words, engineering sentience out of agricultural animals would relocate some of the debate about animal suffering away from animal treatment toward human motives. In this outcome, animal agriculture progresses in a type of dialectic, ratcheting between social Gordian knot, scientific solution, new knot, new solution, and so on. Likewise, although social anxiety about the risks of scientific complexity abound, science that works is generally science that is accepted. In effect, protest and social perturbation may slow the development and acceptance of new technologies and give voice to diffuse and vague discomfort, but ultimately if the science and technology addresses real needs and solves real problems, it will be adopted. Hence, in this view the current social disarray is merely social "noise" as culture moves between agricultural epochs, as food production shifts between paradigms.

Another possible outcome involves the development of a boutique agricultural system wherein consumers are given a vast array of choices to match their pluralistic value demands, e.g. organic carbon-neutral milk at a higher price than high-intensity confinement milk. In this system, those agricultural practices deemed offensive by shifting consumer preference and the expansive aesthetic instrumentalism mentioned earlier will either change, or change locations to remove the source of perturbation. A highly rationalized animal agricultural system that accounts for various value demands evolves, and involves both domestic and imported animal products.

Lastly, American animal agriculture may just continue to "muddle through". In this, the lessons of British Petroleum and the Deepwater Horizon disaster are instructive. American consumers are subsumed in a petroleum-dependent economy, and are largely addicted to oil. This leads to demand for oil. Concurrently, they demand pristine environments that in many ways are seen to be vestigial remnants of a pre-European America. Environmental preservation has ascended in social value. And yet, those two cannot be easily reconciled; the Arctic National Wildlife Refuge (ANWR) contains vast stores of oil, but is off limits because of the cross-cutting values of oil demand and environmental value. But drilling in the ANWR is a relatively technologically simple endeavor. The incongruence between the two values of cheap oil and pristine environment, pushes drilling "out-of-sight, out-of-mind" off the continental shelf in mile-deep water that requires technology akin to landing a man on the moon. Put simply, we want our oil and environment too, and the Deepwater Horizon represents the flawed, pragmatic attempt by a company to make a profit exploiting a natural resource in high demand while prohibited from the most readily available and rational sources.

In this version of America's animal agricultural future, consumers have an incredible ability to rationalize their behavior, to manage the incongruence and cognitive dissonance that comes from holding intractable and irreconcilable values, and to continue to enjoy both consumption and preservation. Subsequently, policy mechanisms become responsible for absorbing and mitigating social "noise" as the policy process deflects and exhausts perturbations and disruptions. Animal agriculture, like oil exploration, muddles through, adapting in response to perturbation until necessity forces change. In this future, there are no solutions, only processes to manage the abstract, competing and sometimes intractable social values projected onto the production of animal products, therefore minimizing disruption and giving agri-business time to adapt.

Conclusion

This paper has speculated that at least five factors have led to the disintegration of consensus regarding the ethics of animal agriculture. The net effect of those factors has led to the erosion of social acceptability for high-intensity animal confinement systems. Urbanization carries with it an urban frame of reference that is far less tolerant of farming practices once seen as commonplace. The growth and legitimacy of pluralism means that not only are opposing worldviews tolerated, but seen as equally valid and encouraged to multiply. The collapse of a cohesive worldview regarding animal agriculture, away from an anthropocentric consumptive instrumentalism, means social disarray can be expected. Also, the delegitimization of optimistic scientific humanism means that American society no longer vests unfettered faith in agricultural science or technology to solve its problems and no longer trusts an agri-industrial complex that promises an ever expanding and bright food future. And finally, the only feasible resolution to a culture that owns pets, is guided by mediating structures and institutions that define animals as something other than commodities, and yet craves high-quality, low cost animal products, was a "two standards" ethos that allowed different and unequal treatment for farm animals (those intended for consumption) and pets (those intended for long-term aesthetic enjoyment). Certainly, the collapse of the two standards, and the blurring of the line between companion and cuisine, friend and food, means that aesthetic animal treatment criteria are being expanded outward into the barnyard. And animal agriculture as we know it cannot exist under such circumstances.

One reality resists disintegration: animal agriculture ultimately prevails because animals take nature people can't use and convert it into nature people can use. In effect, animal agriculture developed as a type of natural resource bank account, a living, breathing repository of fat, carbohydrate, and protein derived from nature and made more readily available for human use. It was true of Inuit peoples who hunted whales two thousand years ago, it was true of the Bushmen in the Kalahari who used animals as currency two hundred years ago, and it is true of the dairy farmer today. The methods and location of animal production may change, but the fact of its necessary reality will remain. And the social "noise" over the acceptable ethics of the what, where, why, and how of animal use will continue.

Impressions from the agricultural community regarding food-animal welfare and agricultural regulation

Gregory P. Martin
The Pennsylvania State University Extension

Introduction

If we assume that the 2% theory is correct, 2 % of our U.S. population is feeding us food. With 330 million people in the U.S. today that would mean 6.6 million people are actively raising food for the majority of us. That would mean one farmer feeding approximately 50 or so people what they need every day. When you consider that not all farmers have animal enterprises, the 2% falls even lower meaning fewer farmers producing animal proteins for the rest of the U.S. population.

Since much of the rhetoric in the media dealing with issues concerning animal welfare is positioned by people who may not be in direct contact with producers or animals, we were interested in seeing if these alternative viewpoints are being represented in the media. This questionnaire was targeted for those who raised animals or were in direct contact with people in animal agriculture. While this survey may not be inclusive of all viewpoints (e.g., not all farms have computers), we wished to get a measure of the tone of the agricultural community.

The Questionnaire

Questionnaire canvassing was conducted on SurveyMonkey over a period of three months ending on May 21, 2010. There were 1,210 respondents who started the questionnaire and1,077 (89%) completed it. Demographics showed that the majority of respondents were male, 55 years or older, and who raised food animals on medium to small sized farms.

50 Years or Older?	**Percent**
Yes	55.7
No	44.3

Are You:	
Male	64.9
Female	35.1

Do You Raise Food Animals?

Yes	62.1
No	29.0
Not Applicable	8.9

What Size is Your Farm?	Percent
Medium (51-450 acres)	27.9
I am Not Farming	27.4
Small	24.3
Large (451+ acres)	12.1
I prefer not to answer this	8.2

This was interesting to note, because many people look at agriculture as a large-scale enterprise. Many sections of the country devoted to agriculture do have farms of medium to small status. In the United States Department of Agriculture (USDA) 2007 survey of ag places, the average size farm in the U.S. at 418 acres[1]. Further, large and very large family farms which made up only 9% of all farms in the United States, produce 63% of the value of all ag products sold[2].

Affiliations with agricultural organizations seem to be portrayed in the media as being strong, but were mixed in our findings. Most would like to be known as independent farmers first. Due to the relationship of cooperative extension to production agriculture a high number of respondents chose that category.

Group Affiliation	Percent
Independent Farmer	25.0
Cooperative Extension	19.7
Organic, Natural, Free Range Producer	11.4
Other	10.8
Farm Bureau	9.6
Food Animal Veterinarians	8.5
Commodity Assoc. member/producer	7.9
The Grange	4.9
Animal Welfare Advocacy / producer	1.4
Farmers Union	0.7
CAST	0.3

[1] www.agcensus.usda.gov or www.nass.usda.gov (accessed 5/21/2010)

[2] 2007 Census of Agriculture---Farm numbers

Animal Welfare Responses

Of interest were the impressions from the group as to the effects animal welfare legislation / propositions would have on animal production. Several questions were posed to the group to find these trends (if any). Overall, most (85%) were at very least somewhat concerned about food animal welfare. With 2 % choosing "not sure", this meant that almost all had an opinion on the subject.

How concerned are you about food animal welfare?	**Percent**
Very	52.7
Somewhat	32.3
Not concerned	13.0
Not sure	2.0

Turning to who should be making regulatory decisions, for the most part, those who were questioned chose producer associations and farm groups as the method we should use to govern the industry. Next frequent was to allow the market to demand products that fit the markets' animal care expectations. Of note was that ballot initiatives garnered the lowest percentage of choices, with elected bodies as seen in some states not gathering more votes.

Who should make regulatory decisions related to food animal agriculture?	**Percent**
Producer associations & farm groups	51.8
Neither --- change should come from market demand	28.4
Elected legislative bodies	12.7
Voters via ballot initiatives	7.2

Two questions were asked to see how the group would perceive consumers and the market. Most felt that there was a disproportionate balance between the demands of the market and programs concerning animal welfare. They also felt that consumers were for the most part unwilling to pay for certification programs.

Do consumer food expectations match proposed and mandated demands placed on food animal producers?

	Percent
No	72.3
Not sure	16.4
Yes	11.3

Do You think consumers are willing to pay for increased food costs due to certification or regulatory programs?

	Percent
No	59.2
Not sure	21.0
Yes	19.8

Several questions dealt with the impact of animal welfare regulations on this group to see if the impressions expressed matched their responses.

What type of farmers do certification programs & regulations benefit most?

	Percent
None (detrimental to all farmers)	25.5
All farmers regardless of size	23.8
Large size	23.1
Not sure	18.5
Small size	7.5
Medium size	1.7

How much impact do you think animal welfare initiatives, propositions & other legal mandates have on small communities & the rural infrastructure?

	Percent
Severe	56.4
Moderate	27.0
Mild	7.5
Not sure	6.7
None	2.5

In general, what impact does consolidation of food-animal industries have on rural communities?

	Percent
Negative	58.8
Not sure	18.9
Positive (promotes growth)	18.7
None	3.6

Since most of the questionnaire respondents were from medium to smaller farms, they did not always match in responses given. When asked who benefits most from animal welfare programs the respondents either chose Larger Farms, all farms or none, as they saw these programs as detrimental. Very few chose small- to medium-sized farms although demographics showed these farms as the most frequent association. Most respondents however saw that

small communities would be impacted by initiatives on farmers. Eighty-three percent saw at least a moderate to severe impact on such locations. Consolidation, as seen by those polled was a negative influence to rural communities and animal industries, with only 18 % seeing it as a positive influence.

When asked directly about the impact of ballots by size of farms the large portion of the demographic did match in response. Medium-sized farms were seen to be the most impacted by ballot initiatives. If we assume the statistic of average farm size still holds from the 2007 census, then the ballot initiative would affect most farms in the United States.

What Impact do animal welfare ballot initiatives & propositions have on farms of size / scale?

	None	Mild	Moderate	Severe	Not Sure
Small	3.6	17.3	17.5	52.5	9.1
Medium	0.8	4.5	39.0	46.0	9.6
Large	3.8	13.3	21.0	49.9	10.9

Comments

Four hundred fifty-four (454) comments were entered into the questionnaire. These varied from topic specific to unrelated issues of concern to the respondents. Publishing of the comments will be done at the discretion of CAST, and may be posted online at a later date. To summarize, most of the comments could be sorted into the following categories, with examples (as they were received):

<u>General Comments</u>

- Ok good job.
- The law of unintended consequences will ensure that whatever good is intended will be equaled or surpassed by negative results.
- Great job being done by producers. People more worried about nothing than raising their kids wholesomely.
- Animals should be humanely treated regardless of the cost....it is the right thing to do. It is barbaric and deplorable to subject animals to miserable living conditions just to save on cost. These are living creatures that feel pain and emotions just as humans. I don't care how the changes are brought about, but change does need to happen and I don't think we can assume that people will just do the right thing because we have seen that this doesn't work...too much greed and ignorance out there.
- I do have chickens, but no huge amount of land to farm on.

The Ballot Process, Initiatives

- Ballot initiatives are not science-based and should not be used to force animal welfare legislation. Animal Scientists and Veterinarians should be key individuals in the development of animal welfare initiatives.
- These type of ballot initiatives should not be allowed since the goal is not really animal welfare it is to stop food animal production.
- Frankly, the initiative process to implement animal welfare regulations is sufficiently new that I don't know anyone who really knows the consequences. We've been told, by special interest groups on both sides, what the consequences will be, but their opinions reflect their special interests.

Comments against organized animal welfare institutions

- What change is needed? Net returns to producers are directly connected to the care and comfort of their animals. My observation is that skilled extremists create a "crisis" that does not exist. It is called animal welfare, but in reality it is anti-animal agriculture. We will all go hungry if they continue to have success with their unreasonable efforts.
- Not a good idea - animal rightists so powerful and misleading that science is not taken into account, and people are constantly misled about what REALLY happens 99% of the time in agriculture.
- The education of the American public to the dangers of the Animal Rights movement is critical. The exposing of the hidden agenda should be a primary focus for the agricultural sector as well as those involved in national security. A nation that cannot feed itself due to over regulation driven by extremist emotion is doomed to be a servant to the world.

Education of public regarding animal welfare, farming, food

- Being from CA in the egg production business I can attest to the fact that ballot initiatives are not the way to go. However production animal agriculture is going to have to be able to reach an acceptable compromise with animal advocacy groups. Educating the consumer is the most important part of the equation. Farmers only want to produce and consequently have abdicated their rights to activist groups who want animal ag eliminated. It is imperative that ag gain back the confidence of the consumer. It's time to become marketers and educators as well as being producers.
- Today's public is so far removed from agriculture that they DO NOT know where their food comes from!! Modern Animal production practices were developed with the animal's well-being in mind. In the 1960's when my parents had cage free laying hens we had a lot more disease in the flocks due to Round Worm and Tape Worm infestations, Marek's disease and other viral diseases. There is now a vaccine for Marek's, and since the layers are in cages and can't eat their own feces we do not have a round or tape worm problem. The current environment for animals was developed to reduce disease and therefore reducing the use of antibiotics. Animal geneticists have selected blood lines of various species that are better suited to today’s practices. Today's farmer is producing MORE with Less!
- If we as farmers, make a conscious effort to educate our customers and their children about the food supply, we will benefit for years to come.

- In my experience, the general public has very limited knowledge of agriculture and cannot make informed decisions for producers.

Policy of animal welfare regulation

- Commodity groups need to be a leader in animal welfare standards. They should work with university researchers to stick with science based demands. They need to consider the unintended consequences, and seek to balance welfare with the environment, cost/benefit of changes to the producer and consumer and a heavy dose of common sense. Size of farms should not be the motivation. I fear food safety more on small farms than large.
- The most amazing thing I see with all the interest in legislating animal welfare /food safety is that there are no farmers involved. Legislators, unless they are farmers, don't know enough about the subject to write new legislation.
- I raise horses as well as cattle. The animal rights movement has killed the horse industry. I love my horses but there is not a market for cull horses this has effected my horse business dramatically and will force me out of the business. I sold two thoroughbred mares on the auction I got a $50 for one and $60 for the other one and it cost $68 to sell them. I don't blame horse owners for turning horse loose on gov lands.
- The regulations are lobbied for by large producers to force out small farmers, reducing the competition, and monopolizing the market. The market needs competition to keep prices competitive and quality high.
- The group most qualified and with the most to gain and lose in creating regulations are the farmers and ranchers producing the product. They should be the ones to write the regulations in cooperation with Extension Specialists. Once the regulations are established then a good educational effort should be implemented that will inform the farmers and ranchers of the minimal requirements in animal husbandry. Once in place the regulations can be implemented by a state's agriculture regulatory agency such as Departments of Ag or a Land Grant University. Keeping in mind that farmers need adequate time to retool if necessary.

Summary

One of the strongest messages I have gathered from this is that there needs to be more dialog among consumers, farmers and legislators/government on the issues affecting food production processing and distribution. Choice and the choices available to each group will be a factor in the success of agriculture to come. How successful that will be depends on the patience and persistence each group gives to the process.

Taking a look back to look forward
Food-animal production: A brief overview

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The history of food-animal production in the continental United States dates from the colonial period. However the application of science and technology to enhance production through improvements in breeding, feeding, and disease control date from the mid-nineteenth century when systematic research at the state and federal levels along with improved extension practices in the early twentieth century enabled farmers to improve their herds and flocks and achieve greater efficiency and production. The history of food-animal production in the United States is complex because it involves the intersection of science, technology, and public policy, the latter of which has individual components related to health and environmental issues that are not driven, framed, or controlled by livestock and poultry producers. It also is a history that includes not only cattle, swine, dairy, and poultry producers but also the processing industry, government agencies, and consumer groups at home and abroad.

The history of animal food production is based on ten thousand years of observation and experience, that is, empirical evidence as farmers and later scientists worked to control and predict the quality and quantity of meat, eggs, and milk that farmers produced. Breeding often depended on size, color, and behavior. Equally important over time, humankind chose only a few animals for domestication and improvement for food purposes (Byerly, 1976). Moreover, during the late nineteenth and early twentieth century, public policy makers influenced food animal production by seeking to ensure food safety and control large meat packers (Ferrier and Lamb, 2007). Overall, the history of food-animal production in the late twentieth century primarily involved the application of science to fundamental agricultural practices that linked farmers, ranchers, and other producers in their attempts to improve the nature and nurture of livestock and poultry. Animal and poultry science became the interdisciplinary domain of geneticists, chemists, physiologists, mathematicians and statisticians, engineers, and nutritionists, among others and, by the late twentieth century, increasingly influenced by environmentalists and consumer groups, which, in turn, shaped public policy. Pure and applied research became even more significant with the use of computers to assist genetic engineering and the manipulation of deoxyribonucleic acid (DNA) to improve the production of meat, eggs, and milk (Byerly, 1976). To gain a brief overview of the major developments in the history of food animal production in the United States, five general areas merit reflection. They are: (1) disease control, (2) biotechnology, (3) feeding improvements, (4) feedlots and marketing, and 5) environmental and consumer concerns.

Disease Control

Diseases have always plagued food-animal producers because an outbreak can quickly become difficult and costly to control and eradicate. Livestock and poultry producers by themselves cannot solve the problems of disease prevention, control, and eradication. Food-animal producers necessarily have depended on scientists at the United States Department of Agriculture's (USDA) Bureau of Animal Industry (BAI), state experiment stations, and land-grant colleges to cure and prevent livestock diseases (Wood, 1980). Among cattle raisers,

tuberculosis, brucellosis, blackleg, foot-and-mouth, and Texas fever became the most dangerous, troublesome, and expensive diseases while hog cholera and Marek's disease periodically troubled swine and poultry producers respectively (Byerly, 1976; Burmester, 1972). Advances in veterinary medicine reduced the loss of livestock and poultry to disease and helped protect human health. Between 1865 and 1914 scientists sought the causes of and ways to attack the major animal diseases and in the process discovered that microbes could carry diseases. This scientific discovery benefited livestock and producers alike (Schlebecker, 1975). The discovery that microbes could carry disease meant that immunization and medications could prevent the slaughter of sick animals as the only means to control or eliminate the disease. In 1882, for example, Robert Koch discovered the microbe that caused tuberculosis and eight years later developed a test for diagnosing bovine tuberculosis (Schlebecker, 1975). In 1892 veterinarians began testing dairy cows for tuberculosis and discovered an alarmingly high rate of diseased cows. When scientists later learned that humans could contract bovine tuberculosis, the public demand for the testing and elimination of diseased dairy cattle by slaughter brought anger and violence, in part, because some dairy farmers did not trust the accuracy of the tuberculosis tests (Olmstead and Rhode, 2007). In 1917, the federal government instituted a testing program and compensation for the slaughter of tubercular dairy cattle (Keeping Livestock Healthy, 1942; Animal Diseases, 1956). Thereafter, cattle and human health improved as well as milk production. By 1942, bovine tuberculosis essentially had been controlled, although not eliminated among dairy cows. A side benefit of tuberculosis testing on dairy cattle was the increased demand for the pasteurization of milk. Dairy farmers benefitted from healthy, tuberculosis-free cows that produced more milk (Schlebecker, 1975). About 1900, scientists discovered avian tuberculosis in poultry, but as late as 1940 no cure or protection existed. Hog producers also controlled tubercular swine by slaughter (Keeping Livestock Healthy, 1942; Animal Diseases, 1956).

In 1896 Bernhard Bang, a Danish scientist, discovered the bacteria that caused brucellosis in cattle, and in 1914 USDA scientist Jacob Traum isolated the bacteria responsible for the disease in swine (Animal Diseases, 1956). A year later, Alice Evans, a USDA scientist, proved that brucellosis, undulant fever, Malta fever, and contagious abortion were the same disease. Brucellosis became a matter for both veterinary and human medicine, because humans could contract the disease. Humans could avoid it by drinking pasteurized milk, but the disease posed a particularly dangerous hazard to dairy families (Keeping Livestock Healthy, 1942; Schlebecker, 1975). In 1930, USDA scientists developed a comparatively effective vaccine that brought the disease under control for cattle by the mid-1950s (Animal Diseases, 1956; Wood, 1980; Schlebecker, 1975). No drug protected or cured swine infected with brucellosis, and slaughter proved the best control method to prevent its spread (Animal Diseases, 1956; Keeping Livestock Healthy, 1942).

During the nineteenth century Texas fever, a tick-born disease played havoc with the cattle producers on the southern and central Great Plains. Aided by the long cattle drives from Texas to the railheads in Missouri and Kansas, the tick-infested longhorns spread the fever to other cattle within reach of the ticks. Texas fever brought suffering and death to the cattle that contracted the disease and substantial financial loss to the farmers and ranchers whose livestock contracted the disease as it spread northward beyond the southern Great Plains and South. Only the northern region of the nation escaped because the ticks could not survive in the colder climate. Texas fever discouraged breed improvement, particularly upbreeding with

purebreds, because the financial loss often proved too great a gamble for most cattle raisers (Hutson, 1994).

Federal and state quarantine laws provided modest but unreliable protection for cattle producers. In the absence of science, public policy could not solve the problem of Texas fever for cattle raisers. Although livestock producers suspected that ticks caused the disease, many scientists rejected that assumption. In 1889, however, Theobald Smith, a scientist in the BAI in the USDA, among others, discovered that a micro parasite in the red blood corpuscles caused Texas fever (Animal Diseases, 1956). A year later Fred L. Kilborne, who also worked for the BAI discovered that ticks carried the protozoan parasite, which passed the disease from animal to animal. Work at the Texas, Missouri, and Kansas State experiment stations, among others confirmed that ticks were the "transmitting agent." Still a preventive solution was not discovered until 1906 when the BAI and the Live-Stock Commission of Texas began experimenting with arsenical dips based on research conducted in Cuba. Arsenical dips proved effective and did not harm the cattle. By the end of World War I, arsenical dips that killed the ticks and prevented the spread of Texas fever and state quarantine laws that helped control isolated outbreaks of the disease gave cattle producers peace of mind while saving herds and improving production. By 1940 Texas fever no longer threatened cattle producers (Smith and Kilborne, 1893; Hutson, 1994; Schlebecker, 1975; Keeping Livestock Healthy, 1942, Animal Diseases, 1956).

In 1897, scientists at the Kansas State Agricultural Experiment Station tackled the problem of blackleg, arguably the most costly of all diseases for western cattle producers. This infectious, usually fatal, disease that particularly endangered young upbred cattle killed as much as 25 % of the annual new-born calves in some areas (Animal Diseases, 1956). In 1900, the BAI reported that blackleg caused "greater losses in the Southern and Western states than all other diseases combined" (Wood, 1980). Only prevention gave livestock raisers security because once an outbreak occurred devastating cattle losses followed, and the organism that caused blackleg produced spores that remained active in the soil for years. Consequently, cattle could become infected from the same pastures or feedlots long after an outbreak. In 1916, scientists at the Kansas State Agricultural Experiment Station developed a vaccine from the blood of horses and later calves that provided permanent immunity from the disease. Other improvements followed and cattlemen essentially could protect their herds from blackleg by the early 1920s, but the disease remained a problem through the decade (Animal Diseases, 1956; Wood, 1980; Schlebecker, 1975).

Foot-and-mouth disease struck the livestock industry as early as 1902 and periodically thereafter, with the last outbreak in 1929. Livestock producers quickly stopped the spread of this extremely contagious disease by slaughtering and burying the infected cattle, swine, sheep, and goats, but no cure or vaccine existed for the virus, and the disease killed the infected cattle (Keeping Livestock Healthy, 1942; Animal Diseases, 1956). Cattle producers with infected livestock necessarily slaughtered their animals if any contracted the disease and they burned or buried the carcasses to prevent further spread. The temporary eradication of foot-and-mouth disease through slaughter proved costly to cattle raisers who often opposed or refused to slaughter animals that seemed healthy (Schlebecker, 1975).

In 1914 a major outbreak of foot-and-mouth disease reached epidemic proportions from unknown origins in Michigan and quickly spread by hogs shipped to the Chicago stockyards from where contaminated cars carried the disease to twenty-two states. Before the disease was

controlled approximately 200,000 cattle valued at $7 million had been slaughtered and the St. Louis and Chicago stockyards closed and stock shipments ceased (Wood, 1980). Although German scientists discovered the virus that caused foot-and-mouth disease in 1914 and ultimately developed a vaccine, American livestock producers preferred slaughter as the most cost efficient means of control. Vaccination did not bring the disease under control until the 1950s (Keeping Livestock Healthy, 1942; Animal Diseases, 1956; Schlebecker, 1975).

By the mid-twentieth century, then, the major cattle diseases of tuberculosis, blackleg, Texas fever and foot-and-mouth had been eliminated or substantially controlled. In 1907, BAI scientists tested a vaccine to fight hog cholera, and by the early 1940s an anti-hog cholera serum to prevent the virus from spreading to healthy swine was readily available and the disease brought under control (Keeping Livestock Healthy, 1942; Animal Diseases, 1956). Brucellosis, however, continued to be a problem for beef and dairy producers. Mad cow disease or BSE (bovine spongiform encephalopathy) also remained incurable but essentially nonexistent since its discovery in the United States in December 2003 which led to the closure of world markets to U.S. beef (McGarity, 2005). The BSE outbreak proved isolated and limited, and domestic consumers continued to eat beef, although Japan and several other nations temporarily halted U.S. beef imports. Still, BSE reminded livestock producers that animal diseases known and unknown could prove devastating. If the past was a guide, eternal vigilance by the scientific and producer communities proved essential (Corah, 2008). Yet, by the twenty-first century veterinary medicine had saved livestock and poultry producers millions of dollars and proved additionally beneficial during times of low market prices (Wood, 1980).

Biotechnology

During the late nineteenth and twentieth century, the introduction of bioengineered hormones to enhance growth and production provided benefits as well as caused problems for livestock raisers. The introduction of the first major bioengineered growth hormone for agriculture, recombinant bovine somatotrophin (rbST, hereafter also bST), launched a contentious and complex debate between scientists, producers, and consumers, including animal welfare and environmental groups, the latter particularly regarding food safety. Yet, bST complemented innovations in dairying such as mechanical milking, bulk tanks, embryo transfer, and artificial insemination, and many producers used it to stimulate greater milk production. Some dairy specialists contended that bST could increase milk production by 25 %, but critics charged that it would drive small-scale produces out of business and exposed consumers to unknown health risks (Molnar, Cummins, and Nowak, 1990; Krimsky and Wrubel, 1996; Sugarman, 1989; Corey, 1990).

BST did not become an important growth hormone for the increase of milk production until the early 1980s when production costs enabled its large-scale production. In 1985, the Food and Drug Administration ruled that milk and meat produced from bST-treated cows was "perfectly safe for human consumption" and that it was as nutritious as milk from cows not treated with bST (Juskevich and Guyer, 1990). A social firestorm over bST, however, developed because some medical, veterinary, or animal nutrition scientists contended that recombinant bST might pose a health risk for humans (Molnar, Cummins, and Nowak, 1990). Despite strong scientific evidence that recombinant bST and natural BST were indistinguishable in cows and that rbST posed no threat to humans, some consumers feared that milk produced with chemical enhancement posed either immediate or long-term health risks (Krimsky and Wrubel, 1996).

In 1989, consumer, environmental, and animal welfare groups campaigned against bST in milk. Kraft USA and Borden's announced that they would not use bST milk in their dairy products and Ben and Jerry's Homemade Ice Cream noted on its containers that the company opposed the use of hormones to increase milk production and that it supported small-scale dairy producers. Safeway, Kroger, Supermarket General, Stop and Shop, and Vons, which ranked among the largest of the supermarket stores, announced that they would not purchase dairy products from producers who had injected their cows with bST (Krimsky and Wrubel, 1996; Corey, 1990; Sugarman 1989). In addition, the Associated Milk Producers, Inc., the nation's largest dairy cooperative, announced that its members would not use bST (Corey 1990). Consumers worried about the safety of bST and these businesses target those fears (Juskevich, Cummins, Nowak, 1990).

The safety of bST could not be resolved for everyone because the scientific evidence proved ambiguous. When large doses of rbST are given to cows higher levels of bST are found in the milk. Yet, some scientists contended that although rbST cannot be detected in milk that fact alone did not ensure safety. In 1991, however, the National Institutes of Health concluded that, "There are no data to suggest that BST present in milk will survive digesting or produce unique peptide fragments that might have biological effects." Two years later (1993), the FDA ruled that, "There is virtually no difference between milk from treated and untreated cows." Dairy producers might not be confused but the public remained uncertain, even fearful of bST milk. Some dairymen and consumers wanted to solve the problem by labeling milk bST-free despite its natural presence in milk. The FDA, however, ruled that such labeling would be illegal because it would mislead consumers. Nevertheless, the FDA provided that milk companies could label milk as bST-free if they also added that, "No significant difference has been shown between milk derived from cows that were given the drug and cows that were not." This solution satisfied neither side (Krimsky and Wrubel, 1996).

While large-scale and small-scale dairy producers argued over the benefits of bST, the Humane Farming Association (HFA) contended through a national publicity campaign that bST was as dangerous as diethylstilbestrol (DES) which beef cattle producers had used to increase gains but which had proven to be a cancer causing agent. Playing on the fear of the unknown the HFA reported that, "No one knows what effect this secondary hormone will have upon consumers of bGH [biological growth hormone] treated milk." Monsanto, the largest producer of bST, countered with a national advertisement that read, "You've had BST and cookies all your life." While dairy producers worried about the effect of rBST on the price of milk due to increased production, consumers worried about the health risk of drinking bST milk (Krimsky and Wrubel, 1996).

In 1994, the FDA approved the use of bST for commercial dairy producers (Zinn and Bravo-Ureta, 1996). Overall, dairymen considered bST cost effective, although increased production necessitated additional government purchases of surplus milk, primarily for butter, for distribution in food programs. Some agricultural economists still contended that bST would lower milk prices and drive small-scale dairy farmers out of business (Molnar, Cummins, and Nowak, 1990). The social costs of bST, however, proved less exact and more difficult to calculate (Krimisky and Wrubel, 1996). Moreover, until the 1990s the public had considered milk a nearly perfect food. It was safe through pasteurization, consistent through homogenization, healthful with vitamin D fortification, and comparatively low in fat (Corey,

1990). Consumers, however, remained fearful about the possible side effects of milk produced by hormones, genetic engineering, and the injection of chemicals into cows. The assurances of agricultural scientists, government agencies, and manufacturers confirming the safety of bST but could not overcome these fears. At the same time, the dairy farmers most likely to use bST were younger, more educated, and better managers, and they also milked larger herds than non-users (Zinn and Bravo-Ureta, 1990). By the end of the twentieth century, the dairy industry depended on time to end consumer apprehension, because as one observer noted, "The concept of a pure and natural food is culturally determined, mediated by historical tradition and corporate persuasion" (Krimsky and Wrubel, 1996).

Thus, while government agencies have declared bST safe, as long as a small minority of scientists questioned its use, consumers considered bST milk a possible health hazard that was not worth the risk, all to the detriment of dairy producers. At the same time, small-scale producers remained unconvinced that increased milk production was in their economic interest (Molnar, Cummins, and Nowak, 1990; Krimsky and Wrubel, 1996). By the mid-1990s, only 9.4 % of all dairy operations injected rBST although 31.9 % of the dairy farmers with more than 200 cows used it. Dairy farmers with fewer than 100 head generally preferred to forego the use of rBST. Part of the resistance might be attributed to higher feed requirements when the cows begin increased milk production (Coppock, 2002).

Breeding improvements also advanced meat production, sometimes by creating new breeds, such as the Santa Gertrudis, Brangus, and Beefmaster, for cattle producers. In 1953 the discovery of the double helix of DNA by James D. Watson and Francis Crick began a new age of molecular genetics that enabled revolutionary change in animal breeding. Artificial insemination facilitated the rapid dissemination and increase of these new beef cattle breeds, and it increased milk production by the progeny of artificially bred dairy cows (Stephens, 1982). In 1946, artificial insemination and genetic engineering also produced a new hog called Minnesota No. 1, soon followed by the Hamprace. Similar breeding developments occurred for poultry producers (Schlebecker, 1975). By the turn of the twenty-first century, however, the public kept a watchful eye on genetic engineering in fear that the genie would escape the bottle or that scientists would open the proverbial Pandora's Box. Concerns about disease, land costs, and feed efficiency also remained concerns of livestock and poultry producers. New breeding, production, and niche marketing developments suggested growth possibilities for the future, but these changes would remain consumer driven (Corah, 2008; Middleton and Gibb, 1991).

Feeding Improvements

During the twentieth century advances in animal nutrition, minerals, vitamins, or other chemicals that livestock producers add to feeds substantively improved food animal production, particularly after 1940 (Summons, 1968). In 1900 animal nutritionists only knew that proteins, fats, carbohydrates, and some inorganic salts improved animal diets. Yet, between 1912, when Polish scientist Casimir Funk coined the term vitamin, and 1930, vitamins A, B, C, D, and E were discovered along with the value of various trace mineral additives, such as calcium, phosphorus, and iodine, among others for good nutritional health. In 1922 with the discovery of vitamin D, poultry raisers could now produce chickens indoors year-round. The problem of rickets no longer limited indoor production, thereby enabling the expansion of the poultry industry to colder and more environmentally inhospitable areas (Byerly, 1976).

Livestock producers began using more vitamin-enhanced feeds during the 1940s to help increase meat production for the war effort. Moreover, in 1948, Karl Folkers and other scientists working for Merck and Company discovered vitamin B_{12} which increased food utilization in chickens and hogs (Marcus, 1994). Swine and poultry producers quickly began using feeds fortified with vitamin B_{12}. During the early 1950s scientists also recognized that certain antibiotics and synthetic amino acids used as feed additives enhanced growth. By the 1960s antibiotics had revolutionized the livestock and poultry feeding industry (Summons, 1968; Schlebecker, 1975).

The discovery of vitamin B_{12} and the benefits of antibiotics as feed additives also contributed to the discovery of the hormone stilbestrol as a feed additive (Summons, 1968). In 1951 after a series of experiments, Wise Burroughs and others discovered that cattle and sheep feeds fortified with the synthetic hormone diethylstilbestrol, commonly known as stilbestrol or (DES), produced greater weight gains with less feed and more speed (Marcus, 1994; Schlebecker, 1975). In 1954, the FDA approved the use of stilbestrol as a cattle feed additive, and livestock raisers quickly adopted this feed supplement. By the end of the decade agricultural economists reported that every dollar invested in a stilbestrol-enhanced feed returned $11.50 from cattle sales. By the mid-1950s feedlots customarily used DES to help fatten steers (Byerly, 1976). A decade later, an estimated 85 % of all beef cattle consumed feeds fortified with stilbestrol and 95 % of the cattle feeders used the synthetic grown hormone (Marcus, 1994).

Swine and poultry producers also learned that their hogs and chickens reached market sooner when their feeds were enhanced with vitamins, antibiotics and other additives (Summons, 1968). Urea, the first organic chemical to be synthesized became an important protein feed additive after production costs declined following World War II. Folic acid would soon become important for poultry and animal nutrition after its discovery in 1946. Moreover, feed additives, particularly antibiotics, improved animal health. Feed additives not only increased animal nutrition---which improved production and profits---but also enabled producers to concentrate production and produce on an industrial scale. After 1960, fewer farmers raised a small number of cattle, hogs, and chickens. Increasingly producers specialized, often in large-scale confinement facilities, and they used chemistry to facilitate production on an industrial scale (Summons, 1968).

After 1950, hormone growth stimulators and antibiotic feed additives dramatically increased meat production (Perry, 1992). Consumers, however, increasingly questioned the health risks of prolonged consumption of beef, pork, and poultry produced with additive-enhanced feeds, particularly the hormone stilbestrol. As a result, in 1958, Congress approved the Food Additive Amendment to the Food, Drug and Cosmetic Act of 1938. The new legislation, known as the Delaney Cancer Clause, required the producers of feed additives to prove the safety of their substances, and it provided that “no food additive shall be deemed safe if it is found to induce cancer when ingested by man or animal.” Although the DES was not implanted in edible meat, public concerns about safety emerged during the 1960s. By the late 1970s, laboratory tests indicated that DES caused cancer, and the federal government banned it in 1979 (Marcus, 1994; Friedberger, 1994). Consumers also feared the use of antibiotics in feed grains but they had less success prohibiting those products. Although FDA surveillance of the use of antibiotics and other feed additives increased during the remainder of the twentieth century, the producers

of food animals often believed that public opinion, not science, substantively influenced their stock raising practices (Perry, 1992).

They were correct. Since 1989, the European Union (EU) has banned imports of hormone-treated beef. The EU determined that public health concerns merited the ban because European consumers wanted "risk-free" foods. Some grocery chains in the United Kingdom also refused to sell meat produced by cattle fed with genetically modified grain (Lusk, Roosen and Fox, 2003). EU bans, which generated considerable trans-Atlantic acrimony, were generated as much by political needs to provide tariff protection and assert nationalist power as by scientific evidence (Wiener and Rogers, 2002).

Feedlots and Marketing

Although the feeding or fattening of cattle on corn dates to the early nineteenth century along the Scioto River Valley in Ohio, the feedlot industry developed during the last half of the twentieth century (Hudson, 1994; Henlein, 1959; Mintert, 2003). During the 1940s the cattle feeding industry began to shift from the Midwest Corn Belt states of Illinois, Iowa, South Dakota, and Minnesota to the Great Plains of Colorado, Kansas, and Nebraska. By the early 1960s, the cattle feeding industry had expanded to the panhandles of Oklahoma and Texas (Corah, 2008). Increasingly, in the central and southern plains the Ogallala aquifer provided water for the irrigation of feed crops that permitted farmers to raise corn where that crop would have been impossible without irrigation (Opie, 1993). Cattle feeders soon developed feedlots to maximize their investment with close proximity to feed and stocker cattle. The packing plants arrived soon thereafter to provide a nearby market which helped reduce transportation costs (Nall, 1982). By 2002, 74 % of the fed cattle marketed in the United States originated in the Great Plains, with Texas, Kansas, and Nebraska the largest cattle feeding states and which collectively marketed 60 % of all fed cattle in the nation (Mintert, 2003). At the same time, 80 % of the steer and heifer slaughter occurred in Colorado, Kansas, Nebraska, and Texas (MacDonald, 2003). The nexus of feed grains, water, stocker cattle, transportation, and the economies of scale that encouraged the development of large-scale packing plants indicated that this aspect of the feeder cattle industry would remain prominent into the twenty-first century with only the depletion of the Ogallala aquifer a potential problem that would cause the restructuring of the industry.

At the same time, the number of feedlots declined while production remained essentially the same from 1970 to 1995. In 1972, 104,613 feedlots in the thirteen major cattle feeding states marketed 23.9 million cattle. In 1995, only 42,435 feed yards remained, but they marketed 23.3 million cattle for an increase per feed yard marketing of 141 %. In 1972 feed yards with more than 1,000 head marketed 65 % of the cattle, but by 1995 they marketed more than 90 % of the fed cattle. Moreover, by 2002 feed yards with a capacity of 32,000 head marketed 49 % of all cattle sold in the United States, up from 29 % in 1982. In addition, the ten largest feedlots marketed as much as 29 % of the fed cattle sold in 2002. The feedlot industry, then, has consolidated while the number of fed cattle marketed has remained essentially the same (Mintert, 2003). By the turn of the twenty-first century, the feedlots had declined in number but increased in capacity. The feed yards also became concentrated in the central and southern Great Plains, and financing often came from investors outside of agriculture. Shipping fever, however, remained an unsolved problem for cattle coming to the feedlots for fattening, although

livestock producers had access to vaccination, nutrition, and management programs designed to reduce losses due to this respiratory condition (Perry, 1992).

Cattle marketing also changed substantially during the twentieth century. During the early 1900s most livestock was slaughtered on farms, by local butchers, or at major meat packing plants in Chicago, Omaha, and Kansas City, among other meat packing towns. Farmer-stockmen and ranchers either trucked their livestock to market or shipped their cattle and hogs by rail. After World War II, road improvement enabled trucks to provide more convenient shipping than by railroad and the meat packing plants moved closer to cattle feeding operations. Where more than 90 % of all cattle were sold to packers at terminal markets in 1925, by the late twentieth century packers purchased less than 10 % of their cattle though terminal markets. By the turn of the twenty-first century meat packers purchased nearly all of their cattle from nearby feedlots. Direct marketing saved packers money because they no longer paid feed and yardage costs that the terminal markets usually assessed users. Moreover, cattle were handled fewer times in the shipping process from feeder to packer, and the packers could schedule their slaughter operations more efficiently if they purchased systematically and directly from the feed yards (Perry, 1992). By the early twenty-first century the feeding, marketing, and packing system had become efficient operations.

Environmental and Consumer Concerns

Although large-scale cattle, hog, and poultry producers operated systematic efficient, and profitable operations during the late twentieth century, they increasingly confronted state and county governments and nonfarmers over issues of water and air pollution. State and county governments now sought regulatory authority, while neighbors of hog confinement facilities and cattle feedlots frequently complained that such operations ruined their property values and made life unpleasant for nearby residents, and they became increasingly litigious (Hurt, 2002). Consumers might enjoy a pork chop or steak from the patio grill but they did not want to smell the confinement facility or feedlot that produced it. They also demanded that state and local governments preserve streams and rivers from the overflows of sewage pits and eliminate the stench from the confinement facilities or from the fields that had been fertilized with the wastes. Livestock producers used their organizations to lobby against passage of overly stringent regulations. By the end of the twentieth century, however, they did not control the agricultural and environmental political agenda. Environmental regulations increasingly mandated change, particularly for feedlot, poultry, and hog confinement and dairy operations, especially regarding control of manure waters. At the same time government requirements seldom considered the economic and management aspects of these regulations beyond the farm gate. If the past is a guide livestock producers can expect more environmental regulations and government oversight at all levels as well as continuing consumer attention (Morse, 1996).

Indeed, until the 1950s most livestock and poultry producers were little troubled by consumer concerns, and they raised their animals without drugs, growth hormones, or feed additives. The public generally worried about the wholesomeness and safety of food after slaughter as carcasses worked through the meat packing process. During the 1960s, however, the "consumer revolution" saw the emergence of private nonprofit groups that became public watch dogs with their focus on livestock raisers as well as meat packers, processors, and distributors, particularly in relation to the cattle industry. By the mid-1960s, consumer groups were concerned about food safety. Moreover, consumer advocates did not distinguish between cattle

raising by ranchers and small-scale farmers and industrial-scale feedlots that process tens of thousands of cattle annually. In addition, they had their own views about land use for the public good no matter the private ownership by producers. As consumer advocates and livestock raisers contested over the issue of land stewardship, the public demand for regulation of the livestock and poultry industry for the common good brought the federal government into the debate and with it increasing government control and regulation (Friedberger, 1994; Skaggs, 1986).

During the early 1960s as consumers became increasing concerned about food safety, one observer correctly noted that, "Americans are going to become more informed about their food supply. Food like most other basic commodities will become more of an intellectual concern and more of a political concern." By the 1970s nutrition and health dominated the agenda of the consumer advocates who often considered cattle producers the enemy. During the 1980s polls indicated that approximately 75 % of consumers worried about food safety, including the use of drugs, such as antibiotics, and chemicals, such as growth hormones and various feed additives. Some consumers stopped eating beef. Livestock raisers proved slow to counter those attacks (Flake and Patterson, 1999; Friedberger, 1994).

Conclusion

In retrospect, by the turn of the twenty-first century, food-animal producers anticipated the further development of global markets as incomes improved in developing nations, and the China market proved a compelling lure. Tariff protection, particularly by European nationalists, however, continued to make livestock production a political matter as well as an industry based on science, capital, and management skills. Foreign competition remained keen, particularly from Argentina, Brazil, and Australia (Corah, 2008). Food-animal producers no longer thought in terms of animal husbandry but rather animal science. Moreover, food animal production involved far more than emphasizing the most efficient means possible. Rather, it was part of an integrated food system driven as much by consumer demand which was affected by nutritional, health, and safely concerns, and politics in the form of regulations and restrictions, both domestic and international---as it was by science, technology, and management. Food-animal producers confronted those who urged them to use "prudent precaution" to ensure public health and reject the pursuit of "risk-superior" ways to improve production. Indeed, food animal production had become a sophisticated and complicated matter of animal science and politics (William, 1986; Fajt, 2007; Weiner and Rogers, 2003).

If the past is prologue, food-animal producers will see more procurement by contract sales and vertical integration with the further loss of small-scale operators and producer independence as well as more emphasis on country-of-origin labeling and traceability. Food safety and environmental issues will remain at the forefront of public policy (Loureiro and Umberger, 2007; MacDonald, 2003). Animal rights and welfare during handling at feedlots and slaughterhouses may become increasingly important issues (Grandin, 2006; Grandin, 2001; Guither, 1998) While animal rights activists have considered food-animal producers inhumane and unethical, many producers considered these advocates irrational and radical. If anything is certain, based on the history of food-animal production, it is that the industry will continue to change, driven by science and technology as well as politics and public policy.

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Historical perspective of the integration of animal agriculture

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There have been significant changes in United States (U.S.) livestock and poultry production methods and industry structure during the past few decades. These changes have led to increased efficiency and lower cost of production. Some people view these changes as uncompetitive and detrimental to the quality of farm life. In this paper, I briefly discuss seven major trends that have shaped U.S. animal agriculture:

1. Expanding production
2. Fewer and bigger operations
3. Specialized farms
4. Integration
5. Contracting
6. More efficiency
7. Shrinking footprint.

Expanding Production

The U.S. livestock and poultry industry has grown a great deal in the last 50 years. In 2009, U.S. milk production was 54% larger than in 1960 and U.S. beef production was up by 81%. U.S. pork production was 112% greater in 2009 than in 1960. These were small increases compared with poultry: U.S. turkey production has grown by 595% since 1960, while broiler production has increased 719%.

There are three key reasons for this growth. First, the U.S. population increases by nearly 1% per year. There were 70% more people living in the U.S. in 2009 than in 1960. Second, per capita meat consumption has increased. The average American consumed 28% more meat in 2009 than in 1960. Third, U.S. meat exports are increasing. In 1960, the U.S. exported 161,306 tons of meat; while in 2009, the amount of meat exported was 6.7 million tons.

Fewer and Bigger Operations

The number of farms in the U.S. is steadily declining. According to the Census of Agriculture, the U.S. had 6.8 million farms in 1935, but only 2.2 million in 2009. The number of farms raising livestock and poultry is declining at a faster rate than the total number of farms. Since meat production is increasing and the number of farms with livestock is declining, it follows that production per farm is increasing.

In 1986 there were more than one million U.S. farms that had beef cows. In 2009, 753,000 farms had beef cows. During this period the average beef cow inventory increased from 33.3 to 42.1 cows per farm. The change was much more dramatic for other species. In 1965, the number of U.S. farms raising hogs exceeded one million with an average inventory of 47.8 head per hog farm. Last year, only 71,450 farms raised hogs and the average inventory per hog farm was 921 head. In 1974 over 470,000 U.S. farms had milk cows with an average inventory of 24

cows per farm. In 2009, 65,000 farms had milk cows and the average inventory per farm was 144 head. In 1935, 5.8 million farms raised chickens, and in 2007 that number was 178,283.

Why are farms becoming fewer and getting larger? First, farm prices have not kept up with the rate of inflation. As Table 1 shows, since 1960 the deflated prices of meat animals have declined by more than half.

Table 1 Percentage Change in Nominal and Deflated Prices, 1960-2009

Commodity	% change nominal price	% change deflated price
Slaughter steers	+219.2%	-56%
Milk	+276.2%	-48%
Hogs	+122.2%	-69%
Eggs	+131.4%	-68%
Broilers	+179.9%	-61%
Turkeys	+ 86.7%	-74%

Sources: USDA/ERS, Red Meat Yearbook and "Livestock, Dairy and Poultry Situation and Outlook"

Since livestock prices have failed to keep up with inflation, livestock producers have two basic choices: live on less money year after year, or raise more animals.

Another reason livestock farms have gotten bigger is economies of size. In general, bigger farms can buy cheaper, sell higher, and are more efficient. For example, US Department of Agriculture/National Agricultural Statistics Service (USDA/NASS) data indicate that large sow operations average 31% more pigs (2.32 head) per litter than the smallest operations. Much of the efficiency gain comes from labor specialization. Large operations find it much easier to match worker skills and wages to job requirements. On small farms, the owner-operators have to make complex management decisions even though they spend much of their time doing menial labor.

Specialized Farms

In the past, most U.S. farms were diversified and produced more than one product. Today, many farms are specialized and market only one commodity. As Table 2 shows, in 1950 hogs could be found on more than half of the farms in America, dairy cows on two-thirds of U.S. farms, and both beef cattle and chickens on three out of four U.S. farms. The latest Census of Agriculture found that in 2007 only one-third of U.S. farms raised beef cattle while hogs, dairy and chickens were found on fewer than 10% of America's farms. Although not as dramatic, the trend towards specialization is also occurring on crop farms (Table 3). The percentage of farms marketing corn, wheat, cotton or tobacco in 2007 was less than half of the percentage of those type farms in 1964.

Table 2 Portion of All U.S. Farms with Livestock

	1950	1964	1978	1992	2007
Sheep	6.0%	7.4%	3.6%	4.2%	3.8%
Beef	75.5%	72.3%	38.5%	41.7%	34.7%
Hogs	56.0%	34.2%	18.0%	9.9%	3.4%
Dairy	67.8%	35.9%	12.6%	8.1%	3.2%
Chickens	78.3%	38.3%	9.7%	4.6%	6.6%

Source: U.S. Census of Agriculture (various years)

Table 3 Portion of All U.S. Farms Marketing Crops

	1964	1974	1992	2002	2007
Corn	43.8%	31.9%	26.2%	16.4%	15.8%
Wheat	23.4%	19.9%	15.2%	8.0%	7.3%
Soybeans	17.7%	22.8%	19.8%	14.9%	12.7%
Cotton	10.3%	1.7%	1.8%	1.2%	0.8%
Tobacco	10.5%	8.0%	6.5%	2.7%	0.7%
Orchards	7.1%	4.6%	6.0%	5.3%	5.3%
Vegetables	4.2%	3.4%	3.2%	2.6%	3.1%

Source: U.S. Census of Agriculture (various years)

Why are farms specializing? Although specialization usually leads to greater year-to-year fluctuation in profits, it increases efficiency and lowers cost of production thereby enhancing long-term profits. One cannot learn to do 50 things as well as one can learn to do 10 things.

Integration

In the production of America's food, fertilizer feeds crops, which feed animals, which become meat, which becomes food for people. Vertical integration brings together different stages of the production/marketing process under common ownership. Traditionally, animal agriculture integrated feed production with raising animals. Modern livestock and poultry operations are less likely to raise their feed than in the past and more likely to integrate production and processing. More than 90% of broilers are raised by firms that are also chicken processors. According to surveys conducted by Glenn Grimes at the University of Missouri, hog packers raised 6.4% of U.S. hogs in 1994 and 27% in 2006.

Why the move to combining animal production and processing in common ownership? There are a number of advantages of being a producer-packer. The profitability of livestock production and the profitability of meat processing tend to be counter cyclical. When hog inventories are low, hog production tends to be profitable and pork processing unprofitable. A firm that both produces and slaughters a species of animal is likely to have less year-to-year fluctuation in net income than firms that only raise that species or only slaughter it. The other key advantage of being a producer-packer is the ability to control the quantity and quality of the animals being slaughtered. An integrated producer-processor has greater opportunity for quality control and to provide consumers with information about the meat they eat than processors who buy animals from a large number of producers. Traceability is easier in an integrated firm.

The disadvantages of integrating animal production with meat processing include the high investment cost, the complexity of managing distinctly different businesses, and the lack of flexibility in production flows.

Contracting

The use of production contracts and marketing contracts became common in animal agriculture in the second half of the twentieth century. More than 90% of broilers and nearly half of hogs are raised under a production contract. With animal production contracts, one person/firm (the contractor) owns the animals and another person/firm (the grower) owns the facilities where the animals are raised. The animal owner typically provides all feed, pharmaceuticals and hauling while the facility owner typically provides utilities and labor for care of the animals. Benefits of contract production for the contractor (animal owner) include lower capital requirements, lower site risks, and potentially less production risk. Benefits to the grower (facility owner) include lower capital requirements, less market (price) risk and potentially less production risk. Production contracts have proved to be popular with bankers, and many lenders have offered more favorable financing to growers than to independent producers.

Traditionally, livestock producers have made marketing decisions when the animals were ready for slaughter and the animals were sold on the spot market. In the case of hogs, 62% of barrows and gilts were sold on the spot market in 1994 (Grimes 2009). Only 7% of barrows and gilts were sold on the spot market in 2009. Today, two-thirds of market hogs are sold under a marketing contract. With a marketing contract, the producer has a binding agreement to sell the animals when ready for slaughter to a specific processor. Why the shift to marketing contracts? Advantages for the producer include lower transaction costs, assured shackle space, and in many cases, higher or more stable prices. Advantages of marketing contracts for the processor include lower transaction costs, a consistent supply of animals of known quality, and in many cases a better quality animal.

More Efficiency

U.S. animal agriculture is becoming more efficient. From 1960 to 2009, annual beef production per cow increased by 73%. Milk production per cow increased by 193% and pork production per sow increased 177%. More production per animal is one of the major reasons that market prices have not risen as fast as the rate of inflation. Why is animal agriculture steadily becoming more efficient? Two primary reasons: first, knowledge accumulates; second, new technology.

Shrinking Footprint

The environmental impact per ton of meat produced is dropping fast, thanks largely to indoor production. In 1960 fewer than 10% of U.S. hogs lived indoors. In 2006, 94% of hogs lived their lives indoors (Lawrence and Grimes, 2007). The movement away from outdoor production has caused a dramatic reduction in soil erosion and runoff of manure into streams and rivers. Being able to moderate of the extremes of weather and to control certain diseases and parasites have brought healthier animals, less death loss and improved feed conversion. U.S. pork production is growing three times as fast as hog feed consumption and hog manure production.

The aforementioned changes in animal production also have had a dramatic impact on the economics of the meat business. From 1960 to 2009, the deflated retail price of beef declined by 27%, the deflated price of pork declined by 31%, the deflated price of chicken in stores dropped 58% and turkey was down 65%. In 1970, the average American spent 4.2% of their disposable income buying meat and acquired an average of 194 pounds of meat. In 2009, the average American spent only 1.61% of their disposable income to buy 210 pounds of meat. Modern animal agriculture offers consumers more for less.

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Consumer trust in the U.S. food system: Implications for communication and regulation

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Overview of the U.S. Food System

1. The U.S. food system provides a large quantity of safe, wholesome, and relatively inexpensive food to hundreds of millions of persons.

2. This system faces real and perceived challenges to its credibility arising from:
   a. More complex food chains.
   b. More complex food processing.
   c. More food imports.
   d. More direct threats to its safety.

3. These challenges are further complicated by the fact that U.S. consumers want to be actively involved in making food-related policy, but most are geographically and conceptually far removed from the food system.
   a. Most persons live off the farm.
   b. Most persons do not know how food is produced, processed, and distributed.

The Sociological Problem

1. Therefore, we have a critical societal system that faces significant challenges arising from its size, structure, complexity, and direct threats to it, and which

2. Is guided in part by citizens with little knowledge about it.

3. This mismatch requires that citizens place much trust in representatives of the U.S. food system.

Two sociological questions:

1. How can food system representatives communicate with the public to instill trust?

2. How can the United States regulate its food system and still have it work effectively in a large, complex society?

Question #1: Communication: The Risk Communication Trilemma

I take some liberty with the English language to describe three horns to the dilemma of communicating effectively about food safety hazards.

Horn #1: Let the experts decide.

Approach

Because most citizens do not understand the great complexity of the U.S. food system, they might be best off leaving decisions to the experts. That is, it might be best to "Let science be the guide for policy regarding the U.S. food system."

Assessment of Approach #1

This approach has some advantages because consumers are: 1) ignorant, 2) untrusting, and 3) skeptical.

Note that:

1. We all are ignorant because we cannot help but be in a complex world.

2. We all to some extent are untrusting. Some distrust is desirable because a viable democracy requires that citizens challenge, probe, ask questions.

3. We all are skeptical. Think of it this way: After about 200,000 years of existence, those of us on this planet are the children of those who responded to potential dangers; the humans who were not skeptical did not live long enough to have children!

Too often, representatives of the U.S. food system assume that ignorant, skeptical, untrusting consumers are irrational, irresponsible, and unreasonable ones. Relating to consumers in this manner is not an effective way to instill trust. In a democracy, all citizens are allowed by law to participate in policy formation.

Summary

Horn #1 cannot easily be resolved because consumers cannot and should not be asked to leave policy decisions about the food system entirely in the hands of a few experts.

Horn #2: Educate consumers.

Approach

Provide consumers with the facts about food safety.

Assessment of Approach #2

This approach appeals to our sense of shared democracy. It is without doubt a necessary component of risk communication.

But it has several limitations:

1. The paradox of democracy: There are lots of cooks in the kitchen and experts disagree.

2. All technologies are flawed and all have negative consequences for some segments of the population. Thus, "educating" consumers means they will hear both favorable and unfavorable comments about any food or procedure for processing and delivering food to their grocery. When limitations are made public, consumers become skeptical because in the short run, negative information carries disproportionate weight.

3. Therefore, educating consumers can actually decrease trust rather than increase it!

Therefore, although education is a necessary component of risk communication, it is not sufficient to instill trust.

Summary

Horn #2 cannot easily be resolved because negative information has disproportionate weight.

<u>Horn #3: Blame the media.</u>

Approach

Blame the media for unnecessarily creating undue concerns, particularly in response to expressed concerns that are either trivial or have little scientific merit.

Assessment of Approach #3

1. This approach has intuitive appeal because media reports “amplify” negative information.

2. It sometimes can seem unreasonable to have to respond to media reports on statements that have little scientific merit.

3. However, one must accept that:

    a. The media has a job to do.
    b. The media has ethical responsibilities to report both sides.
    c. Most of the time, media representatives act responsibly.

4. Blaming the media does not instill trust.

Summary

Horn #3 cannot easily be resolved because the democracy we desire requires protection of free speech and an actively involved press.

The Risk Communication: The Diffusion of Innovations Approach

Approach

1. This approach has been well known and well researched for more than 50 years.

2. It has been implemented successfully in thousands of applications worldwide for many years.

3. The approach involves:

   a. Identifying opinion leaders, who are trusted, respected third-party persons or organizations.

   b. Obtaining endorsements from opinion leaders.

Assessment of the Diffusion of Innovations Approach

This approach offers a solution to the risk communication trilemma. Opinion leaders beat the trilemma by instilling trust upon representatives of the societal system. Through their endorsements as respected outside agencies, they "deem" representatives to be trustworthy.

This approach works, but begs the questions:

1. What are the key determinants of public trust in the U.S. food system?

2. What actions can institutional actors, whether established or new, large or small, take to gain and retain public trust?

Previous Studies on Risk Communication

Here are just some of the variables used to explain consumer trust in the U.S. food system:

perceived risks	stigma
complexity	alienation
age	perceived benefits
familiarity	relative advantage
value similarity	sex and gender
anomie	compatibility
source credibility	trialability
observability	race and ethnicity
income	prior exposure
media attention	education…..

The Sociological Approach

Of course, a simpler model would be preferable! We seek a model that:

1. explains much of the variance in trust,

2. with just a few variables,

3. that are easily understood, and is

4. actionable.

The Consumer Trust Model (Center for Food Integrity)

The Consumer Trust Model posits that trust can be explained by just two key variables: competence and confidence. Competence is an assessment that a firm or organization has the skills, experience, and expertise to carry out its tasks effectively. Confidence is an assessment by the consumer that a firm or organization will act with integrity and honesty—that it will do the right thing. In this application, the model seeks to explain consumer trust in the U.S. food system, which is posited to lead to compliance with recommendations by representatives of this system regarding proper regulation of it.

Testing the Consumer Trust Model

In 2007, 2008, and 2009 the Center for Food Integrity conducted nationwide surveys to investigate the viability of the Consumer Trust Model. A reference to the academic work on this model is provided below.

The studies examined the efficacy of the Consumer Trust Model across five areas of the U.S. food system: food safety, nutrition, worker care, environmental protection, and animal welfare. They evaluated the model for 7-9 pertinent representatives of the food system (e.g., producers, processors, grocers, regulators, restaurants, advocacy groups) within each of the five areas. For the 2007 study alone, this approach yielded 41 tests of the model.

The results indicated that the model:

1. explains much of the variance in trust,

2. with just a few variables,

3. that are easily understood,

4. and actionable.

Confidence is the key driver of consumer trust in the U.S. food system. On average, confidence outweighed competence by a factor of 3 to 1 in explaining consumer trust. Clearly, consumers were driven more by their assessments of the honesty and integrity of food safety representatives than their assessments of their skills and expertise.

These results were replicated in 2009 on another topic of public controversy (i.e., building additional high voltage power lines).

Implications of the Findings

1. Communicating about the competence of food system representatives is important for gaining and maintaining consumer trust.

2. Even more important for gaining and maintaining consumer trust is instilling confidence in food system representatives.

3. Future research needs to identify specific actions that reflect competence and instill confidence.

Question #2: Policy Issues for the U.S. Food System

Policy Issues Related to the Consumer Trust Model

1. Opinion leaders in the U.S. food system (USDA, FDA, EPA, etc.) typically ask for more regulations as a means of instilling trust.

2. The self-interest of maintaining consumer trust infers industry encouragement and support for recommendations offered by opinion leaders.

3. Therefore, maintaining trust often infers support for more regulation of the food system!

This conclusion seems reasonable. Consider, however, the potential negative consequences for small and medium size food companies of supporting greater legislation.

Economies of Scale

1. Conforming with regulations requires a burden of time and expertise.

2. These burdens weigh less heavily upon large firms compared with small and medium size firms.

3. Therefore: The greater the regulation, the greater the advantage for larger firms.

Two-Edged Sword

1. New regulations bring about greater safety, but new regulations might bring about greater industry control by a few large firms.

2. Small and medium size firms cannot oppose new regulations for fear of appearing to be "anti-safety."

3. Government agencies might appear to endorse favoritism if they set different regulations for different size firms.

4. Smaller firms might find it difficult to beat the “trilemma” by relying upon the diffusion of innovations approach because the actions of opinion leaders tend to create policies that create disproportionate burden on these firms.

5. Therefore, smaller firms must rely more on changing institutional approaches as a means to instilling consumer trust in them as representatives of the U.S. food system.

The Policy Dilemma

The U.S. food system faces a policy dilemma related to instituting regulations intended to bring about greater food safety.

Horn #1: Institute More Regulations and Enforcement of Regulations

This approach might be needed to maintain proper functioning of the highly critical and complex U.S. food system.

Horn #2: Encourage Entrepreneurship in the U.S. Food System

Instituting more regulations often places disproportionate financial and managerial burdens on smaller firms, which might hinder entrepreneurship and innovativeness in the U.S. food system.

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Redefining sustainability: Ethically grounded, scientifically verified, and economically viable

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Introduction and Overview

Use of the term "sustainable" is very much in vogue today. One hears the term used across a range of topics from economic development to politics. The word sustainable has at its root meaning the concept of sustenance, i.e., nourishment. This presentation will focus specifically on sustainability of animal agriculture. Discussions about defining agricultural sustainability have embraced a number of issues and viewpoints including: (1) consideration of impact on future generations, (2) having the least impact on nature, (3) ensuring that food production and distribution keeps pace with population growth, (4) contributing to positive economic development, and finally, (5) "that which lasts."

This presentation will tend to focus on animal agricultural systems that will last in coming years. Specifically, the question presented herein asks, "In terms of being sustainable, which housing systems and husbandry practices of today will be in place in American animal agriculture some 50 to 75 years from now"? It is suggested that if one knew the answer to this question, then one could today more easily and accurately define sustainable animal agriculture. Ultimately, economics, science, and ethics are each likely to play a significant role in determining which animal agriculture practices will be practiced in the latter half of this century. However, ethics may prove to be a major driving force in defining sustainable animal agriculture over the coming decades. Specifically, polls repeatedly indicate that the majority of the public wishes to continue to consume animal products, but these same polls indicate that the public wants assurance that animals are treated in an appropriate manner. The public's view of what is appropriate and ethical treatment of animals versus what some persons in animal agriculture consider to be appropriate treatment is currently in conflict. Resolution of this difference is most likely to result in some current animal agricultural practices ultimately proving to not be sustainable over extended decades.

Some critics contend that animals should be eliminated as a food source. Attempts at structuring this argument tend to build from at least two contentions. First, it is biologically inefficient to use animals in the production of food. Second, animal agriculture is inherently cruel; thus, it is unethical and the use of animals should be gradually phased out through what has been referred to as "animal liberation." This presentation is not an attempt to address either of these issues in detail. However, the manner in which the majority of persons in the future come to view these issues is likely to be critical in determining which practices of animal agriculture prove to be sustainable. Therefore, a brief comment is included about each of these two points.

Natural ecosystems involve a balance of both plant and animal life. Both plants and animals exist in natural systems quite simply because it is optimally biologically efficient to have both plants and animals in the utilization of the resources available in a balanced ecosystem. Thus,

one should argue that an optimal animal agriculture involves some balance and utilization of both plants and animals. Regarding the liberation of animals through their gradual elimination, one could argue that preventing animals from living as a means of preventing animal suffering is not altogether in the best interest of the animals involved. A more appropriate goal from the viewpoint of serving animal interests would seem to be the pursuit of animal housing and management systems that provide a reasonable quality of life before the animal's death. The polls that indicate the majority of persons wish to continue to consume animal products would tend to indicate a general public recognition that annihilation of food animals is not necessarily a preferred ethical standard over providing animals with proper treatment.
Finally, a theoretical discussion of animal agriculture sustainability is presented. A primary contention is that the animal agricultural systems that will last are ones that involve a balanced ecosystem built on a bioethical foundation. This foundation gives an appropriate balance in consideration to the interests of animals, humans, and the environment. Additionally, it is suggested that democracy may provide the optimal approach to attaining sustainability.

The Role of Science and Ethics

Science and technology brought forth revolutionary change in animal agriculture during the last half of the past century. The unit of food produced (milk, meat, eggs, etc.) per animal today is several fold greater than it was before 1950. This increase through technological advances has produced considerable positive benefits in that a large number of persons have been removed from a life of stoop or hand labor. Additionally, most Americans today have ready access to relatively cheap food. Thus, scientific research has played an important role in past development of animal agriculture and likely will continue to play an important role in the future of animal agriculture. However, the dramatic increase in the amount food generated per individual animal has brought forth new problems. Specifically, some animals (laying hens, high-producing dairy cows, etc.) are metabolically challenged to point where bones become leached of calcium, problems with feet or legs develop, rebreeding is a problem, etc. Additionally, large scale, intensive confinement farming systems have brought about questions related to animal welfare (confinement space, social isolation, etc.), the continuing decrease of small farms and supporting small towns, and environmental issues such as ground water pollution, etc.

A common contention today among some advocates of animal agriculture in addressing animal welfare and these related topics is that, "Science alone should be the basis for addressing these issues." I strongly disagree. Science should absolutely play a strong role. Additionally, a very strong argument can be made regarding the need for additional research funding in animal welfare and similar topics affecting animal agriculture today. However, science is a human endeavor that primarily answers questions related to, "What is?" Animal welfare ultimately poses questions involving, "What ought to be?" For example, using traditional methodologies of science, researchers can (and have) defined the amount of space required for a hen to stand, turn around, stretch her wings, perform certain behaviors such as mating, flying, etc. However, science cannot provide answers to the question of what behaviors a hen "ought to" be able to perform. Ethics is the human endeavor that has traditionally been said to deal with questions related to what ought to be. Ultimately, when one proposes an answer to the question of whether or not a hen ought to be able to perform a specific behavior, one is engaging in making an ethical statement even if that person is a scientist. Scientists do, and should, engage in such discussions. However, these discussions should not be left to scientists alone. Nor should

scientists remain ignorant of the fact that they have entered the realm of ethics when they engage in statements about how animals “ought to” be treated.

One of the reasons for the contention that science alone should be used is possibly related to the use of the term science today becoming basically a synonym for objectivity. Of course one should address welfare and related questions objectively. However, one can and should also address what “ought to be” type questions (i.e., ethical questions) objectively. In too many instances, scientists state positions about what ought to be while contending that the position they have presented is one of science alone. Again, I would argue that scientists should engage in discussions involving ethics. In fact, to avoid doing so is impossible. But to state again, scientists (and others) should recognize that when they have moved from making statements about “what is” to making statements about “what ought to be” they have made a transition from science to ethics. Accordingly, when this transition is made, one should attempt to do so with some knowledge and awareness of an obligation to follow some of the basic principles associated with appropriately engaging in making sound, objective ethical statements.

If science and ethics both objectively address the same question, there ultimately should be some convergence of the two approaches. In fact, a well constructed ethical argument should be one that involves science. Specifically, the ethical position that is most consistent and most strongly grounded in current scientific knowledge and theory possibly could (and should) prove to be the strongest---and the one most likely to last, i.e., be sustainable.

Economic Trends and Issues

Economic viability is of course essential for sustainability in a free market system. Today, the profit margin for animal food products at the farm level is narrow, in some instances one could say near microscopic. The narrow profit margin at times has turned to red and contributed to the dramatic decrease in the total number of farm units. Another economic factor with an ethical implication is that cheap labor has historically (and currently) been a tradition in agriculture. Yet, of each dollar spent at the supermarket counter for food, almost forty cents goes to labor, mostly associated with processing after the product leaves the farm. Even cheaper labor is available today in China and other Southeast Asian countries, South America, and other parts of the world. In a global economy, issues such as the environment and animal welfare could combine with the availability of cheap labor to push food animal production systems outside the United States (U.S.) borders.

Some of the following economically related states and changes may come about in the coming decades. First, some form of animal agriculture will most certainly continue to exist in the U.S., but there will likely be an offshore trend. Some trends in the amount of production and even systems of animal food production will likely prove to be unsustainable. For example, the current rate of increase in milk production per cow, some stall systems of housing, etc. are most likely to prove unsustainable. Biotechnology offers many new possibilities including some promise of bioengineered animal food products independent of the living animal. If these new technologies prove technologically possible and economically feasible, then they could prove to be the greatest threat to the sustainability of animal agriculture as it is known today---because they will tend to eliminate the animal from the system. We may come to know milk without the cow, eggs without the hen---even beef without the steer. Technologically, each of these already has some early research stage basis. Economically, were these to become technologically practicable,

each would likely be implemented on some scale. Ethically, one could argue that were these practices to come about, a number of associated negative consequences would result, not the least of which would be that a sizable aspect of animal agriculture would become unsustainable, eliminating both some animal life and some agricultural livelihood.

Theory of Sustainability

Adams (2006) presented a theory of sustainable development based on a Boolean model (Figure 1). His model involved the overlapping issues of social, economic and environmental factors. He contended that the overlap of social interests with the environment must be bearable. The social and economic overlap should be equitable. The economic and environment overlap should be viable. Finally, sustainability was said to be attained where the model overlapped in terms of each: bearable, equitable and viable.

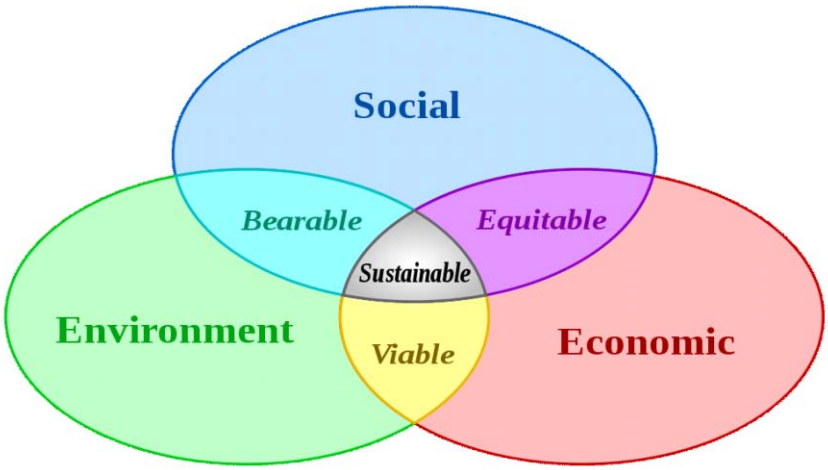

Figure 1. Theoretical Model of Sustainable Development. (Adams, W.M. 2006. The Future of Sustainability: Rethinking Environment and Development in the Twentyfirst Century. Report to the IUCN Renowned Thinkers Meeting. 2031 Jan 2006. www.iucn.org).

Suggested herein is a proposal that a theoretical model of sustainable animal agriculture might be developed by adopting some concepts from Adams' model as presented in Figure 2. Bioethics could be used in place of Environment. Bioethics in this instance could be considered to involve: (1) food-animals, (2) the environment, and (3) issues associated with the farm community, such as the trend toward the demise of small farms. In Figure 2, sustainable animal agriculture is thus represented by the area common to the three circles; Social, Economic and Bioethics. And, the overlap of Social and Bioethics represents those practices considered acceptable. The Social and Economics overlap should be equitable. Finally, the interface of Economics and Bioethics must overlap viably for sustainability to occur.

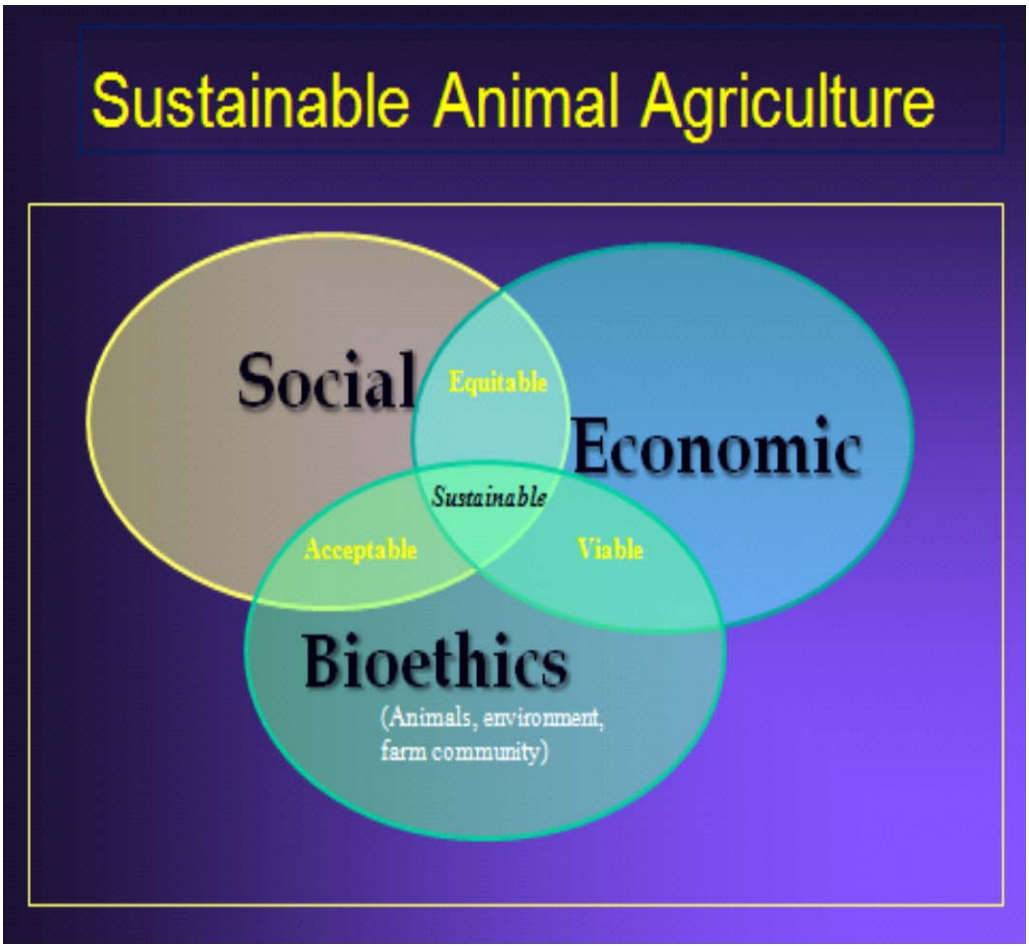

Figure 2. Proposed theoretical model for Sustainable Animal Agriculture.

A question that this model would seem to present is, “What actions would increase the probability of attaining sustainable animal agriculture?” That is, what actions would result in an increase in the area of the model labeled as “sustainable” in Figure 2? One could argue that the area representing social and bioethics overlap is likely to increase in coming years. Public concern about animal welfare and the environment is likely to grow. Thus, the direction of the shift could either increase or decrease the probability of sustainability of aspects of animal agriculture. In terms of sustainability of animal agriculture overall, the most critical question may be, “What direction will the economic factors shift?” Those animal production systems and units that shift toward meeting the social and bioethical viable and acceptable categories are likely to be the animal production systems that most likely prove to be sustainable over decades.

Conclusion

To be sustainable long term, animal production systems and units must have consumer support and confidence. An animal agriculture that is not considered bioethical will not prove to be sustainable over an extended number of years. To gain public support and confidence, there must be public input. Therefore, an animal agriculture that makes decisions by involving an appropriate balance of opinion from the public through a democratic process could ultimately prove to include those animal agriculture systems and units that last, i.e., animal agriculture that is sustainable.

Panel: Trends in society and their impact on our future food-animal systems

Charlie Arnot
Center for Food Integrity

Paper not provided. See power point section for slides.

Panel: Trends in society and their impact on our future food-animal systems

Janet Riley
American Meat Institute

Paper not provided. See power point section for slides.

Panel: Trends in society and their impact on our future food-animal systems

Animal agriculture and crop production - partnership in modern agriculture

Jay Vroom
CropLife America

Grand Challenges for Food and Agriculture

Today's grand challenges for agriculture may appear to come from sensationalized headlines that circulate emotive misinformation to attract the attention of an information-hungry, but food-satiated, American demography. Issues including animal welfare, the clean energy myth, the global food crisis and the cheap cost of food continue to be serious topics but they are re-packaged to abound in opinion journalism, the new method of selling magazines. The **real** critical issues facing agriculture include delivery of human health care, reduction in hunger, and increasing energy supply, all in a sustainable manner with minimal negative impact on the environment (CAST, 2010). As Dr. Norman Borlaug stated in the preface to the CAST paper, "You have to be able to communicate. Research information must be applied in order to meet human needs." The critical issues require science-based, cross-cutting, and multi-disciplinary solutions. The United Nations (U.N.) predicts world population will exceed 9 billion by mid-century and has called for a 100 % increase in world food production by 2050 (U.N., 2007). According to the U.N., this doubled food requirement must come from virtually the same land area as today. The U.N. Food and Agriculture Organization (FAO) further states that 70 % of this additional food must come from the use of new and existing agricultural technologies (U. N., FAO, 2002). Therefore, the need for innovation in modern agriculture through new technologies, and communication toward adoption and acceptance, is essential for the future of citizens, communities and natural resources.

The grand societal challenges of the future will not be overcome unless we invest in viable food and agricultural research, extension and education programs. New innovation will not be achieved without increased public funding for research. Federal funding for food and agricultural research, extension and education represents a top national priority and a necessary long-term national commitment. Research investments are demonstrated to yield tremendous returns, according to a United States Department of Agriculture (USDA) Economic Research Service (USDA, ERS) (2007) report that showed the average social rate of return to public investment in agricultural research is nearly 50 %. Research programs deliver not only highly valuable technologies at low cost, but most importantly, research programs train young scientists of the future.

The bottom line is that twenty-first century solutions will require adoption of many effective technologies without discrimination, in recognition of the importance of community and regional differences in agricultural production practices, food chain demands and consumer views. CropLife America (CLA) represents the crop protection industry that provides plant science

solutions for crop production. Our partnership with animal agriculture is essential to our industry. The dynamic face of agriculture must include an array of production methods that benefits farmers and consumers worldwide. We cannot afford to cherry pick technologies when we are striving to enhance quality of life and health for mankind, based on more affordable and sustainable supplies of food, feed, fiber, fuel and industrial products.

A Synergistic Relationship

The basis of modern agriculture is the synergistic relationship between animal agriculture and crop production. The livestock and crop production sectors have increased in value in a nearly parallel manner since 1970, to the 2010 estimated annual values of nearly $140 billion for livestock production and $160 billion for crop production (USDA, ERS, 2010a). American soybean producers have long-recognized that livestock and poultry consume nearly 95% of the U. S. soybean crop (United Soybean Board, 2010). Similarly, livestock and poultry consume at least 80% of the U.S. corn crop. Across all grains (barley, corn, grain sorghum, and oats), the ERS reports that in 2008-2009, 43% of grains produced were used as feed for livestock and poultry, whereas 41% went to food and fuel (USDA, ERS, 2010b). This was a shift from 2004-2005 when 52% went to feed and 23% went to food and fuel. The current increased use of grains in the U. S. for food and fuel presumably reflects the increased use of corn for ethanol production. One of the challenges the livestock and crop production sectors must resolve is to co-exist with the shifting markets for grains and still enhance the synergy between the sectors that has contributed to our historical successes for decades.

Trends in Society: Understanding "Crop Protection"

There is no doubt that today's consumers do not understand food production but they have been increasingly more aware and opinionated about nutrition, health and foods. Agriculture must be cognizant of the trends in society and respond proactively with information that inspires Americans to know the facts about food production.

CropLife America recently conducted research to better understand consumers' reactions to the benefits of the agricultural pesticide industry. An independent research firm conducted an extensive and far-reaching opinion poll. The survey reached 1300 adults, a group that included informed Americans and special audiences. "Informed Americans" included 800 Americans who went to college, are aware of political issues, vote, read the news, and know the issues. The remaining 500 were from "Special Audiences" consisting of the top thought leaders and policy influencers. This included policy leaders, health experts and scientists. Misconceptions and negative responses were high by both groups for words such as "pesticides." But both audiences were much more receptive to words and phrases such as "crop protection."

Research audiences were polled about their opinion of pesticides before and after introducing fact-based information and new messaging. Before the discussion, 55% of informed Americans and 61% of thought leaders favored the use of pesticides in agriculture. After introduction of new messaging, the percentages jumped to 81 and 78%, respectively. These results indicate that consumers respond to phrases and framing of your business and your industry, causing a key change in their understanding and receptivity.

Based on the research, four key new messages describe the crop protection industry.

1. The crop protection industry plays an important role in modern agriculture. By supplying farmers with important crop inputs, we are helping farmers produce an affordable and sustainable supply of food to help feed a hungry world.

2. The technologies that go into modern agricultural practices are safe. We work closely with government agencies to ensure that farmers have access to the most modern, safe, and effective products. Scientific integrity is vital to modern agriculture and all products are tested rigorously before widespread use. When used according to the label and application instructions, these products can be used safely and responsibly.

3. Constant innovations in farming practices not only produce more, but they also help growers reduce their environmental footprint and make farming more sustainable.

   Innovations make agriculture more productive, and therefore help prevent encroachment onto unfarmed land and preserve biodiversity.

4. The modern agricultural practices adopted by today's farmers ensure that all inputs are used with care and only when required.

Regulatory Challenges: Impacting Livestock and Crop Production

Agriculture is one of the most heavily regulated industries in the world. These regulations, whether it is the livestock, crop, animal health, meat and poultry or food industries, form the basis of one of the safest food supplies in the world, for which Americans spend less than 10% of their disposable income. The crop protection industry abides by the Federal Insecticide, Fungicide and Rodenticide Act, which describes the rigorous, science-based, risk and benefit assessment for the registration of pesticides. Pesticides registered by the U. S. Environmental Protection Agency (EPA) are safe for humans, animals and the environment when used according to the label and application instructions.

Today, growers and livestock producers are in a synergistic regulatory "cloud" that is aggressively threatening modern agricultural food production practices. Many of the environmental laws and regulations are being challenged as the EPA (EPA, 2010) responds to the impact and reactions of the legal system as well as the voices of non-governmental organizations. Some examples of the issues raised by the EPA since the fall of 2009 include a proposal on spray drift labeling language, a proposal on occupational risk assessment for farm workers, a request for public comment on a petition regarding the impact of crop protection on children of farm workers, and a proposal on disclosure of inert ingredients in crop protection products. In addition, the courts have decided that the EPA must issue National Pollutant Discharge Elimination System (NPDES) permits under the Clean Water Act for pesticides applied on, over or near water which will affect mosquito control and aquatic weed control. In early June of 2010, the EPA published a draft NPDES permit for public comment within sixty days. Further, the courts decided that the EPA failed to consult with the U. S. Fish & Wildlife Service or the National Marine Fisheries Service on risks to endangered species for pesticide registrations.

CropLife America has established a proactive plan to meet these regulatory challenges. The goal of the CLA EcoRoadmap™ (CLA, 2010) is to have regulatory agencies implement a fair and credible risk assessment process that utilizes sound science and reliable data to affirm that pesticide products can be used safely in the environment and comply with applicable environmental laws. The CLA EcoRoadmap™ comprehensively addresses environmental issues, including clean water, clean air, spray drift, ecological risk assessment, and endangered species. Based on the EcoRoadmap™ and in unity with our friends and stakeholders in agriculture, CLA currently has several science, policy, governmental affairs and communications initiatives addressing the environmental issues that impact both livestock and crop production.

Future Food Systems through Modern Agriculture: A Call to Action

Dr. Borlaug said "Now, more than ever, it is important for the general public to know the facts underlying the many agricultural issues influencing daily life." (CAST, 2010.) CropLife America strongly believes that a proactive unified voice is needed for all sectors of agriculture to share the facts about the sustainability and benefits of modern agriculture in producing affordable, safe, healthful, and plentiful food. A new initiative is being planned to promote modern agriculture. Whereas terms such as "production agriculture," or "corporate agriculture" are often used, "Modern Agriculture- Food for All" succinctly brands and summarizes our practices and beliefs. CropLife America resolves that agriculture must speak with one voice to Americans to share the benefits and facts about modern agriculture and food production.

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Ethical and practical implications of food-animal agriculture

Paul Thompson
Michigan State University

See Appendix C for paper.

Panel: Different perceptions of sustainable agriculture

James R. (Tres) Bailey
Walmart

Paper and power point slides not provided.

Panel: Different perceptions of sustainable agriculture

Mike Morris
YUM Brands

Paper and power point slides not provided.

Panel: Different perceptions of sustainable agriculture

Bryan Dierlam
Cargill

Paper and power point slides not provided.

Panel: How can we move forward? The need for a collaborative vision

Jack Fisher
Ohio Farm Bureau

Paper not provided. See power point section for slides.

Panel: How can we move forward? The need for a collaborative vision

Chandler Goule
National Farmers Union

To create a unified idea for America's scientific, technological and agricultural future, it is critical to emphasize that all organizations involved reach toward a single vision. Our agricultural communities have changed significantly: in the 1950s fifteen percent of the U.S. population was, at the most, only one generation away from the family farm. Now, in 2010, most consumers have no direct connection to, or knowledge of, where their food comes from or how it arrives at their table. If we are to progress in a successful direction for collaboration, then education is key. Our endusers and consumers need to know about agricultural America and how their knowledge is the key to our success.

With all movements there arise challenges. The challenge here is avoiding the weakening wedge between groups, organizations, and government. Agriculture is a victim of a "wedging" philosophy because of its connection with both internal and external groups. Often times this "wedging" is seen in the area of trade---pitting one commodity against another, preventing all of agriculture from mutually benefitting. If we are to achieve success then we must define a unilateral theory among all groups.

Coexistence is key. In order for this to be achieved, agricultural organizations across the board must realize that there is a place for everyone. We must all work together: conventional, organic, sustainable, small, and large producers need to make a pact that the importance is agricultural success for everyone.

How are we to do this? By a strong collaborative effort. This year funding will be slightly less for the 2012 Farm Bill. Thus, it needs to be understood that all organizations and partnerships matter for the success of America's agricultural future. It is important we work with our nutrition counterparts throughout the 2012 Farm Bill and educate the public on the importance of domestic food security. To secure the safest food supply to our nation, it is crucial to be a team.

In conclusion, we must focus on working together, speaking out to consumers and the media about positive steps taken that are both healthy and environmentally friendly. To achieve success we must focus on finding a common ground within our own industry and being able to coexist with all sectors. The goal is to obtain an abundant, affordable, and safe food supply.

Panel: How can we move forward? The need for a collaborative vision

Christine Bushway
Organic Trade Association

Paper not provided. See power point section for slides.

Panel: How can we move forward? The need for a collaborative vision

Moving animal welfare forward in the beef industry

Joseph M. Stookey1 and Dan Thomson2
1University of Saskatchewan, Saskatoon, SK
2Kansas State University, Manhattan, KS
Co-chairs of the North American Food Animal Well-being Commission on Beef

In May of 2008 the first International Symposium of Beef Cattle Welfare was held at Kansas State University in Manhattan, Kansas. That event sparked discussions regarding the need for a North American-wide approach to responding to welfare issues that face the North American beef industry. Dr. Dan Thomson from Kansas State University, Dr. Mike Siemens from Cargill, Drs. Elisabeth Parker and Tom Fields from the National Cattlemen's Beef Association (NCBA) and others recognized that beef cattle welfare issues are not restricted to the United States, but span the borders into Canada and Mexico. The same live cattle, processors, transporters, wholesalers and retailers in the United States move back and forth across the Canadian and Mexican borders making issues that arise in one country of major concern and interest to the neighboring countries. This realization led to the formation of the North American Food Animal Well-being Commission on Beef.

How is it that the topic of beef cattle welfare deserves such a coordinated approach? Like food safety and environmental concerns the issues arising that relate to animal welfare represent potential tipping points for the industry. Though economics is typically the driver in determining the success or failure of a farming operation, a slaughter plant, etc., we are now at a point where animal welfare issues play a major role in the sustainability of the livestock industries.

Indirectly, economic constraints can lead to the vulnerability of the livestock industries on welfare grounds. As an example, Figure 1 shows the dramatic decline in the number of swine and beef producers in Canada during the last 45 years. During this time the number of cattle and hogs being produced within Canada has risen. Tied to the increase in livestock numbers and the decrease in the number of producers is a dramatic increase in farm size. This relationship is not unique to Canada and the exact scenario has occurred in the United States and elsewhere. As a general rule, as the number of animals on the farm increases, the operation becomes more intensive and more dependent on confinement rearing systems. At the same time we see less diversity in the types of systems and we see similar strategies emerge across an industry within a country. Survival of the fittest not only describes the producers who survive over time, it also describes the systems that survive through economic "selection." It is estimated that nearly 80% of breeding sows in the United States are housed in gestation stalls during their pregnancy. If gestation stalls become socially unaccepted on welfare grounds (as they have in the United Kingdom, some European countries and in some U.S. states), then it places many producers in a vulnerable position. In such a scenario it becomes somewhat ironic that the widespread use of gestation stalls, adopted as an economic strategy to remain competitive and sustain the future of the operation, is in fact not a sustainable choice under public pressure. In very simple terms it means that in order to be sustainable, a

system must be sustainable on economic, animal welfare, and environmental grounds. Producers who are making decisions on which system to embrace on economic grounds alone may find their system or practices are not sustainable in the long run. This lesson is now very clear to producers in countries that have experienced the relatively recent arrival of welfare legislation for farm animals.

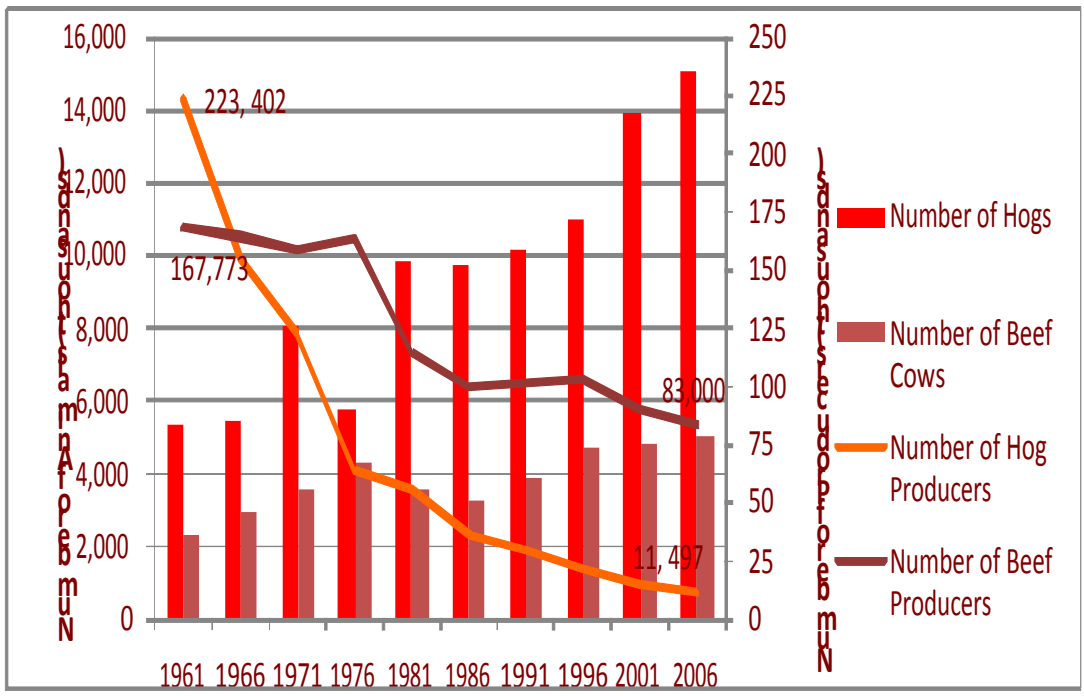

Figure 1. The number of beef cows and hogs (left vertical axis) in Canada and the number of producers (right vertical axis) (1961-2006) Source: Statistics Canada, Census of Agriculture, various years.

Based on a Canadian study aimed at describing farm income and structure, a present day farm needs in excess of $250,000Cdn in annual revenue (Sparling, 2006, Institute of Agri-Food Policy Innovation) or roughly a herd size of 400 beef cows to remain viable. As a result our beef herds are growing in size, too, but surprisingly the cow/calf industry seems to be one livestock segment that becomes less intensive and less reliant on confinement as the farm and herd size increases. Currently more and more of the larger cow/calf producers in Western Canada are shifting toward a spring or summer calving season. While it may be more natural to calve in sink with the availability of grass, it also means some of the larger operations are spending less time attending cows at calving time because the cows are scattered over a larger area and because the calves are not at risk to extreme weather conditions. Therefore, cows that need assistance at calving can go undetected for longer periods of time and some may miss assistance altogether and be more vulnerable to predation than was typically seen when calving in corrals. This may be an example in which the general public becomes less concerned about welfare issues for beef cattle under the extensive range systems because the risks appear more

natural, but in fact the change toward pasture or range calving simply brings with it a different set of animal welfare concerns.

Like other livestock and poultry industries, the beef cattle industry is not immune to welfare concerns and, as mentioned earlier, the issues span across the borders of North America. For this reason the North American Food Animal Well-being Commission on Beef (NAFAWC-Beef) was established in 2009. The group is comprised of animal scientists and veterinarians who have demonstrated through their research and careers an interest in beef cattle welfare issues. Their mission is to serve as "an independent voice to advance evidence-based and practical improvements in the care and well-being of North American beef cattle."

The beef commission will operate under the umbrella of the Food Animal Welfare Network (an organization yet to be formed). In time it is expected that other livestock and poultry industries will form similar commissions. The responsibilities of the NAFAWC-Beef are listed in Table 1.

Identify the most important animal welfare issues facing the beef industry
Develop standards of production for beef cattle
Guide research needs and field investigations
Produce reports to address issues and solve problems
Independently review and endorse practices, standards and assessment tools when asked by stakeholders
Develop animal well-being monitoring system for real time feedback in outcomes of practices utilized to raise cattle
Recommend and develop animal care-giver training programs and monitor training
Represent our stakeholders interests in state and national public forums when requested by overarching commission

Table 1. A list of responsibilities of the North American Food Animal Well-being Commission on Beef.

The list of responsibilities is ambitious and will require significant coordination and time for the commissioners to attend to each area.

Top Beef Cattle Welfare Concerns	Response
Environmental conditions for animals (heat, mud, etc.)	14
Painful procedures	13
Weaning/Preconditioning/Respiratory disease issues	11
Transportation	8
Cattle handling	7
Disposal of chronically ill animals	6
Alternatives to branding	5
Euthanasia techniques	4
Public perception and legislation of Animal Welfare	3
Metabolic disease	2
Electro ejaculation of bulls	2
Timing of castration/dehorning	2
Employee training	2
Basic best management practices	2
Unwanted dairy bull calves	2
Auction market handling of animals	1
Dust control for cattle	1
Economics of improved welfare	1
Dystocia of feeder heifers	1
Disconnect between beef and dairy industries	1

Table 2. Beef cattle welfare issues identified by commissioners of the NAFAWC and the number of times the topic was selected.

Prior to the first meeting of the NAFAWC-Beef an informal survey was completed by the members to identify the top welfare concerns they believe to be facing the beef industry. The survey results are listed in Table 2. The list is varied and ranges from the broader hot button issues, which are typically identified by public critics (e.g., painful procedures, transportation, etc.) to more specific problems that informed beef producers are trying to improve (e.g., cattle handling, weaning, respiratory diseases, etc.).

Nearly all the issues will require more research, education and coordination to tackle, and some topics are recognized as needing more regulations to control the problem. For example, the issue of downed animals at auction markets will require a combination of educating producers and transporters to identify candidates unable to withstand long hauls, with stronger regulations or penalties for shipping animals unfit for transport. Historically there was a strong moral and ethical responsibility to avoid waste and to salvage the meat from any animal fit for human consumption, but public outrage at the sight of a downed animal clearly demonstrates that the "sin" of wasting an animal is trumped by the "sin" of an animal suffering and unable to rise. Producers, transporters and livestock markets must adapt to this newer ethic. Also, because a large portion of downed cattle are culled dairy cattle that were destined for slaughter and consumption as "beef", the beef commissioners recognize that such issues will require coordination and collaboration between the dairy and beef industries.

Funding for NAFAWC to research, review and address these issues will come from the Grandin Foundation (a nonprofit 501©) 3 charitable organization). The board of directors for the newly

formed Grandin Foundation and the Farm Animal Welfare Network remain to be selected. The current beef commissioners for NAFAWC are listed in Table 3 and represent a cross-section of scientists and veterinarians who are already working on many of these issues.

Name	Affiliation
Coetzee, Hans	Kansas State University
Gill, Gill	Texas A&M University
Grandin, Temple	Colorado State University
Griffin, Dee	University of Nebraska
Loneragan, Guy	West Texas A&M University
Mitloehner, Frank	University of California, Davis
Noffsinger, Tom	Benkelman, Nebraska
Riddell, Gatz	AABP, Executive Director
Rushen, Jeff	Agriculture and Agri-Food Canada
Schwartzkopf-Genswein, Karen	Agriculture and Agri-Food Canada
Shearer, Jan	Iowa State University
Sjeklocha, Dave	Academy of Veterinary Consultants
Smith, Bob	Oklahoma State University
Stookey, Joseph	University of Saskatchewan
Stull, Carolyn	University of California, Davis
Swanson, Janice	Michigan State University
Thomson, Dan	Kansas State University
Woods, Jennifer	Blackie, Alberta

Table 3. Members of the NAFAWC-Beef and their affiliation.

It is the vision of the NAFAWC on Beef that all North American beef cattle receive proper care for their entire life. The commission intends to work toward that goal in an ethical, practical, unbiased, science-based manner driven by measurable outcomes.

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Economic impact of transitioning from swine gestation stalls to group pen housing

Brian L. Buhr[3]
University of Minnesota

Need for Study

Modern swine production systems rely heavily on confinement production systems for cost effective and humane production of pork products. However, there are increasing calls to reduce or eliminate the use of individual sow gestation stalls for housing breeding sows and gilts. The European Union is phasing out stall use by 2013. Voters in Florida and Arizona have approved ballot initiatives to ban their use in the coming years, and in 2007 the Oregon Senate passed a bill banning gestation crates. Restrictions on gestation crates also have entered the U.S. Farm Bill discussions.

Imposition of regulatory requirements on production methods will result in significant costs to producers and, ultimately, to consumers who pay a higher price for pork products. This study examines the economic costs of transitioning the U.S. swine production sector from a breeding sector based on gestation stall facilities to one based on group housed pen facilities.

Do Pens Improve Welfare and Maintain Productivity?

Prior research on sow productivity and welfare suggests that the type of system does not necessarily determine sow welfare. Stalls allow for individual sow management and remove the potential for sow aggression and injury, but sows are incapable of full movement. Pens allow for greater mobility, but also allow sow aggression that can result in injury and also extreme variation in body condition between aggressive and submissive sows.

It is also not clear that productivity differs between gestation stalls and pens. Prior research has found no significant productivity differences. A survey was conducted asking producers using pen housing on a commercial scale to address productivity impacts. This survey also found no consistent difference in productivity. However, respondents indicated several key issues that would affect group housing productivity: (1) producers must learn to manage group dynamics of sows; (2) some stall use must be available for up to 32 days after breeding for proper implantation and also for isolation of sows when they "fall-out" of pens; (3) feeding for management of body condition variation is critical; (4) space allocation per sow relative to pen

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This report is an executive summary of a full staff paper that can be found at: http://purl.umn.edu/61604.

size is critical; and (5) the potential for catastrophic productivity losses is greater with pens. So, although there does not appear to be significant differences on average in production, there are significant risks posed by transitioning the industry from stalls to pens in a short time frame.

Base Assumptions and Scenarios for Economic Analysis

The economic analysis is based on the economic impact of transitioning from gestation stall housing to group pen housing under a regulatory mandate. The capital costs of transition are evaluated in addition to the potential impacts of differences in productivity.
To determine the economic impacts on the pork industry of a transition to pen housing, two alternative pen systems were simulated: a trickle feed system with small pens of six or fewer sows and an electronic sow feeding (ESF) system with large pens of 50 to 60 sows. The trickle feed system is simpler to operate and implement as a retrofit, but may require additional barn square footage. The ESF system is technically more sophisticated with the potential for greater management and maintenance issues, but it allows for sows to be housed on the same square footage as existing stall systems. Both systems were scaled to a commercial level of 2,400 and 1,200 sow units.

The capital replacement cost is modeled so that the additional cost of retrofitting or replacing an existing barn prior to the end of its depreciable life (about 25 years) results in increased capital costs, but no improvement in revenue if productivity is unchanged. This is modeled as an infinite horizon net present value problem. To aggregate impacts to an industry level requires estimation of the number of barns to be replaced or retrofitted and the average age of the barns to determine their useful life lost. Based on US Department of Agriculture data it is estimated that 1,725 barns with 1200 sows would need to transition to the replacement housing system and 1,370 barns with 2400 sows would need to transition as a retrofitted facility. No information is available on barn age, so the ages are assumed to be uniformly distributed over 25 years.

Three scenarios are analyzed: (1) the productivity costs are unchanged between stall and pen based gestation and the only cost is the capital cost of retrofitting stall facilities or building new pen systems; (2) in addition to the capital costs, it is assumed that productivity decreases for two years during the transition, this is the most likely scenario; and (3) the productivity decreases are persistent for the life of the facilities, this is the worst case scenario.

Barn Level Economic Impacts

The following table shows the most likely impacts of a transition to pen housing assuming a uniform distribution of the age of existing facilities at the time a regulation requiring transition is introduced. Industry losses will range between $1.87 billion and $3.24 billion.

Most Likely Aggregate Industry Economic Costs of Transitioning to Group Pen Housing

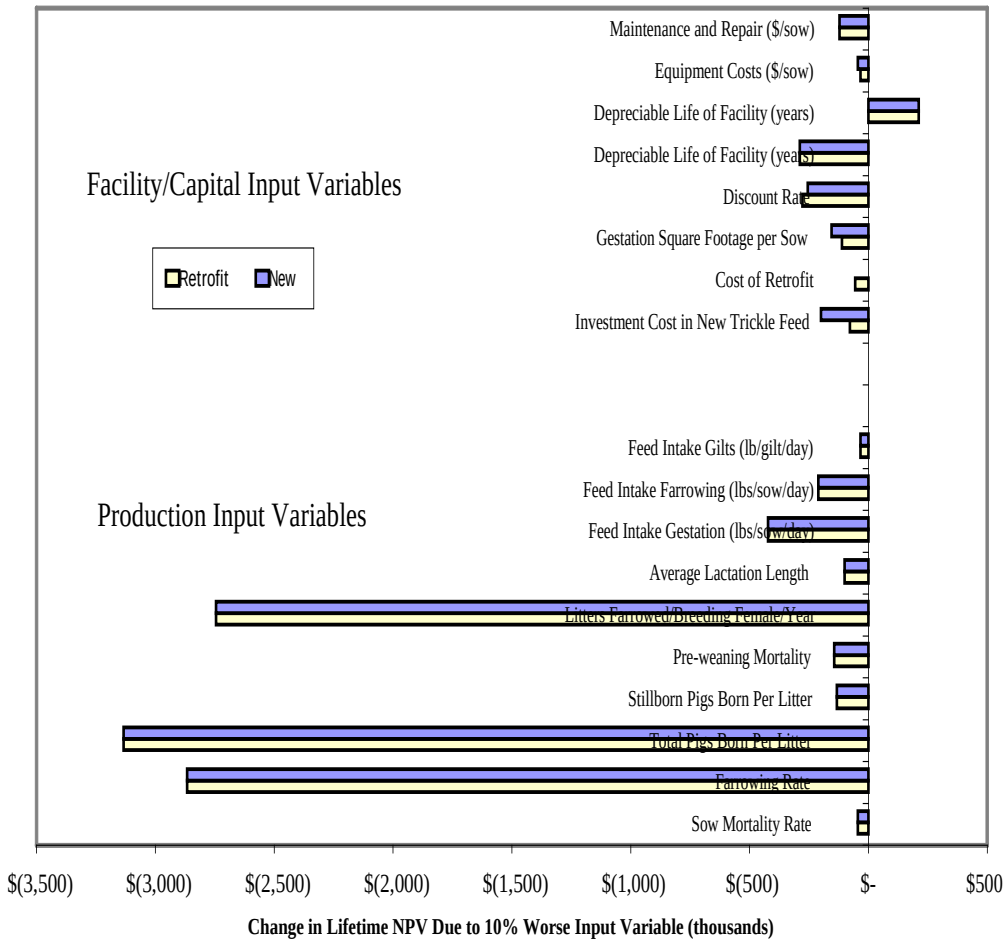
	Capital Cost Plus 2 Year Productivity Loss	
Scenario	**Total Industry Cost**	Percent Decrease in Industry NPV
Total Average Cost to Retrofit Barns to Trickle Feed	**$ 1,867,892,023.74**	74%
Total Average Cost to Build New Trickle Feed	**$ 3,240,730,303.66**	129%
Total Average Cost to Build New ESF Feed	**$ 3,237,111,517.39**	97%

Note: ESF percent decrease is lower because the cost basis of the stall barn comparison was also different. NPV = net present value

Several factors affect these losses. The shorter the time period for transition the greater the economic losses. If productivity losses are permanent, which may be reasonable if pen facilities are more difficult to manage, the losses will increase. The best case is to allow barns to transition at the end of their useful life, and with no loss in productivity from group housing sows. Also, because facility ages likely do vary by region and firm, even policies that allow transitioning at the end of facility life will create structural competitive differences among firms and regions. Those with older average age facilities will benefit more relative to those with newer facilities.

Sensitivity of Economic Impacts to Assumed Variable Levels

The levels of key input variables such as sow productivity measures, depreciable life of the barns, and the transition period can impact the economic estimates of the costs of a transition to group housing. A sensitivity analysis was completed, varying the level of key input variables used in the simulation. The following graph shows the relative impact of a 10% change in these input variables on the net present value producers will receive after the transition. Results show that as expected, productivity variables such as farrowing rate have the greatest impact on profitability. Therefore, it is imperative to determine expected productivity impacts. Capital costs are not as crucial because the one-time transition is eventually amortized from the production system.



For the two "Depreciable Life of Facility" bars, assume one barn depreciates faster than the other. Having faster depreciation reduces the cost of the transition.

Market Level Adjustment to the Transition

As the cost of pork increases due to the transition to group housing, hog production will be expected to decrease and hog and pork prices will increase. A market supply and demand model including trade is used to analyze the market level price/quantity adjustments. The following table shows the impacts on consumer and producer surplus which is a net measure of the increases in prices and reductions in quantities from market response to higher costs of production.

The key implication is that pork producers lose $1.5 billion dollars---less than half the approximately $3.2 billion they lose if market adjustments are not accounted for. As typical of cost increases in a commodity market, consumers bear most of the cost increases resulting in an estimated $5 billion loss to consumers.

Beef and chicken producers gain because consumers switch consumption to these meats and their prices rise as well. A similar substitution effect occurs for imported pork products that increase to replace the more expensive domestic pork products. Therefore, regulations to restrict sow housing will place the U.S. pork sector at a competitive disadvantage to other domestic meat sectors and to international pork production if they don't adopt similar standards.

Most Likely Impacts on Market Level Producer and Consumer Costs

		ESF Productivity Impacts 2 year Transition
Variable		
Change in Producer Surplus (Net Impact)		
Pork Producer Surplus	Mill $	**-$1,491.30**
Beef Producer Surplus	Mill $	**$1,193.20**
Chicken Producer Surplus	Mill $	**$469.23**
Change in Consumer Surplus		
Pork Consumer Surplus	Mill $	**-$2,714.12**
Beef Consumer Surplus	Mill $	**-$1,698.46**
Chicken Consumer Surplus	Mill $	**-$576.34**
Total Consumer Surplus	Mill $	**-$4,988.92**

An argument is typically made that increased animal welfare is demanded by consumers and they will compensate producers by paying higher prices. However, as clearly shown the market alone will not compensate producers. To fully compensate pork producers would require an additional 25 percent increase in consumer willingness to pay for U.S. pork products from sows raised in pens. The problem is that only a small subset of consumers is actually willing to pay a large difference for animal-friendly practices. Consumers not willing to pay for these practices are essentially taxed by a regulation that mandates costly production practices such as the transition to pen housing.

Conclusions

Any regulation that mandates transition to pen-based housing from existing stall housing prior to the end of the useful life of existing facilities will result in increased costs to the pork industry. Ultimately these costs will be borne by consumers. An alternative approach is to allow phase-in as barns reach the end of their useful life, but only if it can be determined that there are no reductions in productivity or sow welfare due to pen housing, a process that will require further research and preferably commercial-scale research trials. Perhaps the best alternative is to develop labeling and certification programs that allow producers and consumers who share concerns regarding gestation stalls to more effectively participate in market-oriented transactions. This would avoid the aggregate cost impacts of a large-scale mandatory transition and allow consumers to target their spending to preferred animal rearing methods and products.

Future welfare of farmers and their animals

John Deen
University of Minnesota

Paper not provided. See power point section for slides.

Panel: Comprehensive analysis of certification and regulatory programs: What is the future?

David Townsend
Smithfield Foods (Swine industry)

Paper and power point slides not provided.

Panel: Comprehensive analysis of certification and regulatory programs: What is the future?

Yvonne Vizzier Thaxton
Mississippi State University

A world without laws would be like musical chairs with no rules. Laws and regulations are necessary, however. It is difficult to write a law and subsequent regulations that are neither ambiguous nor plagued with unintended consequences. Compounding the problem is the recent trend to participatory democracy in which citizens have access to the ballot through the referendum process.

For example, Proposition 2, a citizen's initiative that resulted in regulations banning the use of traditional cages for chickens, was intended to provide the birds with an environment that allowed egg collection for food use while providing the birds with more humane living conditions. This has been interpreted by many to mean "cage-less." Current scientific evidence demonstrates that enriched cages may be more humane based on comparing the positive and negative aspects of various housing types. Regardless of intent, this legislation could easily result in a reduced supply of commercial eggs at a significantly increased cost.

Another example is the current U.S. regulation for the presence of *Salmonella* in poultry. In the United States, regulations address the genus with no species or serotype exceptions. The original goal of the regulations was to improve human health through a reduction in the presence of *Salmonella* on raw poultry products. The motivation was good, but the execution flawed. Not all of the two thousand plus serotypes cause human disease so reduction is possible without any reduction in the incidence of disease—which is indeed the current situation. In addition, other countries that regulate specific serotypes are using the published data as a reason for banning importation of U.S. products. This is further complicated by variation in sampling methodology among countries.

Further, it is difficult in many cases to adequately enforce regulations due to a lack of personnel. This often results in compliance by complaint. In contrast, certification programs can be written that allow precise evaluation of compliance and ease of amendment or alteration as new information becomes necessary. In certain situations, the laws can be better upheld and compliance verified using certification programs rather than extensive regulations. Third party auditors can be used on a fee basis making them more economical and efficient than the broader-based governmental regulatory programs.

If the general public continues to lose connection with agriculture, it is likely that there will be increased pressure on regulators to promulgate regulations that will have negative consequences for the food supply. If, however, there are third party audit programs in place that can be verified, it will be easier to avoid the negative impact of regulation.

World and U.S. population growth: How can we feed everyone?

William Weldon
Elanco Animal Health

See Appendix C for paper.

Should there be biotechnology in the future of animal agriculture?

L. Val Giddings
PrometheusAB, Inc.

Should the future of animal agriculture have a place for biotechnology? First, what IS biotechnology? The term has been used in many ways, with different meanings. It embraces fermentation, tissue culture, embryo rescue, somatic cell nuclear transplantation, marker assisted breeding, genome sequencing, and transgenic. Most of the controversy in recent years has centered around the use of transgenic technologies and somatic cell nuclear transplantation, or "cloning." For the purposes of this paper/presentation, the primary reference will be to transgenic technologies, in which exogenous deoxyribonucleic acid (DNA) is incorporated into the genome of an organism to impart a desired characteristic through expression products of the introduced genetic material.

A useful baseline for consideration is provided by the experience to date, around the world, with transgenic technologies applied to domesticated crops. Primarily used in soybeans, corn (maize), and cotton, the impacts have been dramatic and positive. At the end of the first fourteen years of commercial growing of biotech crops, from 1996–-2009, 134 million hectares (331 million acres) of biotech crops were in the ground, grown by 14 million farmers, 13 million of whom are smallholder in developing countries (James, 2010). These farmers grow biotech crops in 25 countries, legally, and several more (e.g., Ukraine, Iran) in which the legal status is unclear, or actually "prohibited." History does not record a more rapid adoption of a new agricultural technology. Introduction of artificial selection took place over millennia, as did the introduction of plowing for weed control. The introduction of hybrid seed, particularly with corn/maize, spanned several decades. By contrast, in less than two decades, biotech-improved varieties of soybeans have grown to comprise 77% of the global soybean harvest, 49% of the cotton, 26 % of the corn/maize, and 21% of global canola (James, 2010). The reason for this is simple: biotech-improved varieties deliver dramatic value at every level from farm to fork.

These crops have delivered substantial and significant economic, environmental, and consumer benefits. They have added $33.8 billion to farm income (Brooks and Barfoot, 2010), decreased the carbon emissions associated with agriculture by 15.6 billion kilograms of CO_2 in 2008 alone, and reduced the use of pesticide sprays by 352 million kilograms between 1996 and 2008. It is estimated that the increased production derived through biotech-improved cultivars has helped keep commodity prices significantly lower than they would otherwise have been (from 3 to10%; Brookes et al., 2010) and that producing the same amount of harvest with non-biotech varieties would have taken 2.64 million hectares of land (6.5 million acres) beyond what was actually used.

Despite the claims of opponents, the safety record of foods and feed derived from these crops has been exemplary. At the end of a 15-year project involving 81 separate studies by 400 teams, costing 70 million Euros, the European Commission concluded:

> Indeed, the use of more precise technology and the greater regulatory scrutiny probably make [GM foods] even safer than conventional plants and foods;… …the benefits of

> these plants and products for human health and the environment become increasingly clear (EC, 2001).

The Commission on Green Biotechnology of the Union of the German Academies of Science and Humanities concluded that:

> Food from GM maize is more healthy than from conventionally grown maize… samples with the highest fumonisin concentrations are found in products labeled "organic" (ABIC, 2004).

The Government of Australia found that:

> Anti-GM campaigns have focused on possible environmental and food safety concerns associated with GM crops and food products. **The likely position is, in fact, the complete opposite. GM crops offer potentially significant health and environmental benefits.** For example, adoption of GM varieties has transformed the Australian cotton industry's environmental performance, reducing insecticide use by 70% over the past decade (Agriculture and Food Policy Reference Group, 2006).

The conclusions of independent, authoritative scientists can be summed up in a representative citation:

> The risks GE crops pose for the environment, and especially biodiversity, have been extensively assessed worldwide during the past ten years of commercial cultivation. Consequently, substantial scientific data on environmental effects of the currently commercialized GE crops is available today….**The data available so far provide no scientific evidence that the commercial cultivation of GE crops has caused environmental harm** (Olivier, et al.,)**.**

In view of such stellar benefits derived through the use of biotechnology innovations in crop agriculture, one could be forgiven for wondering on what basis any suggestion to abjure the use of biotechnology in animal agriculture could rest.

The United Nations' Food and Agriculture Organization (FAO) has estimated that global demography will shift dramatically over the next 40 years. Whereas in 1999, 70% of people grew what they ate, it is estimated that by 2025, 50% of the global population will live in cities and depend on imported food and market channels. Global population is anticipated to reach 9 billion by 2040, and economic uplift is expected to double the demand for meat protein over this period. The FAO estimates that in order to achieve the necessary doubling of food production, gains will have to come from additional farmlands (20%), increased intensity of agricultural production (10%), and new technologies (70%; OECD-FAO, 2010).

Particularly in regard to animal agriculture, how might biotechnology help? Virtually every livestock production or quality constraint can be mitigated or overcome through biotechnology (Giddings, 2006). Myriad applications exist in the biomedical arena as well. Tools available to address agricultural challenges include, of course, breeding, the analysis and manipulation of qualitative trait loci, and various forms of marker-assisted selection, combined with chromosomal analyses and genome-wide selection. Tools in biomedicine (and all of these tools

are applicable in multiple sectors) include genomic and proteomic analysis, metabolomics, nuclear transfer technologies, microinjection, and phenotype assays. Agricultural traits that can be enhanced with these tools include meat and milk quality and composition, productivity, conformation, disease resistance, hardiness, fertility and fecundity, environmental tolerance, and environmental footprint. Biomedical applications will include animal disease models; xenotransplant sources for cells, organs, and tissues; as well as high value products including inter alia, devices, drugs, and biologics.

There are safety and ethical issues, to be sure, but these do not seem to be qualitatively different from those with which societies have grappled since the dawn of domestication (Budiansky, 1992).

It must nevertheless be said that biotechnology is not a silver bullet; it will not solve all the problems we face, nor is there any reason to prefer it to other approaches when and where they provide superior solutions. Indeed, the magnitude of the challenges we face is such that we cannot afford to reject any approach for any reason except that there is a better way. But when the question is raised as to whether or not biotechnology should be one of the tools in our toolbox, the conclusion seems clear:

> Instead of rejecting the solutions offered by science, we should change policies to assure that the solutions benefit the poor… Condemning biotechnology for its potential risks without considering the alternative risks of prolonging the human misery caused by hunger, malnutrition and child death is unwise and unethical (Pinstrup-Anderson, 2001).

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Agricultural productivity strategies for the future: Addressing U.S. and global challenges

Gale A. Buchanan
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Luther Tweeten
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Bob Herdt
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We appreciate the opportunity to share a summary of CAST Issue Paper No. 45, *Agricultural Productivity Strategies for the Future – Addressing U.S. and Global Challenges.* We appreciate your interest, commitment, and concern for the future of agricultural productivity.

I was honored to chair the writing team with two outstanding co-authors, Luther Tweeten from The Ohio State University and Bob Herdt formerly with the Rockefeller Foundation and now at Cornell University. Both are distinguished agricultural economists. The preface was written by Nobel Laureate Norman Borlaug. I'll say more about Dr. Borlaug later.

We had three very able reviewers: Chuck Conner, President and CEO, National Council of Farmer Cooperatives; Charles E. Hess, University of California, Davis; and Per Pinstrup-Andersen, Cornell University.

Dr. Norman Borlaug was truly a giant, especially to those of us engaged in various aspects of agriculture. Although he has been recognized in many ways including a Nobel Peace Prize, a Presidential Medal of Freedom, and the Congressional Gold Medal, his greatest contribution was his vision and commitment to ensuring food security for the people on this planet.

Introduction

In this paper, we describe some of the challenges facing agriculture and present strategies that will enable agriculture to meet future demands and expectations we will face.

We do not explicitly address important issues of food safety, international trade barriers, farm prices and income support, etc. Rather we focus on the basic need for developing the information, knowledge and technology required to make sound decisions regarding agricultural productivity and ensuring sustainability.

Correcting pathologies in the broader U.S. economy can reinforce the ability of agriculture to increase its productivity and exports. This may include correcting such things as living beyond our means; importing more than we export; borrowing more than we lend; spending more than we earn; and consuming more than we produce.

Given the finite nature of agricultural production resources such as water, land, and nutrients, as well as the myriad constraints on agricultural production—particularly animal agriculture—future successes of agriculture must be achieved through enhanced productivity.

Future Demands Facing Agriculture

The principal drivers of global demand for agricultural output includes a growing population, particularly in developing countries; increased expectations for a better standard of living that includes more protein in the form of meat, milk, and other animal products in both developed and developing countries; increases in disposable income; and the use of some agricultural output for addressing energy needs of the planet.

One billion people in poor countries today rarely get enough to eat. Another billion do not get sufficient nutrients, minerals, and proteins. Poorer countries will continue to draw heavily on food imports in the face of global climate change.

Based on the median population growth that includes non-food demands, the overall demand for farm products is projected to be 143% of year 2000 output in 2025 and 179% of 2000 output in 2050.

Bioenergy and Bioproducts Bring about a New Paradigm for Agriculture

In the future, petroleum will become more limited and expensive. It is clear that we are nearing the end of the era of cheap petroleum. This fact along with recognition that agriculture can contribute to meeting the energy challenge means that future strategies for agriculture must take this into account.

Harvesting the sun's energy through agriculture will be one of the approaches to meeting the energy challenge and this means an almost limitless demand for agricultural output. This will bring about a new paradigm for agriculture.

Current and Emerging Constraints on Future Agricultural Productivity in the United States

While agriculture is already facing many challenges, there are also a number of current and emerging constraints that will affect agricultural productivity in the days ahead. Here are a few of those constraints.

<u>Soil erosion caused by water, wind, and other factors</u>

Water is already a major constraint, but undoubtedly will become an even greater issue in the future.

<u>Lack of support for bioengieered crops</u>

Plants bioengineered to cope better with heat, salinity, and too much or too little moisture offers substantive new benefits. Unfortunately, significant voices still oppose the use of the powerful techniques of biotechnology and genetically engineered crops.

Animal welfare issues

Protein from meat and other animal products are a source of high-quality proteins and comprise an important component of the diet of many humans. Globally, much land unsuited to crop production is best suited for livestock grazing. However, particularly in Europe and the United States (U.S.) there are strong voices that oppose animal agriculture. Most of us see this as a major challenge and substantial constraint on agricultural productivity in the decades ahead. This is a challenge in which we must project and communicate a credible, transparent message that accepts accountability.

Personally, it does not bother me if someone prefers to not consume animal products. That should be a personal preference. However, those of us who are involved with agricultural productivity and have responsibility for meeting the needs and expectations of the people are concerned.

Quite frankly, there is a struggle for who determines what we eat. Will it be food producers? Probably not. More likely, it will be various organizations and groups that have a specific agenda. These include the vegans, those who push meatless days or organic days or locally grown days. Then, what about those of us in agriculture who push our own products, even at the expense of others.

Of course, the consumer should be the one who determines what he/she eats. But the decision should be made on an informed, non-emotional basis.

As a plant scientist, I find that the whole issue of animal agriculture reminds me of the opening scene of "Dances with Wolves." You recall, Costner is riding between two armed camps and *both sides* are shooting at him. It is important that we find common ground such that animal agriculture remains a viable and integral component of agriculture. We must find a way to meet the challenges that lie ahead. In the final analysis, the future of animal agriculture is in the hands of society as a whole.

Animal confinement has led to the development of EPA regulations on concentrated animal feeding operations (CAFOs). These regulations can significantly increase capital requirements and costs in dairy, hog, and other livestock production systems. We recognize that animal agriculture will change due to many economic and social pressures that include various regulations, certifications, local ordinances, propositions, and laws.

State and local regulations stemming from animal welfare concerns have a similar effect of raising production costs. If costs increase too much, livestock production will shift to jurisdictions without such regulations or out of the country. Thus, federal regulations may drive production overseas and state regulations may drive production into other states with lower animal welfare standards.

When markets alone do not provide desirable levels of environmental protection or animal welfare, a public role may be appropriate. The usual avenue for public policy is through state or national legislative bodies.

Some alternative agriculture advocates are increasingly trying to turn such environmental issues to direct vote of the people rather than the traditional *representative democracy* of legislatures to achieve their objectives.

Unless voters are informed by science and education, unintended consequences may result from such plebiscite democracy. For example, requirements for costly facilities and equipment mandated for U.S. poultry and livestock producers can drive production elsewhere.

A recent example is in California where voters passed Proposition 2 mandating that as of January 1, 2015, it shall be a misdemeanor for any person to confine a pregnant pig, calf raised for veal, or egg-laying hen in a manner not allowing the animal to turn around freely, stand up, lie down, and fully extend its limbs. A laying hen has a wingspan of 3 feet, hence would require 9 square feet per bird, more than 10 times the current average cage space per laying hen.

We recognize some of the challenges in animal agriculture but there are some bright spots. For example, some recent research into controlling climate emissions indicates that feed additives (including oil) can reduce greenhouse gas (GHG) emissions. Developing a better understanding of the advantages and disadvantages of confinement vs. free range systems and how we can balance welfare and economics is an important goal for research.

Other challenges include developing better animal health products, developing alternatives to antibiotics and addressing antibiotic resistance, food security such as decreasing microbial risk, and capturing the power of biotechnology. The latter includes a host of challenges such as metabolic modifiers. Much research should be focused on more effectively converting animal waste into energy. Another important challenge is enabling the public to have a better understanding and appreciation of animal welfare and its relation to livestock production. Because of the importance of animal agriculture in achieving a secure food future for the people on this planet, CAST has a long history of addressing important and relevant issues related to animal agriculture.

Here are some other constraints on agricultural productivity.

Endangered Species Act

Preserving the planet's diversity of flora and fauna is important for future generations. It should be borne in mind, however, that preserving diversity comes at a price. In the final analysis, decisions must be made carefully after weighing costs vs. benefits.

Fertilizer resources

Among principal commercial fertilizer resources, nitrogen is plentiful in the air (78%), but currently is made available to agriculture primarily through natural gas feedstock resources. Potassium reserves are abundant. However, phosphorus derived from phosphate rock is a limiting mineral resource in crop production. The United States extracted 31 million metric tons (mmt) of phosphate rock in 2008 from a reserve base of 3,400 mmt.

Global warming

Although overall agricultural output and cropland area may not be affected materially by global climate change in the United States, the crops we grow and the location of crop production will change. While specific climate changes are still being observed and the topic debated, there is general agreement that agriculture will certainly be impacted because of water availability, temperature variation, and other factors.

Major Issues Facing Agricultural Productivity Outside the United States

As the world becomes more global in nature, there is a greater need to consider agriculture productivity from a global perspective. I'd like to mention four countries or places in the world that are particularly relevant to agricultural productivity considerations for the twenty-first century.

China and India will generate a major fraction of future global agricultural demand from both income and population growth centers today and for the foreseeable future. Brazil, already an agricultural power probably more than any other major country on the planet, has the ability to become an even greater center of agricultural production in the future.

Conversely, sub-Saharan Africa is a region of the world where a significant portion of the population lives very close to the edge of hunger and has not been able to increase its agricultural production to keep pace with its needs. In this region, the growth rate of agricultural gross domestic product (GDP) per capita was close to zero in the 1970s, and negative throughout the 1980s and 1990s. Even with a positive growth rate in the last 10 years, however, this region desperately needs to increase productivity of agriculture if it is to progress in the future.

Strategies to Meet Future Agricultural Needs for Agricultural Output

The future success of agricultural productivity requires a supportive institutional structure. Much of this must come from the public sector. The private sector generally under invests in this area because it is unable to capture or derive profit. Basic research and education are definitely in the public domain.

How Should We Assist Less-Developed Countries?

1. First, we will continue to provide humanitarian food and support for less developed countries (LDC) to deal with crises, as we are doing currently in Haiti.

2. We must continue supporting and helping to build institutions and intellectual capacity. This reminds me of the adage: (1) Give him a fish (2) Teach him to fish (3) Teach him to grow fish.

3. We must continue working to develop international agreements and work to enhance international trade to address problems such as global climate change; air; water and land degradation; endangered species; and, protection and sharing of germplasm.

While more developed countries spend 2 to 4 % of their agricultural gross domestic product (GDP) on agricultural research, most of Africa spends less than 0.5%.

The Next "Green Revolution"

Agricultural policy in the twenty-first century for all nations of the world must include a strong commitment to science.

Dr. Borlaug clearly understood that science was a necessary and key part of agricultural policy to alleviate hunger in poorer regions of the world. That is why in his last writings he called for a second "Green Revolution." The critical and key question for us today is, "How do we go about creating a second "Green Revolution"?

First, I'd like to emphasize that all branches of science must be involved: basic and applied. Classical genetics and plant breeding played a central role in the first Green Revolution and will continue to be needed, but biotechnology that generates genetically modified organisms (GMOs) will play an increasingly important role in the second and future Green Revolutions.

The following are examples of promising approaches to improving agricultural productivity.

Example #1 – Converting or enabling C_3 plants to utilize the C_4 photosynthetic pathway

Example #2 – Nitrogen fixation in non-legumes

Example #3 – Incorporating the process of apomixis into crop plants

Example #4 – Improving pest resistance in plants

Example #5 – Improving energy efficiency of plants

Example #6 – Effectively and efficiently capturing all animal waste

Example #7 – Eliminating all respiratory disease in livestock

Example #8 – Utilizing the power of genomics and biotechnology to improve food animals

What is the Commitment to Agricultural Research to Bring About Another Green Revolution?

We wish we could say that the commitment to research was there for developing the information, knowledge and technology to bring about a second Green Revolution. We just don't see it.

There is an abundance of professional agricultural economic literature that reveals a strong association between agricultural productivity improvements and agricultural research. Given the unarguable linkage between research and agricultural productivity, we must strengthen our commitment to agricultural research.

Conclusions

Numerous factors are converging to create a “perfect storm” in terms of global food needs and expectations and agricultural output. While population growth rates are falling in some developed countries, global population is still increasing and is expected to increase in many developing countries for the next several decades.

In addition to the increasing demands for food and energy in developing countries, developed countries, particularly the U.S., are increasing their (our) demands on agriculture for fuel (energy), ecosystem services, and other environmental concerns.

Meeting the Challenge

Responding to the needs and expectations is not solely the province of the national and industry leaders and local governments. The public also will have to actively support political action, particularly on such broad issues as global climate change, environmental regulations, welfare of animals, natural resources, and investments in agricultural research and education.

The greatest concern felt by the authors of this paper is the apparent lack of commitment by the United States and other countries to make the research and education expenditures needed to address the problems affecting our future well-being on this planet.

It will take a strong and constant public commitment to ensure adequate funding. We are hopeful and confident we can and will make such a commitment. Indeed, we have no other choice.

Sustainability myths and musts—
key animal agriculture issues moving forward to 2050

Jason W. Clay
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"You can't wake a person who's pretending to sleep."
Oromo (Ethiopia) Proverb

Living on a Finite Planet

The world has finally "awoken" to the fact that we live on a single planet. Its resources are finite. This fact has been brought home to many when recent global economic growth led to spikes in commodity prices. While it should have been obvious that nonrenewable resources are finite, it is now clear that many renewable resources are being used at rates that are not sustainable as well. This includes seafood that comes from poorly managed marine fisheries as well as wood and pulp from poorly managed natural forests and food produced on agricultural ranch lands where soils, water and other key inputs are not managed sustainably.

World Wildlife Fund has developed a peer reviewed methodology, the Living Planet Index (LPI), which examines whether the Earth's resources are being consumed sustainably or not. It publishes this information every two years in the Living Planet Report. What is clearer perhaps than ever before, however, is that the following equation must hold:

Population x Consumption = Planet

Unfortunately, the Living Planet Report (2008) suggests that we are currently living at 1.3 planets, i.e. well beyond the carrying capacity of the planet. So, just when we realize that we are not using the planet's resources sustainably and that we will have to find ways to produce more with less, we now see that we have to rehabilitate the parts of the planet that we have degraded.

And then there's climate change. Many now understand that climate change poses a threat to every living thing on the planet. Unfortunately, many of us are still "asleep" to many of the other environmental threats that are perhaps even more serious in the short term than climate change.

The LPI calculations suggest where we are today with regard to the overall carrying capacity of the planet, but they do not give insights into where we are headed, particularly if we continue business as usual. While the precise numbers are not certain, the trends are. There is increasing consensus among scientists that global population will peak at between 9 and 10 billion by 2050. This translates to some three billion more people, 50% more than in 2000. In addition, by 2050 some 70% of all people are expected to live in cities, and their per capita income is expected to increase by 2.8 times (Clay 2010). Given these factors it is generally assumed that global consumption will double. What is less well understood is that with increasing income levels, many of the world's poorest will in all likelihood more than double their

overall food consumption. In short, while many of us are beginning to understand that we are living beyond the carrying capacity of the planet, few understand the overall impact of such increases in consumption.

Focusing more specifically on water, a billion people currently lack adequate water. By 2025, there is likely to be a 13% increase in overall water consumption (Rosengrant et al, 2003), but every two out of three people will face water scarcity(UNEP 2002). And, by 2050, an estimated 7 billion people in 60 countries (UN 2003) are expected to face water scarcity if something isn't done before then. In short, the lack of water in an increasing number of places most likely poses a more urgent, short-term threat to people and biodiversity and challenge to food production than climate change. But the two are not unrelated—climate change will accentuate water scarcity issues.

Food's Environmental Footprint

The impacts of human activities are not equal. Nowhere is this clearer than with the production of food--the set of human activities with the biggest impact on the planet, bar none. The use of land for food production (farming and ranching) is the single largest cause of habitat loss. It is also the single largest source of ecosystem loss from deforestation, to the draining of wetlands and alteration of local hydrology, and finally to the altering of rivers and river flows. Food production is the single largest user of chemicals globally (including herbicides, insecticides and fungicides as well as fertilizers and other nutrient supplements). Depending on the scientist, producing food is one of the largest, if not the largest source of greenhouse gases (GHGs) that contribute to climate change—and that is without instruments to measure or even adequately estimate impacts of food production on soil, rangeland, wetlands and other ecosystems.

Agricultural land use (e.g. crops and pasture) accounts for 33 % of the land on the planet. However, if one eliminates uninhabitable areas—deserts, mountains, lakes, rivers, cities and highways, etc.—then the land used for food production represents 58 % of the planet. After 1960 with the advent of the green revolution, the amount of land cleared for food production increased about 0.4 % per year. Over the past 10 years, however, the habitat lost for food production has increased to 0.6 % per year (Clay 2010 based on FAOSTAT). The increased encroachment of food production on natural habitat is probably caused by three factors—increased demand for food due to increased consumption; an overall decline in productivity gains through plant breeding and genetics; and the incorporation of poorer soils for farming that are cleared, farmed and more quickly abandoned. In the last 150 years, for example, farmers and ranchers on the planet have lost more than half of all topsoil from farmed areas. This means that they are losing organic matter at a faster rate than they are increasing it.

One message is clear—we are running out of land to produce food precisely at the time when we need to be producing more to meet increasing global demand. And, the state of other inputs is no better. Water is increasingly scarce in many parts of the world and water scarcity will be accentuated by climate change. Soil amendments such as phosphate are also in short supply with known sources expected to be exhausted by +/- 100 years.

Another message should be clear—whatever levels of impact are acceptable with 6.8 billion people will not be acceptable with more than 9 billion if we want to retain a living planet. So, the question that comes to mind is, on a finite planet, should consumers have a choice

about sustainable products, or should all products on the shelf be sustainable? And if consumers shouldn't have a choice, should companies?

Some Key Myths About Food

If we are to be strategic about food and the future, we need to understand clearly what the constraints are. There is general consensus about per capita income levels, population, and consumption trends. We have begun to see some similarities in the different models about the impact of agriculture on climate change. There is even consensus that there will be no silver bullet regarding how we feed the planet in the future (see Clay 2010). In fact, there is general agreement that there are likely to be seven or eight "Food Wedges" (similar to the energy wedges that will help wean us from petroleum) that will allow us to feed everyone. These include genetics, better management practices (BMPs), technology, waste, property rights, degraded land, changes in consumption, and carbon. While none of them will be sufficient by themselves, most analysts think that collectively they could solve our food production problems.

Unfortunately, there are a number of myths that influence public opinion and public policy in some countries that make it harder for us to focus on real issues as well as concrete strategies and actions. These myths are based more on assumptions and ideology than data and science. We must get past the myths if we are going to find solutions to our food issues. Thus it is important to be on the same page about myths vs. realities.

In my experience the following myths need to be addressed if we are to address the key issue of our day—preparing the groundwork for feeding 9 billion people while maintaining a living planet.

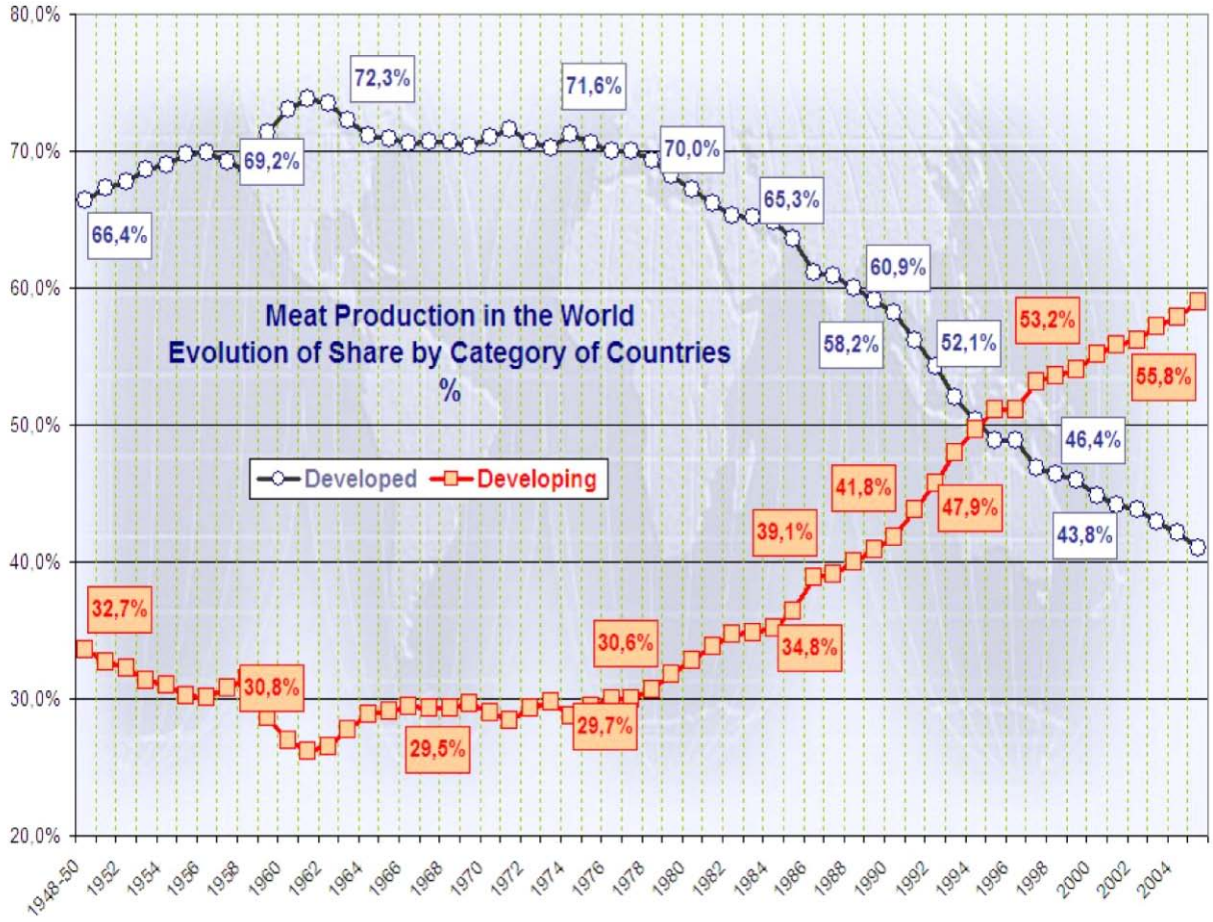
Myth 1—Most agricultural production is traded across international boundaries.

More than 90 % of all foodstuffs are consumed in the country in which they are produced (Clay 2010). At the turn of the century around 6 % of agricultural production was traded across borders. By the end of the decade the portion had increased to about 8 %. So while global trade is increasing, it is still only a small portion of total production.

However, international trade, even at the level of 6-8 percent is sufficient to reduce much of the volatility of global price fluctuations. Only a handful of countries account for most of the surplus production that is exported—Australia, Brazil, Canada, Thailand, Ukraine, and the United States (US).

Myth 2—Most globally traded agricultural raw materials are produced in developing countries.

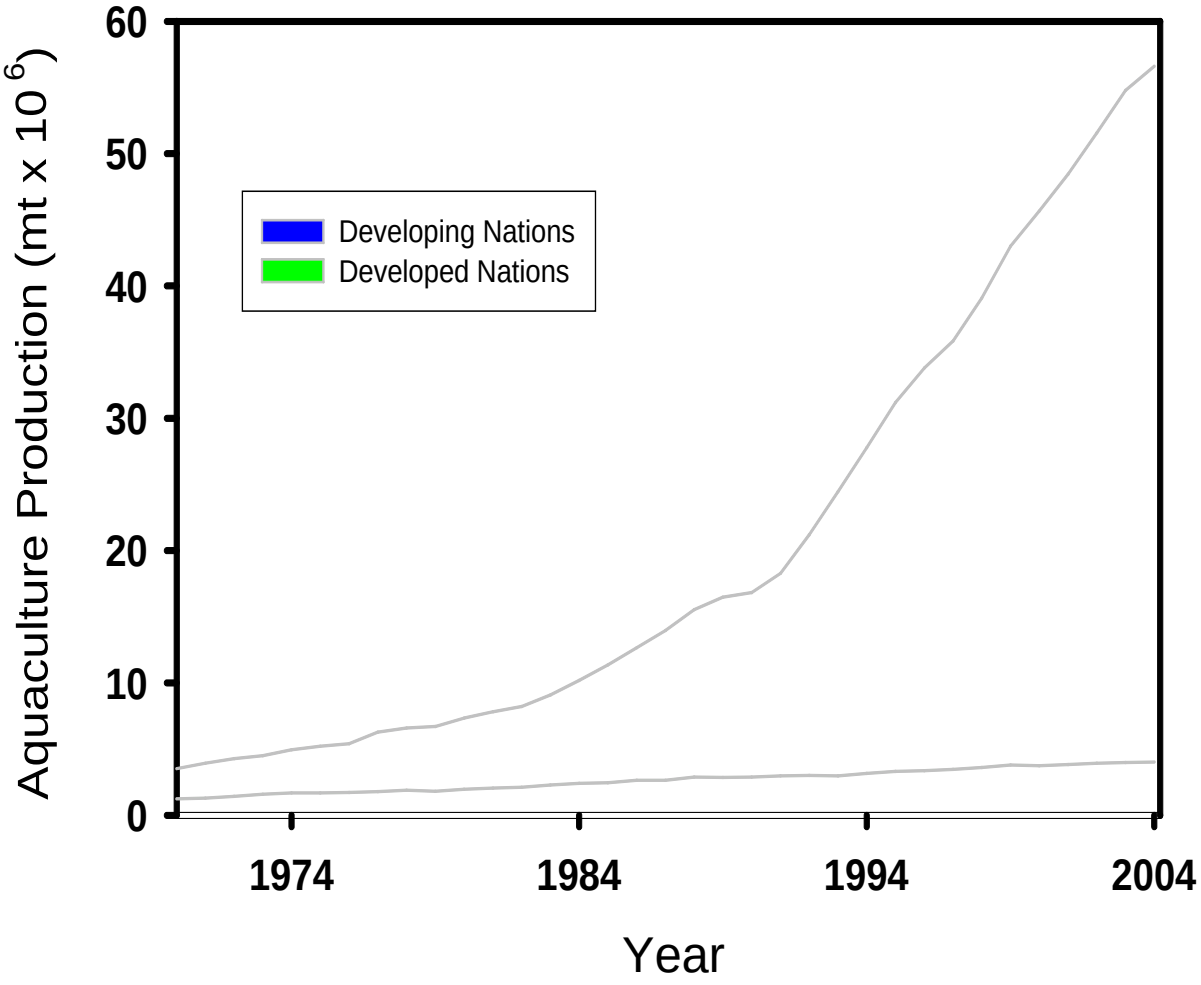
On balance, most globally traded agricultural products are still produced in developed countries. As a whole, developing countries are net food importers. However, some shifts are occurring. The European Union (EU), for example, is exporting fewer foodstuffs by volume than in the past. And, exports from Brazil in particular, and South American countries more generally, have increased considerably both in volume and value.



(Source: FAOSTAT)

The most significant food product category where production is shifting is meat. Developing countries now produce more meat than developed countries, and by 2050 developing countries are expected to produce 70 % or more of meat globally (see chart below). Brazil is currently the largest exporter of beef and usually a close second for chicken and fourth for pork. As global trade increases, it is likely that over time meat will increasingly be traded as well. For example, China will likely increase imports of meat rather than soy from Brazil and avoid some of the pollution associated with animal production.

However, one product category where both production and exports are dominated by developing countries is aquaculture. While China represents some 70 % of global production, Asia produces some 90 % of all aquaculture product and developing countries dominate exports (Clay 2008a). This trend is likely to continue, though, as developing country income increases along with the consumption of seafood.



Source: Clay based on FAO fisheries and aquaculture data, 2009.

Myth 3—Most people eat a wide range of foods

As shown in the table below, only a handful of crops account for most of the calories consumed by people. Ironically, it is some of these same crops that provide much of the feed for pigs and chicken and that supplement grasses and other feeds for beef and dairy.

Most people on the planet obtain their nutrition, by contrast, from a wide range of leafy greens, vegetables and fruits. All of these sources of nutrition, however, represent considerably less than 10 % of the calories most people consume annually.

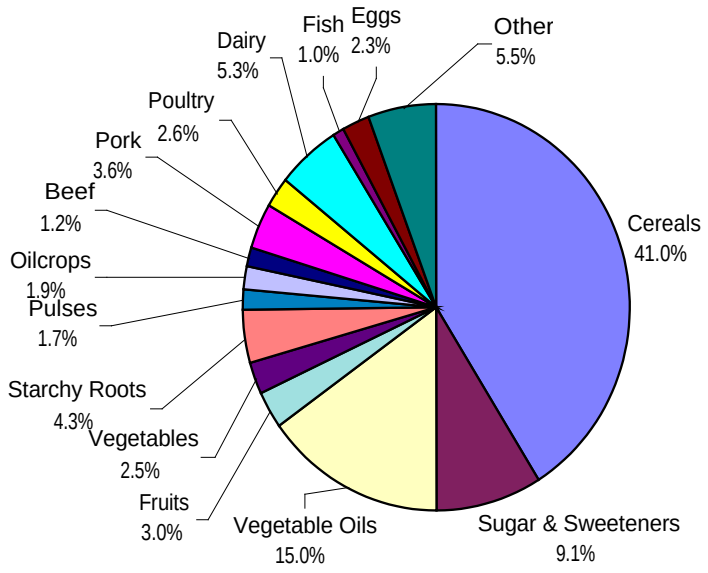
Ranking by Daily Caloric Intake

	Food Crop	Total Crop Calories (2003)	Direct Consumption	Indirect (Animal Protein) Consumption
1	Wheat	559	518	41
2	Rice	541	541	--
3	Corn	372	152	220
4	Sugarcane & Sugar beets	244	244	--
5	Soybeans	180	108	72
6	Potatoes	60	60	--
7	Palm Oil	57	57	--
8	Barley	49	8	41
9	Sorghum	45	32	13
10	Sunflowers	44	30	14
11	Cassava	43	43	--
12	Rapeseed	40	28	12
13	Peanuts	39	39	--
14	Cotton Seed Oil	11	--	--

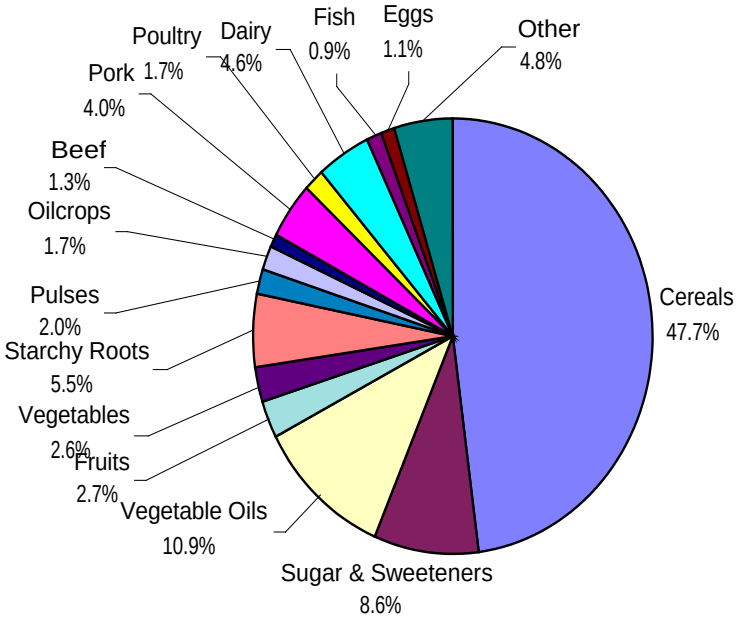
(Source: Global Insight 2010)

Myth 4—Reducing the consumption of animal protein, and red meat in particular, would ensure that there is sufficient food for all.

In 2000, all sources of animal protein represented just 12.6% of the average global diet of 2,712 calories (Global Insight 2010). While beef represented 1.3 % of all calories consumed by humans, the two largest sources of calories from animal protein were dairy, the single largest contributor with 4.6 % followed by pork with 4 %. By 2050, all sources of animal protein will represent 16 % of global calories. Dairy, poultry and eggs will increase the most during this period with eggs nearly doubling, mostly due to increased income in India. An interesting side issue is the projected 15 % decline in the importance of cereal toward the average overall calories of 3,226 in the diet by 2050 (Global Insight 2010). This clearly will contribute to the overall increase in the production and consumption of animal protein.



Total Calories Delivered Per Capita Per Day in 2050
World Average 3,226



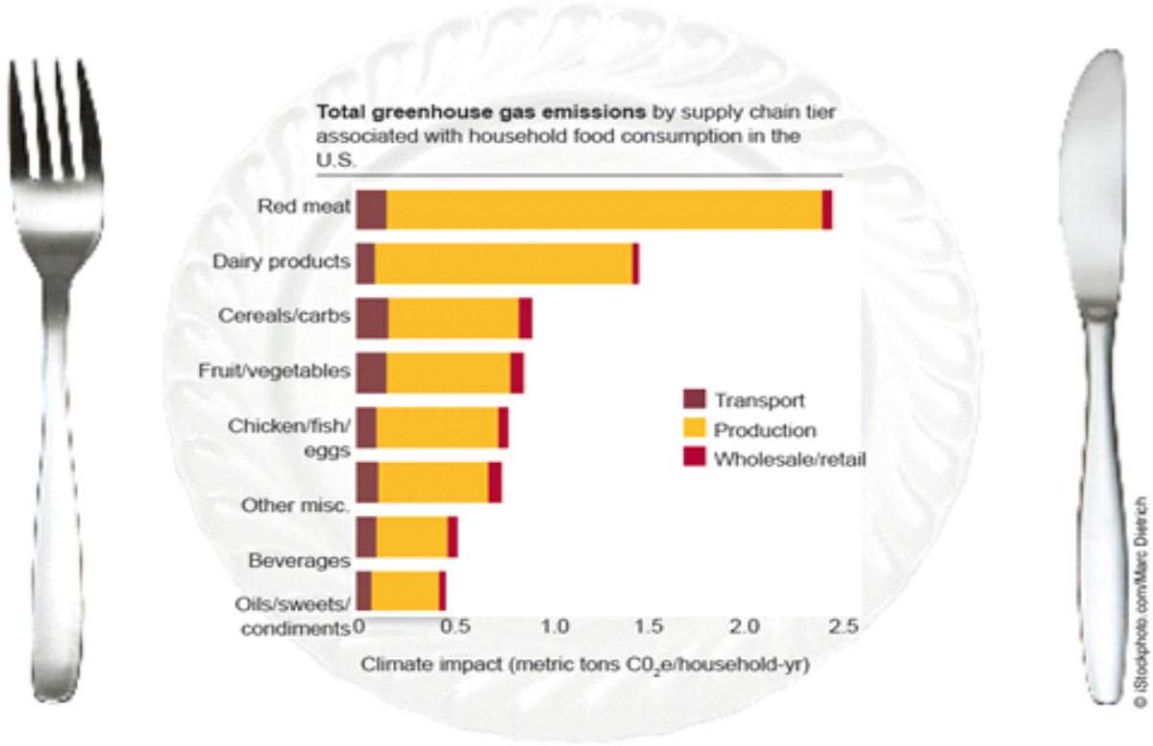
Total Calories Delivered Per Capita Per Day in 2000
World Average 2,712

Myth 5—Income from agriculture and food production is declining in most countries.

Income from agriculture is actually stable or increasing in most countries.

Myth 6—Buying locally is the most significant way to reduce GHGs from food production.

A common assumption is that buying local is the best way to reduce GHGs. This is one of the more persistent food myths. Unfortunately, it shapes public opinion and increasingly public policy as well. In fact, as the graph below shows, for the eight major food groups, how a product is produced is far more important than how far it is transported or the GHGs associated with



From: N Loder, E. Finkel, C. Meisner and P. Ronald. “The Problem of What to Eat” Conservation. July-September 2008 9(3):31

refrigeration and storage. As a result, purchasing frozen and ocean-shipped New Zealand lamb in England can contain fewer embedded GHGs than lamb produced in England where conditions for producing lamb are more energy intensive.

Myth 7—The price of food is increasing.

Expenditures on food as a percentage of income is actually decreasing in most countries. In the US and the EU people spend less than 10 % of their income on food and some 40 %of that is for eating out. That said, the poorest billion people on the planet can spend up to 60 to 70 % of their income on food and still go hungry. And, it has been for some time.

Myth 8—The price of food covers the cost of resources it takes to produce it.

In fact, today the price of food does not include the true cost of production. It does not, for example, cover the cost of soil erosion, biodiversity loss, deforestation or other habitat loss, GHG emissions, various other forms of pollution, or water use.

In fact, water use illustrates this point. The following table shows how much raw material it takes to make each of four popular products, how much water it takes to produce that amount of raw material and how much the farmer was paid for that amount of raw material. Leaving aside whether the water is significant or not (e.g. rainfed vs. irrigated, water-scarce region vs. water-abundant region), what is clear from this chart is that if farmers had to pay for water, their costs of production could easily exceed the total amount they are paid for their product. In some

cases, if farmers paid a reasonable price for water, it would likely exceed the entire amount they are paid for their raw material.

As water becomes more scarce, at least in some regions, and as the carbon emissions associated with moving water have to be addressed, then producer costs will change moving forward. For animal producers, this will likely be a very serious issue. Just as it takes pounds of feed to make a pound of animal protein, water will be similarly compounded. For example, the amount of water embedded in the feed for poultry is easily 10 times more than the amount of water to produce and process the birds themselves.

Selected Products, Water Use and Farmer Income

	Raw Material Input	Water to Produce Input	Farm Gate Price
1 Cotton T-shirt	4 oz ginned	500 to 2,000 liters of water	US$0.20 (Aust.)
1 Liter of soda	6 T sugar	175 to 250 liters of water	US$0.006 (Brazil)
1 oz. slice of cheese	6 oz milk	40 liters of water	US$0.03 (US)
½ pound hamburger	8 oz hamburger	3,000 to 15,000 liters of water	US$0.25 (US)

Source: Clay 2010

Better Management Practices

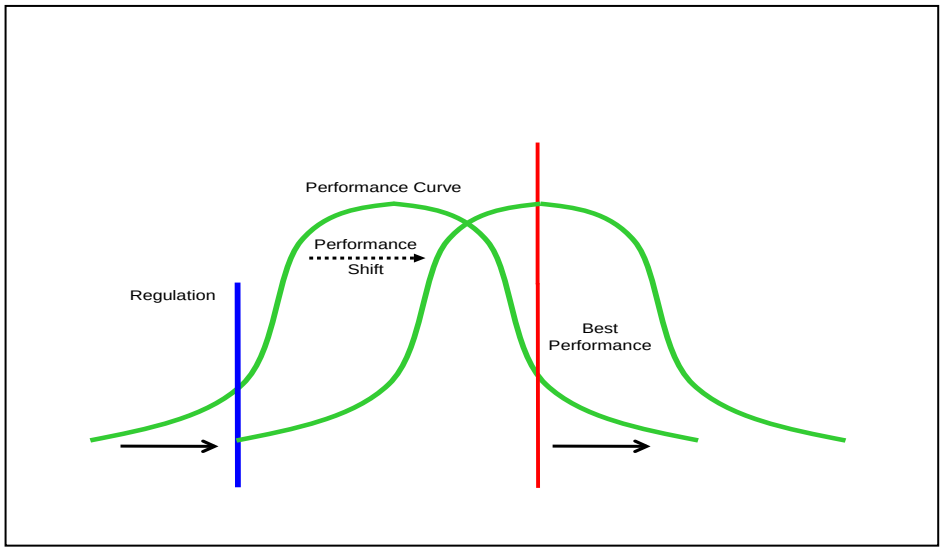
Better management practices are those practices that farmers use to increase production, reduce costs, reduce waste or impacts, and increase profits. Which BMP's are "better" depends. There is no one size fits all list of BMPs. BMPs are constantly evolving—mostly as farmers try to solve problems, save money, increase production, or make higher profits. Today's BMP is tomorrow's norm, and the day after that it is the practice that is being eliminated.

Most BMPs are invented by farmers and then adapted and adopted by others. For the most part public policies do not encourage better practices, much less improved performance. Increasingly, however, some government agencies globally are beginning to look at how they can encourage producers to adopt BMPs to either reduce key impacts or increase productivity or product quality. For the most part, however, public policies have not been driven by the same goals as those of producers, traders, retailers, brands or even NGOs. To reduce key impacts, it would be helpful if the policies of public and private institutions were mutually reinforcing. For example, if government policies, permits, and regulations encouraged the reduction of the same impacts as those identified and addressed in private voluntary standards and purchase or investment conditions, then it would be easier to shift the entire performance curve for any given commodity, at least in the country in question. However, consensus about the most significant impacts is key in this approach.

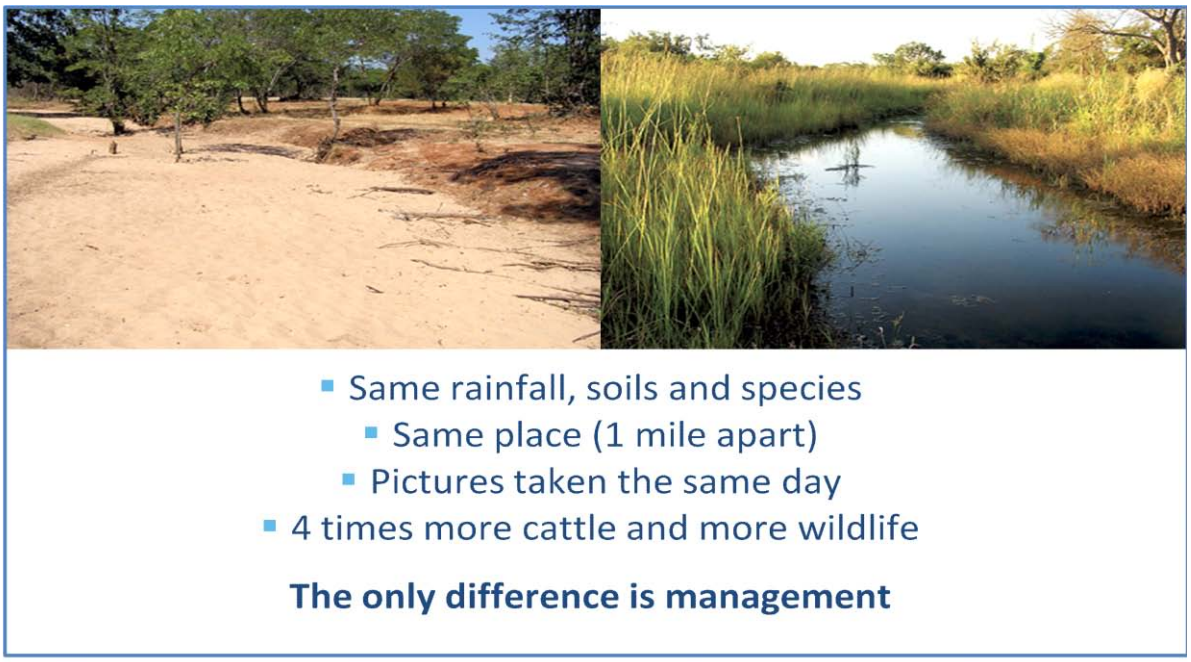
Government permits and regulations aimed at reducing key impacts can encourage the adoption of specific practices that tend to encourage the development of next generation BMPs but only if the focus is on performance rather than practices. This approach encourages innovation rather than compliance (e.g. the adoption of a specific practice). Still, in the information age, there is tremendous room for improvement. At this time, it can take 8 to 10 years to identify BMPs developed by producers, test them, adapt them to different growing conditions, undertake proper field trials, publish the results, and then disseminate them. This all takes far too long—at some point the BMP in question has already been superseded by a newer, better one.

What is also clear is that many, if not most, BMPs pay for themselves. That is, they repay the initial investment immediately or within a short time. In fact, if properly sequenced so that the profitable ones precede the ones that have a net producer cost, the financial impact over time of adopting a range of BMPs can usually be positive or at least neutral, although this varies by commodity and place.

Even with the best genetics, seed technology and inputs, BMPs can result in widely differing results. The results depend on the crop, farmer capacity and local conditions (e.g. soils, water, temperature, etc.). In the end, if you give 100 farmers the same BMP (see figure), you will get a hundred different results. If all the farmers live in the same area, use the same technology, have the same background and more or less the same local conditions, the range of performance will be less than it will be globally. However, the range will always exist and even in a local region the best producer can be two to ten times as productive as the worst. Globally the best producers can be 100 times better than the worst. Eco-labels tend to focus on rewarding the best producers, and governments tend to focus on regulating the worst. From a food production and environmental perspective, however, it is probably far more important to move the worst producers and even the middle ones rather than the best ones. By focusing on the performance of producers at both the top and the bottom ends of the performance curves, the entire curve can be shifted (see graph).



Source: Clay 2008.



The two photos that follow show rather dramatically the impact of better practices. These photos were taken less than a mile apart on the same day. The management represented by the photo on the right produces 4 times more head of cattle and 6 times more meat than the one on the left. Incidentally, the system on the right also manages water and carbon better and provides critical habitat for wildlife as well. As markets develop for water, carbon and biodiversity, the value of the management as represented by the photo on the right will increase.

It's How to Think, Now What to Think—Efficiency in the Poultry Industry

The poultry industry is an interesting example of how we have traditionally thought about animal production and efficiency. Four key factors have driven thinking about increasing efficiency while reducing costs and increasing competitiveness. These involve feed conversion ratios (FCRs), mortality rates, time to market, and finished weight. As the table below illustrates, dramatic gains have been made in each of the four categories. Many of the improvements are mutually reinforcing, e.g. reduced mortality improves FCR. Likewise, FCR, age to market and live weight at harvest are all mutually reinforcing. At the end of the day, however, the cumulative impact of these different improvements with regard to the overall efficiency of resource use increased more than 7 times between 1925 and 2005.

Global Poultry – Evolution of Efficiency Over Time

Chicken – Improvement Evolution

	1925	1945	1965	1985	2005
Feed conversion – kg feed/kg live	4.7	4.0	2.4	2.0	1.8
Mortality %	18%	10%	6%	5%	4%
Age to market (days)	112	84	63	49	42
Live commercial weight – kg	1.0	1.4	1.6	1.9	2.4

Source: Dr. Paul Aho, The World Chicken Meat Industry 1984 to 2004. May 2004. Power point presentation.

This type of performance metrics lends itself to benchmarking and to continuous improvement of not only a sector but individual producers as well. The data lend themselves to open source databases that allow individual producers or producers within a country or a region to compare themselves to others. What the data in such a table does not do is show producers how these results have been achieved (or their financial implications) or what the range of performance is around the world on any given issue much less all of them combined. In the end, the question is Do such improvements in efficiency actually improve margins or simply allow producers to stay in business? Such data also can help to identify comparative advantage where it exists. What the table also suggests, however, is how many issues that are important today are not included in the table. Science and global thinking about such issues shift over time. For example, carbon and water are increasingly important issues. How much water does it take to produce and process a kilogram of chicken? How much water does it take to produce the feed that it takes to produce a kilo of chicken? How much CO2e (carbon dioxide equivalents) does it take to produce a kilo of chicken? And, similarly, how much CO2e does it take to produce the feed? How much if the land to produce soy is recently cleared forest?

Other issues have come into sharper focus as well. Some of these involve the use of scarce resources or resources that are now seen to be used when needed rather than prophylactically. For example, how much fishmeal or oil is used to produce a kilo of chicken? How many antibiotics or other medications have been used?

On a planet with finite resources, however, another measure of efficiency and productivity might be how much land or water does it take to produce a thousand calories from chicken or 100 grams of protein?

The only thing we can be certain of is that expectations regarding efficiency as well as science and metrics will change as we go forward. However, it is doubtful that many of the old metrics will be abandoned. Rather, additional ones will be added. And, the new metrics may be requirements for access into some markets or to reduce risk with financiers.

Animal Breeding, Feed Palatability, and Genetics

An area of research that will result in a net increase in available calories is genetics, both animal breeding as well as plant materials used for feed. Regarding animal genetics, breeding programs for animals still have not been able to take advantage of mapping genomes and using genetic engineering to select for key traits. At some point this will become the norm as it will be much quicker than the traditional breeding programs in addressing new issues and constraints as they arise.

Most research on feed to date has focused on reducing anti-nutritionals in feed sources such as soy and increasing the palatability of feed and FCRs, rather than in changing the animals themselves. In aquaculture, there are efforts to increase the Omega 3s in soy so that it can substitute for fish meal and fish oil. However, this is complicated because soy reportedly has nearly 70 anti-nutrients for fish. Unfortunately, what is an anti-nutrient for one species is not necessarily so for another. And, the issue is not just about nutrition. There also is considerable work being undertaken at this time to reduce the amount of methane produced by livestock to reduce their GHG emissions.

As the productivity focus incorporates FCRs, carbon, nutrition and a variety of other efficiency measures, it is likely that aquaculture will receive more attention. Some animal protein market experts predict that poultry and tilapia will be head to head fighting for market share by 2050. After that, lower trophic-level fish such as tilapia, pangaseus or catfish are expected to win the "white meat" battle. In China, carp production already equals that of poultry, and aquaculture production is twice that of poultry (Clay 2008).

It's Important to Get the Metrics Right

The metrics that are the most common for crops are bushels per acre or metric tons (MTs) per hectare (ha). For pasture animals the focus is usually on carrying capacity of the land or pasture, e.g. head per hectare. We need to get the metrics right. If we are talking about food, food security and feeding the planet, then calories per hectare is a far more meaningful measure than head of animals, kilos, bushels, or tons. The issue of how many calories are produced on average per hectare of crop production or for animals is more difficult to calculate because the type of information needed is generally not collected. For animals, this is especially difficult because heads of animals are not easily converted into weight much less calories. By contrast a MT of a cereal is relatively easily converted to calories.

You manage what you measure, but producing anything has thousands of impacts. So, what should we measure? Here are some questions that might guide our thinking about meaningful metrics for animal protein.

* Kg of meat per ha of land
* Kg of meat per cubic meter (M3) of water
* Calories per ha
* Net human edible calories (e.g. calories out less the calories from human edible feeds)
* Grams of protein per ha
* Net grams of protein
* Cost of production per calorie of production
* Kg of C avoided or sequestered /ha or /MT of production

Calories per hectare or grams of protein are efficiency measures. Other measures that are also important are calories per liter of water and calories per other important inputs (e.g. nitrogen (N), phosphorus (P), potassium (K), pesticides, etc.). The importance of these measures, however, depends on how limiting the input factor is. Calories per liter of water in an area with plenty of rainfall is not terribly important whereas calories per liter of water in a desert or dry climate is very important.

As the markets for carbon mature, carbon sequestered per 1,000 calories produced will likely be another useful metric. And, as biomass becomes important for making biofuels or other products, biomass will also be an important performance metric. The issue here is that the relative productivity between crops is likely to become important as resource scarcity impairs production. Which sources of protein are “better”? Which feed stuffs are “better”? What are the key parameters? How will they vary depending on location and growing conditions? Going forward, the goal will most likely not be to maximize any single performance indicator (e.g. calories per unit of land, water or N), but rather to optimize a range of indicators. In this sense, it is likely that an index of several key performance areas may be the most useful way to think about which crops are “better” and which production systems are most efficient.

In 1995, the Food and Agriculture Organization (FAO) and Consultative Group on International Agricultural Research (CGIAR) reported that four crops provided 73 % of the calories consumed by humans directly—rice, wheat, maize and cassava (The Washington Post, 1995). Potatoes, sorghum, bananas, and sweet potatoes provided another 17 %. By 2010, just 8 crops provide 80 to 85 % of all calories. The increase in demand for these eight crops from 1974 to 1994 increased by an average of 72 % while the average amount of land under cultivation increased by an average of 39 %. In short, increases in production were accomplished more by expansion than by intensification.

Using 2008 FAO data (see table below), it is possible to compare total production per hectare, human edible calories produced per hectare, and the volume of water required to produce one kilogram of product. This is the type of information that will be necessary to compare (all else being equal) the relative advantage of producing one crop or another in any given place. These are global averages, however, and we know that many crops cannot be substituted for each other because of their temperature, water or soil requirements. Adding other key inputs such as energy, N, P, K, and labor would also be helpful in any attempt to determine which foods are the most efficient producers of calories.

Yield, Calories and Water Requirements for Selective Crops

Commodity	Yield (kg/ha)	Calorie Conversion	Average Water to produce 1 kg of commodity
Wheat	3,086.1	6.62918 x 1019	1300 liters
Rice	4,309.4	9.25692 x 1019	3400 liters
Maize	5,109.4	1.09754 x 1020	900 liters
Sugarcane	71,510.2	1.54 x 1021	1500 liters
Soy	2,384.1	5.12123 x 1019	x
Potatoes	17,267.6	3.70921 x 1020	900 liters
Oil palm	14,079.5	3.02438 x 1020	x
Barley	2,776.6	5.96435 x 1019	1300 liters
Sorghum	1,459.1	3.13426 x 1019	2800 liters
Sunflowers	1,424.3	3.05951 x 1019	x
Cassava	12,460.4	2.67659 x 1020	x
Rapeseed	1,908.8	4.10025 x 1019	x
Nuts	1,357.5	2.91601 x 1019	x
Bananas	18,828.2	4.04444 x 1020	x
Sweet potatoes	13,466.6	2.89273 x 1020	x
Yams	10,497.2	2.25488 x 1020	x
Plantains	6,370.8	1.3685 x 1020	x

Source: FAO, 2008, http://faostat.fao.org/site/567/DesktopDefault.aspx?PageID=567#ancor
Source for water comparison: http://www.waterfootprint.org/

While animal protein production and production efficiency have increased substantially during the past 40 years this has been limited more to animal-intensive operations such as (CAFOs) (concentrated animal feeding operations) and in particular poultry and pork operations. Grass fed animals have not intensified at the same rate and in some key producing countries such as Brazil, the intensity of grass-fed beef operations has remained constant for the past 50 years. Given global resource scarcity, it is just a question of time before people begin to ask which sources of protein, much less animal protein, are the most efficient. In this regard, beef globally accounts for more than 60 % of all land used for food production and yet produces only 1.3 % of all calories.

How Should We Think About Animal Welfare

The issue of animal welfare is becoming more important in many consumer markets globally, and as a result is a more politically important issue than it ever has been before. Unfortunately, much of the focus has been on single indicators, e.g. stocking density or cages vs. cage-free. It is not clear that any of these indicators are the most appropriate or important ones. In addition, however, animal welfare might be best understood in terms of multiple variables that might be evaluated individually or serve as the basis of an index.

The thinking in aquaculture might be helpful. Standards setting technical working groups for eight different aquaculture species have suggested several different animal welfare criteria in lieu of stocking density (animal density per unit of area). Some possible indicators from the

aquaculture discussions are provided below. What these have in common is that they are overall indicators of animal wellbeing and an overall lack of stress or they speak to the quality of the environment:

* Feed conversion ratios
* Time to market
* Survival rates
* Disease outbreaks
* Medicine used per MT of product
* Cost of medicine per MT of product
* Water quality (e.g dissolved oxygen, suspended solids, pH, etc.).

As discussed previously, using a single indicator such as stocking density may be a less robust way to determine animal welfare than a method that identifies, measures and through improved management optimizes several indictors of the type listed above. In fact, there may be trade-offs between indicators. So, an index that rolls all indicators into a single figure may actually miss poor performance in a single category. One suggestion is that for multiple indicators, producers could be required to have a minimal performance in all categories as well as a combined total average that is higher than the average of the minimal scores.
Animal welfare, however, is not the only factor to take into account or even in need of maximizing. In poultry and egg production is free range sufficiently important as a variable to trump other key indicators of product quality, worker safety, environmental impacts or financial viability. For example, should we understand better the relationships among some of the following indicators before simply accepting free range as a requirement? Other key variables that might be affected by a free range mandate include:

* Consumer safety
* Product quality
* Total production
* Productivity per unit of feed, water, etc.
* Survival rates (pecking order is real!)
* Disease occurrences
* Land used directly
* Indirect global footprint (e.g. land and water compounded through feed, etc.)
* Worker health
* Profitability

Some of these indicators may be positively or negatively correlated with others on the list or even with free range or caged. The issue is that by focusing on only one issue we may be maximizing one thing at the expense of optimizing a number of other indicators, which taken as a whole, may be more important.

Freezing the Footprint of Food—The Concept of "Food Wedges"

To address both the need to feed nine billion and to maintain the planet, we will need to Freeze the Footprint of Food. The Earth's resources are finite. We can't escape the basic math—population times how much each of us consumes must equal the carrying capacity of the planet. If we exceed that, we are taking away not only resources but the very resource base that

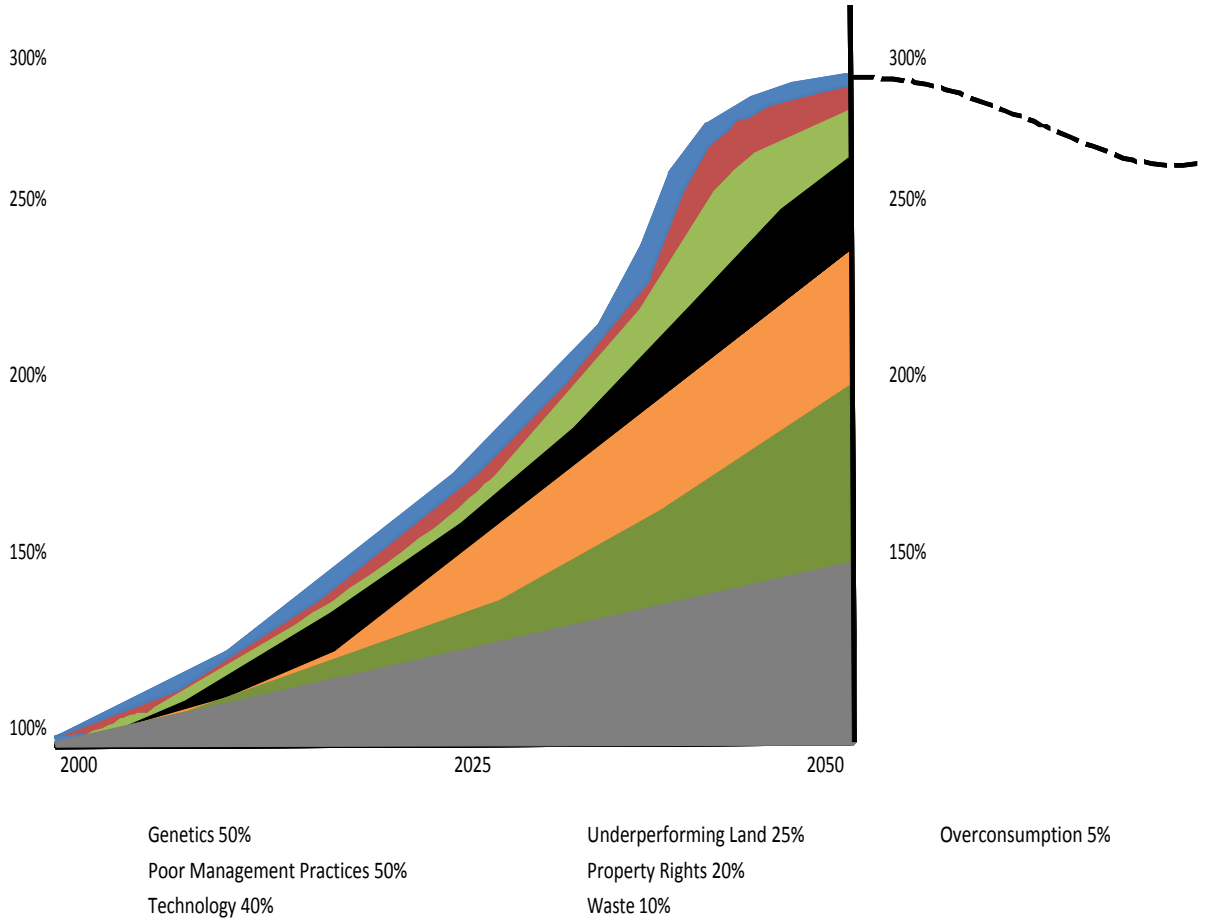
will be needed by our children and our grandchildren.

In fact, as noted earlier, we're living today at the level of 1.3 planets according to the WWF's Living Planet Index. This is the equivalent of eating our seed. We are very literally eating the planet. As "natural capital" it means that we are consuming the planet's principle rather than living off its interest or bounty. So, not only do we need to do more with less, we also have to find ways to restore the planet at the same time.

Every use of resources has impacts. The issue going forward will be to define which impacts and which levels of impacts are acceptable. Right now, the single largest impact of humans on the planet is to produce food. And an estimated 70 % of the terrestrial part of the planet that can be used for food is already taken.

For the past 50 years, we have expanded food production into new areas by converting natural habitat for food production at the rate of 0.4 % per year. For the last decade, however, as some of the key developing country economies (notably China, India, Brazil, Russia and Indonesia) have heated up, we have been converting natural habitat for food production at the rate of 0.6 % per year. In short we have been speeding up the conversion of natural habitat and the loss of biodiversity precisely when one might assume we would have been able to increase the intensity of production by ways other than simply expanding it.

If we assume the business as usual case for expanding into natural habitat, there will be very little natural habitat left by 2050. And yet, we know that global demand for food will increase. By 2050, we will have 3 billion more people with 2.9 times as much income, consuming twice as much. In fact, the research suggests that in developing countries incomes are likely to increase more than five-fold by 2050. This will add considerable strain to the precarious balance between people and nature that already exists in those countries. Moreover, by 2050, more people will live in cities—more than are alive today. If they behave like urban residents today, they will depend on others for virtually all their food.



Source: Clay 2010

There is no silver bullet or single solution that will allow us to Freeze the Footprint of Food and obtain more from less. We need to work simultaneously on a number of issues. If we are successful in building "food wedges," similar to the energy wedges we need to become independent of fossil fuels, we will find ways feed people and still have a healthy planet. Eight complimentary strategies would allow us to achieve both goals. They are summarized in order of likely importance:

1. Genetics—Ten crops account for nearly 80 to 85 percent of all calories. Only two are on track to double production by 2050. We can't afford to leave genetics (e.g. traditional plant breeding, land races, hybrids, genetic engineering, or GMOs) off the table. We should be neutral about the technologies unless there are unacceptable ancillary impacts, and focus on the results desired.

2. Better Practices—In terms of production, the best producers globally are 100 times better than the worst. The best countries are 10 times better than the worst. To achieve global food security and maintain the planet, we will gain far more, both in terms of production and reduced environmental impacts, by moving the middle and the bottom than the top.

3. Technology—We need to use all inputs (water, fertilizer, pesticides, energy) more efficiently. To Freeze our Footprint we will need to double our efficiency of input use. Our goal, then, globally should be triple or quadruple the efficiency of input use.

4. Degraded land—Instead of expanding into new areas to farm, we need to rehabilitate degraded or underperforming lands. Our goal should be 100 million hectares rehabilitated and brought back into full production by 2030 and 250 million hectares by 2050.

5. Property rights—What farmer will plant a tree or invest in sustainability if they don't own the land? What company will invest in new technologies if their intellectual property is not protected? We need to pursue strategies that address both these issues. Perhaps foreign assistance could be linked to guaranteed property rights rather than other factors.

6. Waste—Globally we waste as much as 30 to 40 percent of all food produced. It is a crime to waste food once we use resources to produce it. Our goal should be to cut waste in half in both developing and developed countries. To do this, we should double the percentage of funding to reduce post-harvest losses and food waste.

7. Overconsumption—A billion people don't have enough food while a billion people eat too much. A reasonable goal would be not only to freeze these figures, so they do not increase, but ideally to cut them each in half by 2030.

8. Carbon—Whether in the soil, unburnt crop residue, protected riparian areas and wetlands or perennial crops or trees, carbon makes agriculture more sustainable. Our goal should be to develop carbon markets that allow food producers to sell one billion MT of carbon per year by 2030. This will not only make food production more sustainable but will also make producers more financially viable.

In short, while no single strategy will solve the global food problem or ensure global food security, there is something that each of us as individuals or institutions can do, and together we can find ways to address this issue. We need to question current thinking and existing strategies. As has been demonstrated throughout this presentation, business as usual will not get us where we need to go. We need to invest time, energy, and money into this. Failure, either for people or the planet, is simply unacceptable. No one has all the answers, but together we can solve this problem and leave our children a living planet.

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Trade considerations and OIE guidelines

Phil Seng
US Meat and Export Federation

Paper not provided. See power point section for slides.

Are the poor a recognized stakeholder?

Joseph Glauber
USDA Chief Economist

Paper not provided. See power point section for slides.

Are farmers and rural communities destined to be second-class citizens?

Paul Lasley
Iowa State University

The organizers of this conference are to be commended for addressing such an important broad set of issues that holds substantial influence on how livestock production is structured in the future. The attendance and interest in this conference, "Sustainable Animal Agriculture: Balancing Bioethical, Economic and Social Issues" reflects the broad range of stakeholder concerns about animal agriculture. My participation is to ensure that the social or human dimensions are adequately covered. Being the last speaker at the conference is challenging to wrap up the common themes and not be too redundant of what has already been covered. How society defines the role of animals in feeding the world and what is expected of producers will affect the structure of agriculture and the fate of many rural communities. A common theme throughout the conference is the relationships between all classes of animals and society are changing and this includes livestock, companion animals, wildlife, zoo animals or research animals. Not only are the relationships between people and animals being redefined, but animal welfare is one of those issues that demand careful and thoughtful reflection. No longer is animal care just the sole providence of the owner.

As a rural sociologist, I've studied long term trends in production agriculture, and none are more germane to the future of farming than how animals are raised and processed. I was raised on a small family farm in Missouri, one that wasn't big enough to make a full-time living, but too big to be considered a hobby. Our farm was typical of most farms in the area, producing a mix of crops and livestock. Owing to the trends in specialization brought about by economies of scale, most of the general family farms have been replaced by larger more specialized farms, in which many farms no longer have animals. The presence of livestock on farms---which was once a common feature---is now the exception rather than the rule.

I was asked to address whether farmers and rural communities are destined to become second-class citizens, and part of the answer depends on how we produce and utilize animals in meeting the needs of the global human family. I interpreted the concept of "second class citizen" as being poor. Whether livestock producers and rural communities that support the livestock industry are destined to be poor depends on how the broader public rewards livestock production or what types of regulations are developed concerning livestock production.

There are many explanations for accounting for why people are poor. Some of the reasons include: they don't work hard enough, they are poor managers, they fail to invest in themselves or their businesses, and they often are viewed as lazy or unmotivated. While each of us can find examples to confirm these stereotypes, in the main, farmers often have found themselves poor or marginalized by the impersonal market forces. In some instances it is because consumers no longer desire what the farmers are producing, and this decline in demand results in lower prices. If the producer does not adjust, then profit and income loss will result. For example, lard-type hogs that were once highly prized when lard was the preferred cooking oil are no longer demanded by consumers. Producers who failed to use the new lean-type hogs have found themselves with faltering demand. These shifts in market demand for what

consumers want or desire can provide a glimpse into the future of animal agriculture. Today, some consumers are expressing their desire for free-range livestock, organic meats, cage-free eggs or milk free from synthetic hormones. These demands emanate from consumer perceptions that these products are somehow superior to conventionally produced products.

Other producers are structurally disadvantaged because they are not large enough to achieve economies of scale to compete effectively in the marketplace. In other situations farmers are denied market access for their products or can not successfully negotiate a marketing contract. Increasingly, market access is a growing concern throughout agriculture. For many commodities, a marketing contract must be secured before the commodity is produced.

In our not-so-distant past, animals were much more central in everyday life for most Americans. When the majority of Americans lived on farms and most farms had a variety of animals and fowl, and horses were the dominant mode of farm power and transportation, there was a closer connection between humans and animals. Before the 1930s the majority of Americans lived on farms or were only a generation removed from farming. In this agrarian culture, farming and rural life were closely integrated, and animal husbandry was embedded into their everyday lives. When people were dependent on animals for daily transportation or power, they were careful to take care of the horses. A lame or sick horse meant that the crops wouldn't be planted, or that other serious consequences would happen.

However, the twin forces of urbanization and industrialization have inexplicably altered the culture of agriculture and served to sever the relationship between animals and people. No longer do we rely on animals for power or transportation, and with increasing specialization many farms no longer have animals. Hence even within farm communities there are not the shared values, beliefs, and shared culture about animals and animal care that once existed. The new rural paradigm that has emerged since World War II, in which the majority of rural residents are no longer dependent upon farming for a living, stands in stark contrast to the agrarian paradigm of the preceding era. Today those who choose to live in rural America often have a different set of values about rural life, farming, and livestock, and can be defined as "guests of the country." These new-to-rural folks bring new values and beliefs about rural living, agriculture, and demand for services that are different than the beliefs of life-long residents or farm operators.

Understanding the future of animal agriculture requires that it be placed in the broader context of the changing culture of agriculture. The emergence of new values about animals, placing greater emphasis on certain beliefs and ethical considerations, is part of the changing culture of farming. Questions about animal care and practices---how animals are produced, marketed and processed---reflects a new set of societal expectations. Questions from consumers about the origin of their food, how it was produced, and what practices were used or avoided are important considerations. The desire of some consumers to know the origins of their food, and their show of support for buying food locally through community-supported agriculture, farmers markets, and so forth are indicators of a changing set of values about the food system.

Evidence of Changed Consumption and Food Habits

While consumer food expenditures as a proportion of their total income continue to decline, there are some disconcerting trends in eggs, meat, and milk consumption (See Joseph

Glauber's power point presentation for recent trend data). There are many reasons for the declines in consumption, including an aging population; concerns about obesity, nutrition, and wellness; and, production practices.

Even though the structure of agriculture has changed greatly, the basic functions of farming have remained the growing of plants and animals. With larger proportions of consumers far removed from agriculture, it is imperative that producers do a better job of communicating with consumers about what we do and equally important about why it is done. Reconnecting with consumers, providing education, and understanding the changing market demands are critical to answering the question about whether farmer and rural communities are destined to be poor.

The Changing Relationship between People and Animals

I believe that it is important that we make the distinction between classes of animals. At one time there was a clear demarcation between farm animals that were raised for food versus pets or companion animals. However, in recent years this distinction has become blurred and, in some cases, meaningless. A second trend is that the entertainment industry often assigns human characteristics to animals. Anthropomorphism is the attribution of human characteristics to non-human creatures, and there are many examples of this in the media. Old Yeller, Moby Dick, Lassie, the Lone Ranger's horse Silver, Mr. Ed the talking horse, Bambi, Ms. Piggy and her friends on Muppets show, the Looney Tune characters Wile E. Coyote and the Road Runner, and Rocky and Bullwinkle are all examples of assigning human attributes to animals. Isn't this a confusing message to children? Each of these characters has human attributes: in some cases they talk, display human emotions, and nearly always play the support role of helping their hapless owner or friend.

It goes without saying that most people don't eat their pets, but many of us raised on farms did eat our companions. They didn't live in our house, or share our bed, but it was understood that the pet lamb, calf, or pig was doomed to be sold. Even though we knew their eventual fate, we cared for them, talked to them, sometimes took them to the county fair, and got recognition by receiving ribbons or trophies. Independent of our emotional ties to them, we understood that they would eventually be sold and slaughtered.

As Chair of the Department of Anthropology, I have become acutely aware of the similarity between humans and other high-functioning primates including bonobos and chimpanzees. My association with primatologists has resulted in my increased sensitivity about our duties toward all species of animals. Conservation and preservation of species is a responsibility that all of us share. But as the human population continues to grow, threatening the wild places that are home to many of these species, we must be more proactive in protecting them. Animal welfare is more than some notion of happiness, but surely we are wise enough to assess and measure the notion of welfare. I am not sure that science has developed a measure of animal happiness, but often I hear assertions that pigs are happier in one setting than another. Happiness is a human attribute and this argument rests on the assumption that animals can make decisions or choices about what they prefer. I am not sure we can make that assertion, but nevertheless all of us share the responsibility to ensure that all animals enjoy certain basic freedoms.

The Brambell Report issued in 1965 seems like a reasonable place to start the discussion on animal welfare. More than 40 years ago, the Brambell Commission on Animal Welfare issued a statement on the five basic freedoms that are applicable to all animal life:

* Freedom from hunger and thirst

* Freedom from discomfort

* Freedom from pain, injury, and disease

* Freedom to express normal behavior

* Freedom from fear and distress

It seems to me that these five basic freedoms are at the core of animal husbandry. I am proud to have a bachelor's degree in animal husbandry, not animal science. I was raised in a period when husbandry was a "calling." My parents and grandparents instilled in me that caring for the stock was not simply good business, it was a moral act. Doing chores, feeding, watering, providing bedding, doing the milking, etc. took primacy over the ball game, the date, or any other activities that might have been on the mind of a teenager.

Perhaps livestock producers have fallen victim of the unintended consequences of renaming animal husbandry into animal science. On the farm, everyday producers engage in animal care that may not be profitable, but is a moral decision. They decide, even when cattle or hog prices are low, to give life to every animal born, even if it means a vet bill will exceed the cost of the animal. Or they decide to bottle feed an orphan even though it means the back porch is converted into a temporary hospice. The intention should be to provide the best possible comfort and assistance to every animal.

The media is full of news about animal abuse, with examples ranging from puppy mills, circuses, and zoos, to the hoarding of animals. For many families in our affluent society, animals have become surrogate children; upwards of $50 billion a year is spent on pets. While one can argue about spending this amount of money on pets when children in other parts of the world go hungry, this indicates the centrality of companion animals to many households in society.

The Messages that are Reported in the Media

I am concerned about the reported instances of animal abuse in the media. Often times the reports are biased or incomplete. One instance of animal abuse does indicate an industry-wide problem, but too often the story is blown out of proportion. The failure to make the distinction between a single case of animal abuse versus widespread abuse in the industry needs to be addressed. One bad case should not condemn the entire industry. I am concerned that public opinion is being shaped by a few celebrated cases of animal abuse. For example, all of us know of examples of child abuse, but none of us would ban child rearing in a particular neighborhood because of one bad parent. We need to have a balanced view that the vast majority of animal producers and processors adhere to industry standards and share the principles of the Brambell Commission.

Returning to the question posed by the organizers of this conference, are farmers and rural communities destined to be second-class citizens? Without livestock the answer must certainly be a resounding YES. Animals play an important role in the utilization of grasses and feedstocks not suitable for direct human consumption. Without livestock, many parts of the United States will stagnate and become regions of poverty. It is in the national interest that we seek to maintain a vibrant animal agriculture if we are to achieve the goals of sustainability.

The Chronicle of Higher Education, (October 18, 2009) announced that this decade was the "decade of the animal." Several recent books have explored the relationship between humans and animals. Clearly the challenge is to forge a new social contract with the non-human animal world. All of us hold a unique set of values and experiences about animals. We should be wise enough to find those areas of agreement across the diversity of groups and stakeholders. A starting place is that we seek a well-fed populace, and a stable, reliable food system that respects the integrity of all living things including both plants and animals.

As I have reflected on the issues raised at this conference, the key question is, What are the stewardship responsibilities of mankind? Rather than approaching the question as, Where have we fallen short?, we need to increase our understanding and dialogue, and learn to cooperate. Even pigs and cows have learned the benefits of cooperation and certainly we would be wise to find those areas where we agree. I am convinced there is more that unites us than divides us. Thank you.

APPENDICES

APPENDIX A

Program and Speaker Contact Information

Morning Moderator:

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12:00 - 12:10 **Welcome**

John Ferrell
USDA Deputy Under Secretary for Marketing
and Regulatory Programs

12:10 - 12:15 **Welcome from CAST**

Todd A. Peterson
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12:10 - 12:40 **Integration of competing concepts surrounding the ethical use of food animals**

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12:40 - 1:00 **Impressions from the agricultural community regarding food-animal welfare and agricultural regulation**

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1:00 - 1:25 **Taking a look back to look forward**

R. Douglas Hurt
Department Head/Professor of History
Purdue University
West Lafayette, IN 47907
Tel: 765-494-4122
email: doughurt@purdue.edu

1:25 - 1:50 **Historical perspective of the integration of animal agriculture**

Ronald L. Plain
Professor of Agricultural Economics and Extension Economist
College of Agriculture, Food and Natural Resources
University of Missouri
222 Mumford
Columbia, MO 65201
Tel: 573-882-0134
Fax: 573-884-6572
email: plainr@missouri.edu

1:50 - 2:15 **Consumer trust in the U.S. food system: Implications for communication and regulation**

Stephen G. Sapp
Department of Sociology
Iowa State University
320 East Hall
Ames, IA 50011-1070
Tel: 515-294-1403
email: ssapp@iastate.edu

2:15 - 2:30 BREAK

2:30 - 3:00 **Redefining sustainability: Ethically grounded, scientifically verified, and economically viable**

W. Ray Stricklin
Animal and Avian Sciences Department
University of Maryland
1413A AnSc/AgEng Building
College Park, MD 29742-2311
Tel: 301-405-1382
Fax: 301-314-9059
email: wrstrick@umd.edu

3:00 - 4:00 **Panel: Trends in society and their impact on our future food-animal systems**

Charlie Arnot
CMA
7501 NW Tiffany Spring Parkway, Suite 200
Kansas City, MO 64153
Tel: 816-556-3122
email: Charlie@CMAKC.com

Janet M. Riley
Senior Vice President
Public Affairs and Professional Development
American Meat Institute/National Hot Dog & Sausage Council
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email: jriley@meatami.com

Jay Vroom
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Washington, D.C. 20005
Tel: 202-296-1585
Fax: 202-463-0474
email: jvroom@croplifeamerica.org

JUNE 9, Day 2

Morning theme: **Bioethical and animal welfare issues, rural and food-animal industry structure**

MODERATOR: Nathaniel Tablante
VA-MD Regional College of Veterinary Medicine
University of Maryland Campus
8075 Greenmead Drive
College Park, MD 20742
T#: 301.314.6810
F#: 301.935.6855
email: nlt@umd.edu

8:00 - 8:30 **Ethical and practical implications of food-animal agriculture**

Paul B. Thompson
Department of Philosophy
Michigan State University
503 South Kedzie Hall
East Lansing, MI 48824-1032
Tel: 517-432-8345
email: thomp649@msu.edu

8:30 - 9:30 **Panel: Different perceptions of sustainable agriculture**

James R. (Tres) Bailey
Senior Manager of Federal Government Relations
Walmart
701 – 8th St. NW, Ste. 100
Washington, D.C. 20001
Tel: 202-434-0720
email: tres.bailey@wal-mart.com

Mike Morris
Manager, Poultry Health and Welfare
YUM Brands
1441 Gardiner Ln
Louisville, KY 40213-1914
Tel: 502-874-8828
email: Mike.Morris@Yum.com

Bryan Dierlam
Director, Government Affairs
Cargill
1101 15th Street NW, Ste. 1000
Washington, D.C. 20006
Tel: 202-530-8161
email: bryan_dierlam@cargill.com

9:30 - 10:00 Discussion with all morning speakers

10:00 - 10:30 BREAK

10:30 - 12:00 **Panel: How can we move forward? The need for a collaborative vision**

Jack Fisher
Executive Vice President
Ohio Farm Bureau Federation
280 N. High St.
6th Floor
Columbus, OH 43215
Tel: 614-249-2400
email: jfisher@ofbf.org

Chandler Goule
Vice President of Government Relations
National Farmers Union
20 F St., NW, Suite 300
Washington, DC 20001
Tel: 202-554-1600
email: cgoule@nfudc.org

Christine Bushway
CEO/Executive Director
Organic Trade Association
Hall of the States, Suite 638
444 N. Capitol Street NW
Washington, DC 20001
Tel: 413-376-1233
email: cbushway@ota.com

Joseph M. Stookey
Co-chair, North American Food Animal Well-being Commission on Beef
Western College of Veterinary Medicine
University of Saskatchewan
52 Campus Drive
Saskatoon, SK S7N 5B4
Canada
Tel: 306-966-7154
email: joseph.stookey@usask.ca

12:00 - 1:30 **LUNCH**

JUNE 9, Day 2

Afternoon theme: **Long-term survival and food security**

MODERATOR: Candace Croney
The Ohio State University
College of Veterinary Medicine
Department of Veterinary Preventive Medicine
1920 Coffey Road, A188 Sisson Hall
Columbus, OH 43210
Tel: 614-292-0974
email: candace.croney@cvm.osu.edu

1:30 - 2:00 **Economic impact of transitioning from swine gestation stalls to group pen housing**

Brian L. Buhr
Professor/Department Head
University of Minnesota
231E Classroom Office Building
1994 Buford Avenue
St Paul, MN 55108
Tel: 612-625-0231
email: bbuhr@umn.edu

2:00 - 2:30 **Future welfare of farmers and their animals**

John Deen
Associate Professor
Veterinary Population Medicine
University of Minnesota
385A An Sci/Vet Med
1988 Fitch Ave.
St. Paul, MN 55108
Tel: 612-625-7784
Fax: 612-625-1210
email: deenx003@umn.edu

2:30 - 3:00 BREAK

3:00 - 4:00 **Panel: Comprehensive analysis of certification and regulatory programs: What is the future?**

David Townsend
Assistant Vice President, Environmental Affairs
Smithfield Foods, Inc.
7345 Oakview St.
Shawnee, KS 66216
Tel: 913-563-7400
email: davidtownsend@smithfieldfoods.com

Yvonne Vizzier Thaxton
Poultry Science Department
Mississippi State University
Old Hwy 12 East
P.O. Box 9665
Mississippi State, MS 39762
Tel: 662-325-9087
Fax: 662-325-8292
email: yvizzier@poultry.msstate.edu

JUNE 10, Day 3

Morning Theme: **Societal and global impacts**

MODERATOR: Chuck Conner
President and CEO
National Council of Farmer Cooperatives
50 F Street, NW, Ste. 900
Washington, D.C. 20001
Tel: 202-626-8700, ext. 1802
email: cconner@ncfc.org

8:00 - 8:30 **World and U.S.A. population growth: How can we feed everyone?**

William Weldon
Senior Director, R&D
Elanco Animal Health
2001 W. Main Street
P.O. Box 708
Greenfield, IN 46140
Tel: 317-277-5732
email: weldon_william_c@lilly.com

8:30 - 9:15 **Should there be biotechnology in the future of animal agriculture?**

L. Val Giddings
President
PrometheusAB, Inc. – Advanced Expertise in US and Global Biotechnology
9004 Fairview Road
Silver Spring, MD 20910-4105
Tel: 202-345-3671
email: LVG@PrometheusAB.com

9:15 - 9:45 **Agricultural productivity strategies for the future**

Gale Buchanan
Retired Under Secretary, USDA/REE
Dean and Director Emeritus
College of Agricultural and Environmental Sciences
The University of Georgia, Tifton Campus–NESPAL
P.O. Box 748
Tifton, GA 31793-0748
Tel: 229-386-7274 (Office)
229-546-5318 (Cell)
Fax: 229-386-7371
email: galeb@uga.edu

9:45 - 10:15 BREAK

10:15 - 11:00 **Sustainability myths and musts—key animal agriculture issues moving forward to 2050**

Jason W. Clay
Senior Vice President Market Transformation
World Wildlife Fund
1250 Twenty-Fourth Street, N.W.
P.O. Box 97180
Washington, D.C. 20090-7180
Tel: 202-778-9691
Fax:
email: Jason.Clay@wwfus.org

11:00 - 11:30 **Trade considerations and OIE guidelines**

Phillip M. Seng
U.S. Meat Export Federation
1855 Blake Street, Suite 200
Denver, CO 80202
Tel: 303-623-6328
Fax: 303-623-0297
email: pseng@usmef.org

11:30 - Noon Discussion with all Day 3 speakers

Noon - 1:30 LUNCH

JUNE 10, Day 3

Afternoon Theme: Societal and global impacts

1:30 - 2:00 **Are the poor a recognized stakeholder?**

Joseph Glauber
Chief Economist
U.S. Department of Agriculture, OCE
Whitten Building, Rm 112-A
Washington, D.C.
Tel: 202-720-4164
email: jglauber@oce.usda.gov

2:00 - 2:30 **Are farmers and rural communities destined to be second-class citizens?**

Paul Lasley
Professor & Dept. Chair of Sociology
Iowa State University
107 East Hall
Ames. IA 50011
Tel: 515- 294-0937
Fax: 515- 294-0592
email: plasleyiastate.edu

2:30 - 3:00 General Discussion

APPENDIX B

CAST Animal Welfare Symposium Steering Committee

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APPENDIX C

Referenced Papers

Appendix C

1. A. What is CAST, What Can CAST Do?

What Can CAST Do?

- **CAST, the Council for Agricultural Science and Technology, can plan, organize, and host symposia, conferences, and workshops and publish the proceedings**
  - *Sustaining Animal Agriculture: Balancing Bioethical, Economic, and Social Issues.* Symposium in Washington, D.C. June 2010
  - *Water Quality and Quantity Issues for Turfgrasses in Urban Landscapes.* Workshop in Las Vegas, Nevada. January 2006
  - *Management of Pest Resistance: Strategies Using Crop Management, Biotechnology, and Pesticides.* Symposium in Indianapolis, Indiana. April 2003
- **CAST can work with other organizations to assemble writing task forces, technically edit, and publish scientific reports and issue papers**
  - *Sustainability of U.S. Soybean Production: Conventional, Transgenic, and Organic Production Systems.* Published by CAST in conjunction with the United Soybean Board
  - *Avian Influenza Vaccines: Focusing on H5N1 High Pathogenicity Avian Influenza (HPAI), with a Comprehensive Bibliography*. Published by CAST in cooperation with the U.S. Agency for International Development
  - *Fate and Transport of Zoonotic Bacterial, Viral, and Parasitic Pathogens during Swine Manure Treatment, Storage, and Land Applications.* Published by CAST for the National Pork Board
- **CAST can organize, staff, and manage programs for government agencies and other nonprofit organizations**
  - CAST coordinated the Agricultural Biotechnology Safety Assessment Cooperation Program for the U.S. Trade and Development Agency
  - CAST collaborated with the Institute for Conservation Leadership on a series of Shared Leadership Workshops, supported by the W. K. Kellogg Foundation
- **CAST can coordinate special events**
  - CAST, in cooperation with USDA's CSREES, created and administered a national agricultural science essay contest for 6th, 7th, and 8th grade students
  - CAST hosted a series of "desk-side" telephone briefings for media personnel to speak directly with experts on "hot topics" in agricultural science
- **CAST can network throughout the U.S. and in many countries around the world**
  - CAST is composed of numerous professional societies, representing more than 170,000 individuals in academia, industry, and government
  - CAST has issued more than 300 scientific reports, special publications, issue papers, and commentaries since its founding in 1972 by drawing together scientific experts from the U.S. and many foreign countries as authors and reviewers

What Is CAST?

The Council for Agricultural Science and Technology (CAST) is a 501(c)(3) tax-exempt nonprofit organization based in Ames, Iowa

- CAST assembles, interprets, and communicates credible, science-based information regionally, nationally, and internationally to legislators, regulators, policymakers, the media, the private sector, and the public
- CAST Membership is composed of
    - Professional scientific societies
    - Associate societies
    - Sustaining companies, nonprofits, and trade organizations
    - Subscribers
    - Individuals from the United States and 19 foreign countries
- CAST was founded in 1972 after the National Academy of Sciences' National Research Council identified the need for better communication of the science behind food and agricultural issues
- In 2010, CAST is celebrating 38 years of continuous service to its stakeholders

CAST fulfills its mission through publications, projects, and sponsored activities

- CAST publications are highly regarded as a source of science-based information written and reviewed by subject experts
    - Task force reports
    - Special publications
    - Issue papers
    - Commentaries
    - Spanish language translations
- CAST "Friday Notes," a weekly e-newsletter providing links to current resource materials gleaned from more than 125 sources
- Symposia and conferences to promote communication among professionals in many disciplines of agricultural science
- Education and training workshops for hands-on learning
- International exchanges of scientific experts
- Support for student essay contests
- Facilitated communications among media personnel and scientific experts
- Invited presentations at professional society meetings
- Briefings to legislative and government personnel in Washington, D.C.

1. B. Issue Papers on Livestock Carcass Disposal

CAST®

The Science Source for Food, Agricultural, and Environmental Issues

Issue Papers on Livestock Carcass Disposal

Current Publications on Livestock Carcass Disposal

Whether due to accidental disease entry, natural disaster, or an act of bioterrorism, widespread livestock deaths pose daunting carcass-disposal challenges that must be met quickly and effectively (Carcass Disposal: A Comprehensive Review, 2004, National Agricultural Biosecurity Center, Kansas State University).

In an effort to increase awareness and promote adoption of safe and healthy carcass disposal practices, CAST is publishing three separate Issue Papers targeting commodity livestock species. Each carcass disposal publication will provide a comprehensive summary of the scientific, technical, and social aspects of various carcass disposal technologies, using information gleaned from a review of the literature, including a comprehensive Kansas State University report.

Swine Carcass Disposal Options for Routine and Catastrophic Mortality
CAST Issue Paper 39, July 2008
Dr. Allen F. Harper, Virginia Tech Tidewater Agricultural Research & Extension Center, Chair

- Routine mortality, catastrophic mortality, and mortality rates
- Predominant methods of mortality disposal in commercial swine production
- Alternative and nontraditional methods and technologies
- Biosecurity and disease control with traditional methods

Poultry Carcass Disposal Options for Routine and Catastrophic Mortality
CAST Issue Paper 40, October 2008
Dr. John P. Blake, Department of Poultry Science, Auburn University, Chair

- Current and emerging practices for disposal of poultry carcasses
- Causes of catastrophic mortality and mass carcass disposal options
- Case studies of various loss situations
- Biosecurity issues

Ruminant Carcass Disposal Options for Routine and Catastrophic Mortality
CAST Issue Paper 41, January 2009
Dr. Marty Vanier, National Agricultural Biosecurity Center, Kansas State University, Chair

- Predominant methods of mortality disposal in commercial ruminant production
- Principles of the technologies
- Environmental implications
- Special considerations for material potentially infected with TSEs

All CAST Issue Papers are available for download, free of charge, at www.cast-science.org, click on Publications List, Issue Papers.

1. C. Scientific Assessment of the Welfare of Dry Sows Kept in Individual Accommodations

CAST

An Issue Paper from the Council for Agricultural Science and Technology

The use of individual gestation accommodations (IGAs) for dry sows in commercial pork production is an issue that has raised much debate. Public perceptions and misconceptions of welfare issues may have a dramatic impact on swine production if governments, the swine industry, or consumers react to these issues without factual scientific information.

CAST is releasing a new Issue Paper that provides a review of the most pertinent scientific literature on the welfare of dry sows housed in IGAs and critically evaluates the scientific evidence of IGAs for sows. The nine-member international Task Force indicates that more large-scale, on-farm, multidisciplinary research is needed before rigid regulations should be imposed.

This new CAST Issue Paper, *Scientific Assessment of the Welfare of Dry Sows Kept in Individual Accommodations* (IP42, 20 pp.), is available FREE online at www.cast-science.org and in print (515-292-2125; fee for shipping/handling). Task Force Chair: Stanley E. Curtis, University of Illinois, Urbana-Champaign

CAST Issue Paper

Number 42
March 2009

Scientific Assessment of the Welfare of Dry Sows Kept in Individual Accommodations

Dry sows resting and eating in individual gestation accommodations. Photo courtesy of Egebjerg International A/S, Denmark.

ABSTRACT

The use of individual gestation accommodations (IGAs) for dry sows in commercial pork production is an issue that has evoked intense public debate. Public perceptions and misconceptions of welfare issues have the potential to dramatically impact swine production if governments, the swine industry, or consumers react to these issues by outlawing housing systems or by boycotting pork. In determining whether or not the welfare of sows is compromised, individuals and lawmakers may act emotively and without factual scientific information. Too few statistically adequate, scientifically controlled trials on industry farms have been conducted; many reports are not useful for critical evaluation, thus for developing public policy. Recent reviews, however, indicate that the welfare of dry sows can be equivalent in IGAs and group pens.

This Issue Paper provides a review of the most pertinent scientific literature on the welfare of dry sows housed in IGAs. The international Task Force critically evaluates the scientific evidence of IGAs for sows, including considerations for behavior, nutrition and feeding, reproduction, health, manure management, worker safety, and system design. The authors indicate that more large-scale, on-farm, multidisciplinary, scientifically robust research and development is needed before rigid regulations—which would increase production costs but not necessarily sow welfare—should be imposed.

This material is based upon work supported by the United States Department of Agriculture under Grant No. 2007-31100-06019 / ISU Project No. 413-40-02 and Grant No. 2008-38902-19327 and by the Agricultural Research Service under Agreement No. 59-0202-7-144. Any opinions, findings, conclusions, or recommendations expressed in this publication are those of the author(s) and do not necessarily reflect the view of the U.S. Department of Agriculture, Iowa State University, or the Agricultural Research Service.

Visit the CAST website at www.cast-science.org for these FREE related publications of interest:

Ruminant Carcass Disposal Options for Routine and Catastrophic Mortality (Issue Paper 41, 20 pp.)

Poultry Carcass Disposal Options for Routine and Catastrophic Mortality (Issue Paper 40, 16 pp.)

Swine Carcass Disposal Options for Routine and Catastrophic Mortality (Issue Paper 39, 16 pp.)

Vaccine Development Using Recombinant DNA Technology (Issue Paper 38, 12 pp.)

Global Risks of Infectious Animal Diseases (Issue Paper 28, 16 pp.)

Environmental Impacts of Livestock on U.S. Grazing Lands (Issue Paper 22, 16 pp.)

All CAST Issue Papers are available for download, free of charge, at www.cast-science.org, click on Publications List.

2. A. Comments from the CAST SurveyMonkey Questionnaire

Greg Martin

(edited, e.g., spell check, grammar check to facilitate easier reading)

If you recognize your comment and believe it was mis-represented, contact the editors for a correction.

454 responses

#	Response Date	Response Text
1	Mar 3, 2010 6:02 PM	ok good job
2	Mar 5, 2010 7:21 PM	Ballot initiatives are dangerous in that the voters, as experienced in California, do not really understand what they are voting for or what the consequences are of the change that will be mandated. Ballot initiatives have a real possibility of putting farmers and an entire state's animal farming out of business. Such legislation should be left to elected officials who have a better chance of understanding the consequences as well as listening to all points of view and considering the science that should or should not justify such changes.
3	Mar 5, 2010 7:53 PM	Ballot initiatives, when used with an uneducated public can be devastating to an industry. In this case, animal agriculture production. It seems that people that understand the least criticize the most, and the general public does not recognize a wolf in sheep's clothing (HSUS). Like the rats and the Pied Piper, they're being led to the river to drown.
4	Mar 5, 2010 8:27 PM	Ballot initiatives are not science-based and should not be used to force animal welfare legislation. Animal Scientists and Veterinarians should be key individuals in the development of animal welfare initiatives.
5	Mar 5, 2010 8:42 PM	The education of the American public to the dangers of the Animal Rights movement is critical. The exposing of the hidden agenda should be a primary focus for the agricultural sector as well as those involved in national security. A nation that cannot feed itself due to over regulation driven by extremist emotion is doomed to be a servant to the world.

6	Mar 5, 2010 8:54 PM	I think in general a ballot initiative would work in the farmers favor when the consumer is educated in its consequences
7	Mar 5, 2010 9:08 PM	The concept of voter initiatives seems democratic; however, individuals cannot have an adequate understanding of every issue. While equally democratic, representative government makes elected officials responsible for understanding a broad range of issues. By having a limited number of decision makers the public is better able to access and educate them, resulting in better decisions. In a ballot initiative system the populace is confronted with a choice. Most don't invest the time and thought necessary to make the best decision. This results in the voter making a snap judgment at the poll. These decisions are the result of quick and potentially erroneous hearsay or advertisement supporting one perspective - often lacking credibility. The resulting decision can lack balance and objectivity.
8	Mar 5, 2010 9:56 PM	A group of farmers, animal livestock scientists, and veterinarians should determine the best animal welfare practices in each state. Ballot initiatives and government regulations not based on animal science will result in increased costs to produce food, less affordable safe food, and put farmers out of business. Any legislation needs to be based on sound animal science and welfare as described by these groups. Otherwise, the US will be importing unsafe food from other countries and putting their own farmers and ranchers out of business. In the long run this will ruin the US economy. Not all people can afford cage free eggs, organic meat, etc. As a mother, I hope our farmers can stay in business and continue to produce a safe affordable food supply. Most farmers care deeply about animal welfare and producing safe affordable food for everyone. Legislation needs to come from them and the veterinarians, not radical groups that will ruin our country.
9	Mar 6, 2010 1:00 PM	Use of ballots tends to get out negative voters in larger numbers. Those in favor of more regulation tend to get out the vote in larger numbers. Animal welfare groups tend to be against helpful production practices.
10	Mar 6, 2010 5:44 PM	Livestock producers who strive for viable and profitable farm operations are first line users and defenders of technologies that humanely, safely, and efficiently produce livestock products for human consumption.

11	Mar 6, 2010 6:56 PM	I am highly concerned that the public will be making decisions based on emotions of cleverly disguised smear campaigns by the vegan activists.
12	Mar 7, 2010 5:40 AM	These type of ballot initiatives should not be allowed since the goal is not really animal welfare---it is to stop food animal production.
13	Mar 7, 2010 5:27 PM	Commodity groups need to be a leader in animal welfare standards. They should work with university researchers to stick with science based demands. They need to consider the unintended consequences, and seek to balance welfare with the environment, cost/benefit of changes to the producer and consumer and a heavy dose of common sense. Size of farms should not be the motivation. I fear food safety more on small farms than large.
14	Mar 7, 2010 6:29 PM	Seems like some of the options in this survey weren't all-inclusive. For example, one could think that animal welfare rules are legitimately adopted by some ballot measures but not others, by some legislators, and not others, by some trade groups, but not others. I'd bet that most people responding to this survey would say they don't like ballot measures animal welfare groups propose, but do like ballot measures agricultural groups propose. Or vice versa for some respondents, perhaps. Seems like the main question to ask is: are there any standard industry practices that we can do better on? If so, what are the alternatives to those practices, and what's the most realistic way to help the industry convert to them. Many within ag don't think there are any standard industry practices in need of serious reform, while others want to see certain innovations that would result in significant changes from the norm today.
15	Mar 8, 2010 2:26 AM	The ones promoted by HSUS and similar groups are dishonest and use emotions rather than facts to persuade the uninformed public to support them. Ultimately, it will lead to higher food costs, more hunger, and more poverty.
16	Mar 8, 2010 3:08 AM	I am more concerned with animal HEALTH than animal WELFARE. An abused animal will not be healthy. Health is an easy way to determine if the animal has its needs met, and is not as subjective as some non-farmer thinking about how he/she would FEEL if he/she were the animal and had to _____ (fill in the blank--eat corn every day, live in a cage, whatever).
17	Mar 8, 2010 1:00 PM	Today's public is so far removed from agriculture that they DO NOT know where their food comes from!! Modern animal production practices were developed with the

		animal's well-being in mind. In the 1960's when my parents had cage free laying hens we had a lot more disease in the flocks due to Round Worm and Tape Worm infestations, Marek's disease, and other viral diseases. There is now a vaccine for Marek's, and since the layers are in cages and can't eat their own feces we do not have a round or tape worm problem. The current environment for animals was developed to reduce disease and therefore reduce the use of antibiotics. Animal geneticists have selected blood lines of various species that are better suited to today's practices. Today's farmer is producing MORE with Less!
18	Mar 8, 2010 1:01 PM	Regulations should be science based, not a marketing campaign. This is best accomplished through animal agriculture commissions that are composed of industry and academia veterinarians and scientists.
19	Mar 8, 2010 2:03 PM	If we could eliminate the use of paid petition carriers we would save huge amounts of money to fight these ridiculous ballot issues in Ohio. No one should be able to get paid to collect names on a petition. This is a must!
20	Mar 8, 2010 2:24 PM	We must educate consumers from the agricultural standpoint in order to sustain animal agriculture. We need farmers to help with this, along with commodity groups, Cooperative Extension, and others.
21	Mar 8, 2010 3:07 PM	Government has too many problems and will only cause more damage to animal agriculture. Stay out of this. Government games and politics has already shown what happens with your help. Eleven percent of the people are out of work and now you want to starve the world.
22	Mar 8, 2010 3:07 PM	The lack of knowledge of the general public of food production (animal and plant) is a serious challenge. Many people view farmers/ranchers as being totally unregulated. They are not aware of the many regulations that already exist. I also don't feel that many people promoting more regulations are aware of the cost impact to the final product OR have an alternate agenda of eliminating meat from the diet of most people.
23	Mar 8, 2010 3:12 PM	The number of barns that would be required to meet California Prop 2 language is probably cost prohibitive and nearly impossible to accomplish due to permitting regulations. This is exactly what the activist groups were hoping for.

24	Mar 8, 2010 3:18 PM	The law of unintended consequences will ensure that whatever good is intended will be equaled or surpassed by negative results
25	Mar 8, 2010 3:22 PM	Legislators and farmers should work together to determine what changes need to be made. These changes should not incur any more costs to the producers.
26	Mar 8, 2010 3:41 PM	All the regulations on farms whether at the county, state, national levels or a combination of all three levels is making it impossible for the family farm to exist in the United States. In our opinion as a family farm operation, the regulations do not help; they all hinder the farming process. Don't need more regulations. Need education for the consumer as well as the farmer.
27	Mar 8, 2010 3:44 PM	These issues will become more important as the industry fails to regulate itself. Exposure to various negative media reports continues to point to the failure of present controls. As agriculture attempts to gain efficiency, it destroys the basic tenets of animal husbandry. As the public is made more aware of the factory farming practices used in food production the burden of proving the quality of these products will certainly prove to be most difficult.
28	Mar 8, 2010 3:45 PM	Has the potential to drive production to areas with less restrictive regulations. Even out of the country leading to a decrease in food security.
29	Mar 8, 2010 3:59 PM	Customers, meaning the companies purchasing beef, pork, chicken, turkey, eggs, lamb and other animal products will impact changes on the farm first. Their audits and requirements are often ahead of any government requirements. The more governmental regulations mean more yearly costs, forms, classes, audits and training for all farmers - they will need to get bigger, consolidate through partnerships, or exit farming. Consumers will not pay the increase needed to make up these costs. To date the "small" farmer has been exempted from much of this, that will have to change too. Specialty producers will also have to join the rest of the food producing farmers and comply with the regulations too.
30	Mar 8, 2010 4:06 PM	Ballot initiatives are a way of short circuiting the process. Sound science is ignored and emotions and scare tactics are used that totally distort the issue. Food costs will skyrocket and consumers will suffer once the food system absorbs the shock and shuts down. It will take time (and lots of it) to regenerate.

31	Mar 8, 2010 4:13 PM	If the California law is passed to only permit agricultural products produced outside the state to be brought into the state for sale a suit should be immediately filed as this is an obstruction of free trade. Not only is there no substantial scientific proof that their legislated way of production is better, there is substantial scientific proof that their legislated way is worse for the environment and food safety. Are we hypocrites if we dock our dog's tails, alter our dog's ears, etc. and still pass a law that makes it illegal to dock a dairy cow's tail? Come to think of it, should it be a crime to pierce the ears of a baby? Seems like baby cruelty to me.
32	Mar 8, 2010 4:15 PM	Regretfully there are still some producers who do not understand the animal welfare issue and there are others (i.e. - consumers, politicians, and others) who think they know animal welfare but do not understand or work with animals. The animal industry must police itself if they want to have effective and rational requirements.
33	Mar 8, 2010 4:19 PM	This was not a very good survey. (1) High concern does NOT imply that a problem exists, just importance (2) Regulation is the job of the legislative body. Decisions should be made based on EVIDENCE from MANY sources --which was not a choice. (4) Certification programs may be voluntary; regulations are not. They do NOT therefore, have the same expected effects (6-8) I don't think ballots themselves have much effect at all --Now OUTCOMES might be very different, but it sure depends...
34	Mar 8, 2010 4:38 PM	Some states have a fairly weak ballot initiative process, those states have been targets. At the same time I believe that most of the ballot initiatives are good for our industry. Our consumers need to be told the positive story of protein food production on animal farms!
35	Mar 8, 2010 4:41 PM	I do not believe ballot initiatives should be used to make changes in regulations. Only Legislative bodies of government should have this power.
36	Mar 8, 2010 4:45 PM	Ballot initiatives/referenda are political creatures by their nature. As such, they must be carefully worded to truly reflect the need that is being addressed, and that care needs a cooperative dialogue to be maintained between regulators/legislators/industry with sources of accurate information (presumably including but not necessarily only Land Grant entities).

37	Mar 8, 2010 4:50 PM	This is another idiotic proposal that adds another layer onto the already bloated infrastructure, that does nothing for the farmer but cause additional costs. There are numerous check points all the way to the market, starting with the shipping yards to the grocery store. It's about time that the government and the lawyers get out of our face and go back to their parasitical endeavors elsewhere, like driving the cost of healthcare out of site. This whole idea makes me sick to my stomach; unlike any of the food that comes off this farm. I am repulsed by these "progressives" trying to fix what isn't broken, because it makes them feel warm inside. It is nothing more than the continued assault on individuality that is spearheaded by our current administration.
38	Mar 8, 2010 4:58 PM	How do you go about educating the consumers on the production of food animal agriculture?
39	Mar 8, 2010 5:00 PM	Animal welfare is a troublesome concept. Regardless of the number of laws passed there will always be "bad actors" but to assume all producers are bad and need to be managed leads to a dangerous path. There is another underlying premise that is in error. Contrary to many activists, meat consumption is not immoral. Animals are not humans and have no rights. Animals are property. Every person is expected to treat animals with respect and commercial agriculture will be rewarded economically for doing so. Even without economic reward, a large majority of producers treat the animals in their charge with respect.
40	Mar 8, 2010 5:03 PM	Here in Colorado we have seen what happens when uninformed voters adopt referenda. Many unintended consequences which are not beneficial to agriculture. We have representatives who should debate and then vote up or down, not shirk their duties by passing hard decisions on to a public who votes on what they see or read in the media, then vote with their emotion, not science.
41	Mar 8, 2010 5:11 PM	When regulations are mandated - like no crates for swine in Florida then the production shifts to areas where crates are allowed. Some of the other education certification programs may provide education to help those who care, though the small percentage that do not care, will continue to cause problems to the industry.
42	Mar 8, 2010 5:33 PM	Govt regulation of agriculture is a mistake. Most, if not all, govt officials & their staffers have never actually worked on a farm or ranch & have no idea of the real issues facing farmers. Why should the farmers be regulated by people who don't understand the business? You can regulate

		agriculture until there no longer is an American farmer & then where will you get your food? Farmers & ranchers must keep their livestock healthy & treat animals in a humane manner to stay in business. If the animal dies, it's a drain on the business. So, a free market does more to ensure change than any regulation ever could.
43	Mar 8, 2010 5:34 PM	Industry will continue to voluntarily regulate itself in the proper way. We must allow our industry the ability to provide safe food products to the consumer. We are the largest animal welfare supporters due to the fact that our livelihood is tied to these production animals. Production is achieved through good husbandry practices. The current ballot initiatives are not intended to create positive change, they are directed at stopping meat production. This is why HSUS is the largest supporter of these initiatives. We can produce the safest food and be the most proficient in the world if allowed to do so and the market will drive out the bad actors. This has been proven time and time again.
44	Mar 8, 2010 6:01 PM	What change is needed? Net returns to producers are directly connected to the care and comfort of their animals. My observation is that skilled extremists create a "crisis" that does not exist. It is called animal welfare, but in reality it is anti-animal agriculture. We will all go hungry if they continue to have success with their unreasonable efforts.
45	Mar 8, 2010 6:07 PM	The free market should dictate what consumers want. Supply and demand should dictate what consumers buy and are willing to pay. Why should government interfere with free markets? We cater to both markets, cage free and caged. Clearly the money being spent by special interests are skewing the discussions and pressuring legislation.
46	Mar 8, 2010 6:19 PM	Ballot initiatives should not be allowed period! Non ag sector trying to dictate our business, our potential profit, and our livelihood. How would non ag people like me to block their subdivision and tell them they cannot go to work today to earn a living? Same principal in the ballot initiative. Most voters are uninformed, or informed by slanted info, PETA, HSUS. How many people vote and have no idea what the legislation is or really what it means?
47	Mar 8, 2010 6:38 PM	I used to believe in ballot initiatives but today anyone with enough money can come in and create an initiative that is very seductive that creates chaos with no science behind it.

48	Mar 8, 2010 6:41 PM	Any rules need to be scientifically developed not based on misinformation or fears instilled by political correctness. Any group supporting said bills must be exposed as to number of members, expenses, salaries and stated purpose for existence.
49	Mar 8, 2010 7:08 PM	Fear welfare initiatives have as the ultimate goal to eliminate the use of animals for milk meat eggs etc., regardless of how they are raised. They will continue to make demands until it becomes impractical or impossible to do so.
50	Mar 8, 2010 7:15 PM	The problem with using the ballot for these types of issues is that most voters vote based on emotion not facts. It is tough to provide food demands when emotion dictates how you produce.
51	Mar 8, 2010 7:16 PM	It is a must that we change the following: provide a more natural environment to raise animals for food, quit with the steroids and antibodies, increase funding for the above, reduce funding for large scale producers of corn, etc. We HAVE TO CHANGE OUR WAYS HERE!!!
52	Mar 8, 2010 7:24 PM	Closure of horse slaughter plants has caused more inhumane treatment of horses & has caused tremendous economic impact. There needs to be an outlet for old & disabled horses before they are starved & abandoned. There needs to be population control on wild horse herds that are overgrazing their ranges & starving themselves.
53	Mar 8, 2010 7:28 PM	Unless all food entering the USA will come under all regulations, then the initiatives will only harm American farmers.
54	Mar 8, 2010 7:45 PM	Ballot Initiatives would be extremely detrimental to agriculture, decisions would be made by emotion, not fact. To allow people who have no associations with, or do not have any idea how a particular business or industry is operated, make hugely impacting decisions on someone else is not only wrong, it's not a part of American Free Enterprise. Those of us in animal agriculture make not only financial decisions, but decisions based on what's best for our animals, and those decisions are based on the latest and best scientific data on animal care. I have yet to meet a farmer who raises animals who didn't want the healthiest, happiest, animals possible. Because even if you want to translate everything to a bottom line argument, the happiest, healthiest animals are the most productive.

55	Mar 8, 2010 8:12 PM	No more Govt. or regulations by them; the ag. community should be governed by farmers not politicians.
56	Mar 8, 2010 8:16 PM	We should let the farmers do the farming and keep government out of it as much as possible.
57	Mar 8, 2010 8:58 PM	The general public cannot understand agriculture since most are not familiar with the range of practices and needs of animals. Ballot initiatives tend to make animals to be like humans or pets, which is the only way most of the public can relate to agricultural animals. Regulations are similarly limited by the knowledge of those making the laws. Most politicians do not have an understanding of agricultural animals. Even among the agricultural experts at universities, one must be careful not to transfer knowledge of specific species preferences to another species to which the expert has no knowledge, e.g., cows turn their backs to the wind but chickens face the wind.
58	Mar 8, 2010 9:12 PM	We are now out of the production of animal products, but believe firmly in better/more strict regulation of animal processing. It affects all of us in the consumption of food. Thanks
59	Mar 8, 2010 11:01 PM	Most voters are truly unaware of how their food supply is provided in a safe animal friendly way and as such bend to the media provided by animal rights advocates.
60	Mar 9, 2010 12:01 AM	When production is reduced because of regulations causing farmers, ranchers and who else produce FOOD to go out of business. Who will decide what segment of the population will die because of not enough food to feed the world's population now and in the future?
61	Mar 9, 2010 12:52 AM	Iowa is an agriculture state and always has been. Producers and legislators should work together to preserve the profession. It should not be left to the voters, a ballot initiative or more regulations would kill rural Iowa. Do the right thing!
62	Mar 9, 2010 1:10 AM	The public lacks the knowledge to vote in ballot initiatives pertaining to animal agriculture. We don't have ballot initiatives pertaining to other industries. Animal agriculture should be pro-active, so that neither ballot initiatives nor regulations become the norm.
63	Mar 9, 2010 1:21 AM	The cost to sell an animal matches that which we received 30 years ago, while the price to the consumer has risen dramatically. If not through increased production, the small farmer would have disappeared ages ago. It seems the

		middle man continues to get his cut, but the farmer is at the mercy of the market.
64	Mar 9, 2010 2:04 AM	The language of the ballot initiatives, to date has been consistent, if not identical across states. They use HSUS language, and in a legal context are vague on purpose. States that have reached ”agreements” with the HSUS language are likely to be sorely disappointed when, in the case of swine gestation stalls, the producers think they can place female pigs in stalls for the first 30 to 40+ days until pregnancy is confirmed. In addition, the language regarding the ability for a breeding female to turn without touching another animal or their surroundings, as currently written in HSUS terms, would mean that each female pig would need to be able to stand and turn in place concurrently without touching another pig or structure (this implies 64 square feet per pig) which is much greater space allocation than currently used in systems with females housed in pens. The goal is clear, elimination of food animal production systems.
65	Mar 9, 2010 2:25 AM	Let the free market dictate the farm policies.
66	Mar 9, 2010 2:58 AM	Ballot initiatives cause a lot of only half truths to be used as catch words or phrases to get attention. Balloting usually causes the issue to become very polarized with very little attention to the facts and chances to compromise. A lot of money is spent on advertising that could be channeled to research and education to make animal food agriculture more pleasing to the public and still be competitive and a good food source for humans.
67	Mar 9, 2010 3:20 AM	I think that welfare issues can be satisfied without ballot initiatives. The market will dictate what needs to be done and producers will respond in kind. The awareness of these issues is driving the issue to be a priority with producers. The last thing we need is more laws and regulations. Farmers and ranchers are the original welfare advocates. As information and technology increase and improve, producers will respond in kind.
68	Mar 9, 2010 3:40 AM	Not a good idea - animal rightists so powerful and misleading that science is not taken into account, and people are constantly misled about what REALLY happens 99% of the time in agriculture.
69	Mar 9, 2010 6:18 AM	I raise horses as well as cattle the animal rights movement has killed the horse industry. I love my horses but there is not a market for cull horses this has affected my horse business dramatically and will force me out of the

		business. I sold two thoroughbred mares on the auction I got a $50 for one and $60 for the other one and it cost $68 to sell them. I don't blame horse owners for turning horses loose on gov lands.
70	Mar 9, 2010 6:39 AM	I believe ballot initiatives usually result in more harm than good. Voters react emotionally to slick media promotion and rarely take the time to research both sides of the issue and usually do not have a working knowledge of how regulations will impact industry. Human nature being what it is, there are cases where regulation is necessary. However, over-regulation is becoming problematic in today's world. I feel that there are adequate laws in place that, if enforced, would address the legitimate concerns brought forward by animal activists. The opinion of a special interest group (in the form of law) should not be forced on an industry unless supported by legitimate science and subject to review, revision, and/or repeal.
71	Mar 9, 2010 12:38 PM	Not a good idea.
72	Mar 9, 2010 1:26 PM	As legislators often have little knowledge of the science of agriculture even in ag states (Harkin for example) or are influenced by large ag groups (Harkin for example) or animal welfare groups the formation of a livestock welfare advisory board is the only way to ensure science guides animal care and not emotion or personal agendas.
73	Mar 9, 2010 2:04 PM	Let the market and current Animal Health regulations do the job they are intended. I believe the vast majority of Animal Food Producers do a great job and the current quality assurance standards protect the consumer.
74	Mar 9, 2010 2:05 PM	If we as farmers, make a conscious effort to educate our customers and their children about the food supply, we will benefit for years to come.
75	Mar 9, 2010 2:25 PM	Production Agriculture should not be mandated by special interest groups who do not have the society as a whole in mind. With current population trends, production agriculture will continue to feel the pressure to increase production to maintain low cost food. With this in mind, utilizing research based methods of production to increase production is essential. Animal Welfare is of the utmost importance on any modern livestock operation including horses. Modern agriculture operations understand the need to be stewards of the livestock and land in order to maintain sustainability in their operations. USDA should investigate malicious groups who may fabricate false accusations, and should prosecute fully if found that videos

		and reports were false and intent was to bring negative connotation to all agriculture. Banning Horse Slaughter in the US made a difficult situation more difficult. We love our pets! I own horses and enjoy them. I also own dogs and enjoy them. I also know there is a need for "Kill" animal shelters to maintain a moderate level of the dog and cat populations. Removing horse slaughter plants in the United States removed the only control method we have of maintaining horse population levels. This did not stop the slaughter, it moved it out of the country where the methods were less humane and efficient. This actually made the welfare of the animals more at risk than they were in the US. Essentially it had a negative effect on horse welfare. Horses ride longer distances, and endure more inhumane kill and slaughter practices in some other countries. Finally, agriculture is the backbone of any society, "An army runs on its stomach", everyone must eat at least once daily. "America feeds the world." If you wear cotton underwear you are involved in agriculture. If we are to maintain the ability to feed ourselves and the world and remain the dominant world power, we must be able to rely on ourselves. If our society becomes reliant on other countries to feed us, we will become vulnerable. We must educate our next generations on production agriculture and encourage them.
76	Mar 9, 2010 2:55 PM	Too much emotion and misinformation can be involved when these kinds of things are determined by ballot initiatives. I'm not saying the voters aren't intelligent enough, but I am convinced they don't really understand what they're voting for. Glitzy advertisements and one-sided stories can sway a lot of people. Obviously, I'm not in favor of ballot initiatives like California agriculture is being subjected to.
77	Mar 9, 2010 3:10 PM	The regulations are lobbied for by large producers to force out small farmers, reducing the competition, and monopolizing the market. The market needs competition to keep prices competitive and quality high.
78	Mar 9, 2010 3:39 PM	I am against increased regulation by Washington. Increased regulation will drive small/medium independent producers out of business; the present profit margin is slim enough. All producers benefit when animal welfare is taken into account. Happy livestock gain weight and increase profit. It is in our own interest to care for and maintain our cattle. Ranchers do not need Washington to dictate policy to us. Small/medium beef producers are the backbone of the American beef industry. Any regulation should be focused at the large, corporate owned, Agri-Farms where

		they might lose sight of animal welfare. I worry more about the welfare of my cattle than most folks worry about their own children. Please keep the bureaucrats out of our business!
79	Mar 9, 2010 3:52 PM	The public is not generally well informed about how small farms operate. They usually see only scary videos on Utube (on things that should be changed) and extrapolate that to all farms. Happy, healthy animals bring the farmer more profit, so animal welfare is of high concern to the farmer. Calm, clean slaughter practices bring higher quality meat to the market and should be regulated. Consumers can vote with their food dollars and so can buyers like McDonalds and Walmart who demand Quality for their customers. I don't think the general public is well enough informed to vote on agriculture. See books by Dr. Temple Grandin for discussion on these subjects.
80	Mar 9, 2010 4:17 PM	Ballot initiatives and regulations proposed by groups allow for a large range of input into agriculture practices. This large range of input is good in most cases. The final regulations that are derived must be based on science and not wishful thinking. If regulations that are very restrictive are adopted, then the farmers must be allowed time to adopt to the new regulations. If the regulations cause an unfair advantage for imported products, then the imported products should be subject to the same regulatory standards.
81	Mar 9, 2010 5:02 PM	Great job being done by producers. People more worried about nothing than raising their kids wholesomely.
82	Mar 9, 2010 6:02 PM	If we are going to allow the public to tell us how to treat our animals that we raise for production, then we should be able to tell them how to run their business. Any interference at all is an intrusion on our ability to do business in a manner we see fit and serves our best interest. If they are unhappy about the welfare of our animals they have the choice to buy and eat something else. That is what the free market is all about. Unfortunately, most people who want to interfere consider that free market is only free when it applies to someone else.
83	Mar 9, 2010 7:45 PM	Bring back smaller farms that bring more decision makers, more jobs, and more small businesses back into business for better economic stability.
84	Mar 9, 2010 8:50 PM	Larger dairy producers are doing a good job, they have to stay in business or it affects their bottom line. They have

		no reason not to work toward the best interest of production agriculture. However, when you start giving these animals feelings/human rights it is going to become extremely costly for food. Plain and simple people are going to starve to death because food will not be produced as economically and they won't be able to afford it. Animals have the right to food, water, shelter and protection from predators...the stricter regulations will be as hard/harder on the small/medium farmer because those are the ones who have less capital to make improvements in facilities, less time to do dehorning at an early age, etc. because they have less people involved. So by changing the "factory farms" they are going to destroy the little guy who they claim to be trying to save???
85	Mar 9, 2010 9:04 PM	We do not need the common populace deciding the rules that the agricultural industry in this country must abide by. There are enough organizations within most every industry to regulate themselves, insuring their longevity for the benefit of the industry and the consumers who depend upon the USDA and the industry for compliance. We also have anti-trust laws to prevent collusion within most industries within this country.
86	Mar 9, 2010 9:05 PM	Life, liberty and the pursuit of happiness. The people should be regulating government influence, not the other way around. Consumers can and will vote with their pocketbooks, especially in hard times.
87	Mar 9, 2010 10:37 PM	America: Be careful what you ask for...
88	Mar 9, 2010 10:59 PM	As with any survey, I did not appreciate how some questions are phrased. Size and husbandry practice are not always linked. Most ballot initiatives will impact practices; which in turn impact operations regardless of size.
89	Mar 10, 2010 3:03 AM	I have believed that the added regulations we have now has eliminated the wanting of the small young farmer to start in the livestock business. The added torture of the harassment of "city people" moving to the country complaining about country smells has forced people like me to close my small operation. Any ballot initiative will probably force many more small producers to close. This will mean more importing of foreign foodstuffs that may not meet the US consumer’s high quality standards. Unfortunately regulation doesn't affect large producers because they can move to a different state and set up shop in a more friendly area.

90	Mar 10, 2010 12:56 PM	I am against strong regulation of any kind. However, I see the trend in the quality of meat declining due to increased stress from continuous and close confinement, primarily due to the increased stress hormones released in the animals. We, as consumers of this meat (or eggs, milk, etc.) are secondarily affected from the by-products of this unnatural way of housing and raising our food-producing animals. I am at a loss as how to remedy the situation, except to encourage the livelihood of smaller farms / organic farms and to have the public support higher prices for their meat/eggs/milk for higher quality products.
91	Mar 10, 2010 2:30 PM	I do not like question #2. There should be some option for regulation coming from USDA, State Depts. of Ag with input from producer groups, other ag agencies and other outside interests.
92	Mar 10, 2010 4:08 PM	What are acceptable standards to one individual or group may not be acceptable to another. There is not a "right" or "wrong" answer, so consumers should decide by what they are willing to spend at the marketplace. Too much mis-information and generalizations are placed in consumer hands without publication of consequences. A listing of cause and effect would be beneficial. Legislation should not benefit one group over another, i.e. the legislation should not be about marketing but rather about what is real. What person or legislative body can possibly know the best answer for animal welfare? Keep the radical groups out of the discussion.
93	Mar 10, 2010 4:25 PM	Consumers should have the right to choose whatever they want. It's the farmers risk to take if he wants to be a specific certified producer. There should not be any regulations stating what type of food I can buy. There should only be regulations to follow if a farmer wants to get a specific "label".
94	Mar 10, 2010 5:20 PM	Decisions need to be based off of sound SCIENCE, not off of people's EMOTIONS. Allowing people to vote based on emotions will cause the agriculture industry to fall apart. We do not need to be told how to care for our animals and land - we wouldn't be doing this if we didn't care.
95	Mar 10, 2010 6:23 PM	Increasing rules and regulations regarding food animal production will always impact small farmers negatively and will have little effect on the large corporate producers. This has been going on for decades and has driven many small farmers out of business. I know from personal experience. Regarding who should decide about animal welfare regulations and initiatives, it should NOT be the politicians

		or members of the food animal industry or animal rights groups. Their interests are merely self-serving. Deciding by ballot would involve too many people w/o knowledge of food animal production. A committee comprised of individuals involved in various aspects of food animal production (but not industry) should be assembled. Such a committee should be comprised of some food animal veterinarians, some producers, some govt. extension agents, and perhaps others I cannot think of at the moment. Regulation of food animal welfare can be done fairly and intelligently if it is thought out properly in advance, and if it does not rely on the folks with special interests (lawyers/politicians, corporate folks, animal rights folks). My opinion is that small producers are more likely to be already following good practices of animal management and are most likely producing a higher quality animal product than is industry. Yet the small producers seem to be negatively impacted by each and every new rule or regulation.
96	Mar 10, 2010 9:33 PM	Groups and individuals who use hype and hysteria to promote a cause are frequently well intentioned but mis-guided in that they do not tend to understand livestock production practices and do not realize that producers do not intentionally use any production practice that would hinder production, health, or safety of their animals. Production practices that shelter, protect, and maintain the health of animals encourages faster growth and production. Pasture raised swine tend to have lower survival rates because sows frequently lay on/crush pigs, others die of predation and poorer health due to exposure to the elements. Other species suffer similar but different production/survival challenges that many people do not realize.
97	Mar 10, 2010 9:39 PM	Industry demands will be met with progressive small and mid-sized farmers regardless of certifications or regulations. Let the industry handle it on its own.
98	Mar 10, 2010 10:01 PM	Animals should be humanely treated regardless of the cost....it is the right thing to do. It is barbaric and deplorable to subject animals to miserable living conditions just to save on cost. These are living creatures that feel pain and emotions just as humans. I don't care how the changes are brought about, but change does need to happen and I don't think we can assume that people will just do the right thing because we have seen that this doesn't work...too much greed and ignorance out there.

99	Mar 10, 2010 10:03 PM	Any and all change in regulations and laws dealing w/ food animal agriculture and animal agriculture should be based on practical and common farming practices and scientific research based information. Also, it should be feasible to achieve. Use some common sense when establishing regs and laws.
100	Mar 10, 2010 11:22 PM	Initiatives play on consumers' emotions and that is no way to set farm regulations
101	Mar 10, 2010 11:45 PM	I feel that the push for governmental regulation of farms creates more problems than it solves. A good example is the ban of horse slaughter in the US. While horses are no longer being slaughtered here, they are now suffering even more as they are trucked to Mexico for the same fate. Additionally, most consumers are not willing to pay the prices that would be necessary to support the changes that would be regulated. The best way to regulate farming is to allow the consumer to make educated choices about the source of their food products. This market push has the potential to initiate much larger changes than government intervention ever can.
102	Mar 10, 2010 11:58 PM	Being from CA in the egg production business I can attest to the fact that ballot initiatives are not the way to go. However production animal agriculture is going to have to be able to reach an acceptable compromise with animal advocacy groups. Educating the consumer is the most important part of the equation. Farmers only want to produce and consequently have abdicated their rights to activist groups who want animal ag eliminated. It is imperative that ag gain back the confidence of the consumer. It's time to become marketers and educators as well as being producers.
103	Mar 11, 2010 3:16 AM	Ballot initiatives should not be used. The general, non agriculture sector of the population is so far removed from animal production that they vote based on a feeling vs. a fact. Consumers are severely swayed by negative, one sided media that only highlights the small minority of offenders, when overall, true animal production is not like the few hobby or part time producers.
104	Mar 11, 2010 1:46 PM	The group most qualified and with the most to gain and lose in creating regulations are the farmers and ranchers producing the product. They should be the ones to write the regulations in cooperation with Extension Specialists. Once the regulations are established then a good education effort should be implemented that will inform the farmers and ranchers of the minimal requirements in animal husbandry. Once in place the regulations can be

		implemented by a states agriculture regulatory agency such as Departments of Ag or a Land Grant University. Keeping in mind that farmers need adequate time to retool if necessary.
105	Mar 11, 2010 4:26 PM	On the question about unintended consequences, I did not check "Create a change in the quality of products from previous norms"; however, I think the quality of products will INCREASE if animal welfare is taken into account. I am primarily a consumer of animal products. I strongly support raising animals in a "natural" way - no feed lots, no concrete pads, fed a food that is natural for the animal (e.g. no grain for ruminants but OK for hogs), and no prophylactic antibiotics or growth hormones. I only buy non-CAFO meat and milk, which means I usually have to buy directly from a farmer I trust. I currently pay 50-100% more for meat and 100-125% more for milk than CAFO product prices. I expect that premium would DECREASE if more farmers were raising food animals naturally.
106	Mar 11, 2010 4:42 PM	I don't generally think a ballot initiative is a good way of legislating. I do think that some changes in food animal agriculture are needed. My actions so far have been limited to buying free range eggs, and most of my meat in the form of a lamb at the Community Fair auction. I would prefer to see more animals raised on small farms as opposed to feed lots. Luckily, I am in a position to pay the extra cost, but I am not sure what more regulation would do to the food costs for people who are nearer poverty. Legislation can certainly start by regulating animal waste from CAFOs - this is essential.
107	Mar 11, 2010 4:43 PM	There is a huge amount of unintended consequences that will occur. These will range from eggs dropping on litter covered ground to red meat animals not properly finished. The cost factors will go up immensely putting most of the smaller growers out of business.
108	Mar 11, 2010 5:13 PM	Ballot initiatives and referenda tend to elicit more emotional response from voters. Livestock producers and related organizations are far better qualified to generate regulatory legislation pertaining to animal food quality.
109	Mar 11, 2010 6:04 PM	Food animal agriculture is already doing well without inputs from uneducated animal advocates! I don’t see that any change is necessary. The regulations already enforced mandate the proper treatment of food animals, i.e. Humane Methods of Slaughter Act. Farmers treat the animals better than most people get treated by one another! Food safety starts at home with following proper

		cooking techniques. Most people infected with food borne pathogens have done so by undercooking meats. We will never have full control of food borne pathogens, and the regulations mandated are well enough, unless consumers want to spend more money on their meat products. Pathogens live in vegetables and fruits too, but we don’t hear about those!
110	Mar 11, 2010 6:13 PM	I find this survey hard to answer, because the effects of regulation would be very different depending on precisely how the regulations are formulated. I would like to see more controls for both animal welfare and pollution control for large farms, but I do not want small farmers burdened. The last thing I would want is more concentration, but regulations can all too easily lead that way when they require massive new investment, for example. Hence I oppose ballot initiatives, which are often not well-crafted or thought-through. But I would like legislation that simply exempted small farms and had fewer regulations for medium-sized farms. This would reduce the overall efficiency of agriculture and raise prices, but it would have advantages for farmers and others in the long term.
111	Mar 11, 2010 9:16 PM	Food prices are too high. Additional mandates will cause additional price increases!
112	Mar 11, 2010 10:01 PM	If people knew how most animal products were produced, they wouldn't go near them. People need to be connected to the source of their food and know what is going on in agribusiness.
113	Mar 11, 2010 10:47 PM	Judging from the number of items to which I responded "not sure," more education is needed for the general public.
114	Mar 11, 2010 11:10 PM	Totally detrimental to the availability of affordable, sustainable, healthy, and safe food products derived from honest environmentally conscious producers.
115	Mar 12, 2010 12:18 AM	I think producers need to get involved and pass legislation and not wait for initiatives.
116	Mar 12, 2010 2:01 AM	The agricultural industry needs to be pro-active and take the initiative to ensure animal welfare while fighting against animal rights. The Ohio initiative is a good example of this approach.
117	Mar 12, 2010 2:24 AM	I am a retired rancher. If people with no farm background are the rulers, the farmer will be out of business. The farmer doesn't tell the city dweller how to live his life.

118	Mar 12, 2010 2:58 AM	Anything done concerning agriculture should be done carefully. Something may be good for one farm (making it better, better animal practices, etc.), but could be extremely detrimental to smaller farms. Small farms are the backbone of our country. Most small farmers strive to produce the highest quality food products while maintaining the best animal husbandry practices. The small farmers should be protected from any "unintended consequences" that could/would be destructive to their farm operation.
119	Mar 12, 2010 3:05 AM	If the people and leaders of this country want all of our food products to be grown outside of this country's borders, just keep regulating us to extremes and the businesses whether growing or processing, will leave. And only then will the masses complain about country of origin. But, they won't have the smell and the portrayed horrible "factory farms" in their backyards. And, they will have no control as to want happens in any other country.... because the demand will be greater than the supply and we will be at the mercy of the producing countries.
120	Mar 12, 2010 3:08 AM	No Comment
121	Mar 12, 2010 3:55 AM	63% passed the cage free egg law Prop 2 in CA; 6% buy cage free eggs prior to vote; 4% of Californians buy cage free eggs now that the economy slumped. The general population does not realize they will be impacted.
122	Mar 12, 2010 3:19 PM	Ballot initiatives allow those who have little if any knowledge to control and dictate how things are to be done. They are making decisions based on emotions rather than rational thinking and the impact can/will create situations from which animal agriculture cannot recover. Once the animal agricultural industry is "shut" down it will take years to rebuild if it can be done at all. Cheap food will be a thing of the past and food safety will become a major problem. As we transition to more imported food and lose control of the food supply the demise of our country becomes inevitable.
123	Mar 12, 2010 3:30 PM	The confusion and consternation caused among CA egg producers after Prop. 2 is a telling example of the law of unintended consequences. Also the unwanted horses after slaughter was closed, even transportation to Canada or Mexico. HSUS should be accused of extortion for their efforts to demand food chains to purchase from 'approved' sources. There is no defense that I can think of once they show horrible videos as they did in the Prop. 2 campaigns.

		Since we can't overcome those videos, let us encourage (quietly) those who pursue the "racketeering" and extortion techniques they engage in. They need to be revealed as social engineers (they're using religious organizations to buy into their kinder-gentler agenda) and their stated agenda must be made public over and over. Thanks for doing this survey.
124	Mar 12, 2010 4:07 PM	Yes we can! Change for the good of the animals, and your pocket books can adjust. Let the people decide where they want their food to come from.
125	Mar 12, 2010 4:12 PM	The normal consumer is not educated in the farming practices and the production volume that it takes to produce food for the people in the United States and world unless we are able to educate and inform them to the fullest degree, they shouldn't be allowed to vote on issues concerning feeding the people. The food supply is very limited because if one large producer quits, someone may go hungry until that production void is filled, which could take years if the permitting process is delayed. Animal rights people should review their own values and be concerned that there is enough affordable production to feed the people.
126	Mar 12, 2010 5:12 PM	I am for animal welfare, but am tired of the local (city, county) telling me what I can and cannot raise on my farm. I think there are people in the government pulling in a paycheck that do not know what they are doing to the local constituents.
127	Mar 12, 2010 5:58 PM	Most consumers completing ballot initiatives know very little about the production of food supplies, or understand the true impact of the initiatives they sign.
128	Mar 12, 2010 6:37 PM	The vast majority of consumers are in urban areas with limited understanding of production agriculture (see California). It is important that regulations are balanced such that costs of production and compliance don't force small and medium sized farmers out of business and increase food prices. Although our food prices as a percentage of income are very low, this is due to technology and hard work of our farmers and farm families. We have the safest, most secure food supply right here in the US. If you want to regulate anything, it should be the imported food that is grown with substandard practices and regulations.
129	Mar 12, 2010 7:13 PM	It is the wrong way to force change. The public does not have the knowledge to make an informed choice. A ballot

		initiative provides a yes or no vote. Animal welfare is not that black and white. A discussion between informed parties with some unbiased research and data is needed to come up with the best solution. Ballot initiatives often are accompanied by one-sided information offered by the organizers of the initiative. It can be hard for any opposition to provide the public with the other side of the story.
130	Mar 12, 2010 8:27 PM	I believe that ballot initiatives of such things are BAD. The majority of people who vote are informed of most ballot issues. I have been an election judge for over 10 years and even local issues such as tax increases to support the local schools are not well understood. Issues such as animal food issues are foreign to most people and if they are "informed" the information most likely came from 'radical' groups who want to protect "those poor animals". I attended a small group at a church three weeks ago and it was obvious that even the speaker was emotionally involved and did not know much about our animal food system - they had collected some video secretly of some unusual treatment of animals such as the Holstein cow being moved with a fork lift (shown on TV) a few months ago -- "it was fact that all animals were and are treated that way" at that meeting. Any actions taken such as uncaging chickens and farrowing sows will really hurt the small and medium farmer (I was raised on a small farm) As Legislative Director of the Illinois State Grange, we oppose such prohibitions. Farmers don't intentionally abuse their animals!!
131	Mar 12, 2010 8:44 PM	I am very concerned that regulations will put me and the saving of my 5 generation, established in 1856, farm out of business. Direct marketing is allowing us to provide quality products to an appreciative knowledgeable customer. Regulations could prevent us from doing what we are doing and put our farm in jeopardy.
132	Mar 12, 2010 9:15 PM	Food production needs to be in the hands of the producer of row crop, and animal commodities. The consumer has the right of choice on food items. Americans are used to cheap food and around 7% of annual income for food. With ballot initiatives and more regulation the cost of food will go up, creating consolidation and less producers. We do not want our food dependency to be in another country’s hands. Cheap food has been our greatest defense.
133	Mar 12, 2010 10:39 PM	Animal Care Boards at State levels should oversee how animals should be handled. Commodity welfare standards by associations should only be voluntary. As news has

		shown, it seems that the few who may not even eat the commodities they wish to control are forcing the many to pay more for their food. With US population growing over 300 million, how will these rollbacks to older tech meet that food demand?
134	Mar 13, 2010 1:24 AM	I feel that a lot of consumers are "disconnected" from agriculture. It would be nice if they could get connected with farmers and see how production agriculture really is. The saying holds true that, "One bad apple spoils the bushel." Anti-agriculture activist groups seem to be effective in influencing the media and public, emphasizing the few "bad apples" out here. Farmers in my neighborhood are concerned with the environment and do take pride in ensuring the welfare of their animals.
135	Mar 13, 2010 2:23 AM	I think that the protectionists are out to get agriculture any way they can and by scaring the public they get their way at the expense of farmers and livestockmen.
136	Mar 13, 2010 4:46 PM	#14. To which group do you most closely affiliate yourself with? Extension Council for Agriculture, Farm Bureau, Animal Veterinarians, The Grange, Independent farmer, Organic, natural, free range producer. I see most legislatures only helping support Monsanto, Cargill and the like and only hurting the small farmer/producer, minority breeds and many purebred animals.
137	Mar 13, 2010 6:00 PM	The proposed regulations have consequences that have nothing to do with their purpose. The way they are written will cause huge issues to small farmers, exclusions or provisions for anyone raising food animals on a small scale should be included.
138	Mar 13, 2010 7:48 PM	This survey is very poorly worded and will generate bias responses. You can't talk about ballot initiatives and intended/non-intended consequences in the abstract. If you are talking about voters banning battery cages for egg production, say so. Consumers are demanding changes to agricultural, changes that small and medium size farms are willing to accommodate. ItÆs only the established, outdated, industrial agriculture conglomerates that are digging in their heels and fighting change.
139	Mar 13, 2010 10:10 PM	As long as the proposal is initiated by one whose interest in agriculture is more than as a consumer, the ballot initiative process is okay but initiatives sponsored by someone whose only interest is as a consumer or animal rights activist, it can be severely distorted and the outcome

		may be much more than that which was intended. Regulations are different. They are usually promulgated by people who at least understand the breadth of the impact of a proposed regulation.
140	Mar 13, 2010 11:01 PM	In regard to question #5 of your survey, it can have both positive and negative impacts on the rural community.
141	Mar 13, 2010 11:35 PM	I don't think it's a very good way to assure animal welfare but unfortunately, the industrial food complex has done a terrible job on its own. Unfortunately, legislation that mandates good behavior often trickles down in unexpected and often negative ways to small producers (like us) that DO treat our animals very well. I don't see the legislature as being the problem though - in the end, it's the industrial producers that 'rain on the cake' for everyone in the end (and in so many ways).
142	Mar 14, 2010 2:12 PM	Regulation should always be based on sound science and a demonstrated need for intrusion into business. Animal agriculture needs to recognize that there are bad players out there, just as there are in any business and be prepared to point them out. The rest of us do a wonderful job and do not need additional regulatory control. The real effort here is to remove meat from the US diet and I hope that someday the PETA/HSUS crowd is the first to starve to death when they finally make it too difficult and expensive to produce food.
143	Mar 14, 2010 6:47 PM	It deeply concerns me that outside groups who have no agricultural interest want to tell farmers what to do. Such as the HSUS who wants to control the animal production industry by eventually getting "non-agricultural" people to vote for misstated truths. In my opinion, they want to do away with any animal being used for human consumption. They are stepping on my constitutional right of life, liberty, happiness when they tell me what I can or cannot eat. For the most part, many farmers treat their livestock with great care. There are a few, as with any group, who do not which puts a black name on everyone.
144	Mar 14, 2010 7:38 PM	I feel that more stringent regulations only benefit the large producers and manufacturers who are more able to spread out the cost. Increased regulations will reduce or eliminate all but the largest commercial producers, and rarely do these sell directly to the consumer. I feel that farmers should have a RIGHT to sell DIRECTLY to the consumer with a minimum of regulation. No one responsibly producing food will compromise their standard or risk selling less than wholesome food. The longer the "chain"

		from producer to consumer increases the chance of food contamination (accidentally or deliberate). Small farmers are the ones maintaining heritage breeds, heirloom seeds and plants, and the overall health of the soil. You cannot legislate common sense, responsibility, or concern for your animals and land. Farming is hard work, very few of us ride around in million dollar air conditioned tractors with little or no connection to the food we produce. My friends and family eat what I produce, no law will make me be more careful or more responsible about my land, my produce or my animals.
145	Mar 14, 2010 11:13 PM	Let's not legislate the American farmer out of business and drive production to 3rd world countries.
146	Mar 14, 2010 11:40 PM	I think it's a good idea to use this form to gather information from all areas of interest. Our Granges are very interested in anything to do with agriculture.
147	Mar 15, 2010 1:57 PM	Is there a place for animal welfare guidelines - absolutely? Should they be mandated by groups wanting to eliminate food coming from animals - absolutely not. Providing reasonably priced, safe animal protein from this country is important. Mandates by groups onto specific states that can and will so severely impact that state's agriculture sector is ridiculous. We must look at the bigger picture and the future of where our food will come from. How much will it cost, are we looking at animal care or animal rights, how safe is our food supply, and are we willing to regulate food animal production out of a state or of our country? I'd say no. Animal care and welfare is VERY important. But we need to keep the perspective that it is care and welfare we look at with other factors, not just an animal's rights.
148	Mar 15, 2010 2:55 PM	Ballot initiatives allow those not associated with agriculture to make decisions that they have no knowledge of. Most Americans do not know where their food comes from, so we are expecting them to make decisions for the farmer? The farmer has to take care of their animals or the animals will not produce and make a profit. The big question is who is going to pay for these rules and regulations to be enforced? Ultimately the farmer will. Regulations only hurt those that are doing things right in the first place. Those that are doing wrong will continue to do so illegally and there will be no one available to enforce it.
149	Mar 15, 2010 3:00 PM	I believe that in our current system of production that the market will mandate to producers what and how much they should produce. That is if the government will leave the producers and markets (supply and demand) alone. I think

		that government should not meddle in the market place. I also feel strongly that price controls, subsidies as well as other market/production manipulation is not needed and only makes problems for everyone.
150	Mar 15, 2010 3:01 PM	Any regulations can be manipulated by large companies and used to make life more difficult for the small farmer. Less regulation is better in my mind. More consumer education and transparency from big corporations is needed to help people understand how to vote with their food dollars. Thanks.
151	Mar 15, 2010 3:10 PM	Most US voters don't know what they are voting on as it is now. I don't see that changing. Why should the uninformed public decide policy?? Farmers and producers eat too.
152	Mar 15, 2010 3:11 PM	I oppose the use of ballot initiatives and regulations to create change in food animal agriculture. I believe that consumers should "vote" with their dollars to change agriculture. If consumers want to purchase food that is raised "humanely, sustainably, cage-free, antibiotic-free, organic, etc." they should purchase food from farmers/firms that produce food in a way that matches their ideals. The problem of regulation is an information problem. If consumers had perfect information about how their food is produced, they would choose to buy food that matches their ideals. The role of government should be to make sure that farms/firms are providing consumers with accurate information about how they (the farms/firms) produce, process, and handle food. Provided with accurate information about what they are buying, consumers will have the power to influence the way food is produced.
153	Mar 15, 2010 3:13 PM	Non-corporate producers will be harmed by these proposals. Most producers are not making any money or at best getting a minimal return on their investment, hard work and long hours. Any additional strain will cause many small producers to leave the family farm. As these farmers leave, the vacuum will be filled with foreign farm products, where we have no idea what we are eating, and corporate farms which do not benefit the communities. These proposals, however well meant, have the potential to disrupt the American family farm.
154	Mar 15, 2010 3:17 PM	We raise bulls and if you don't have some checks all you have is a bunch of bull
155	Mar 15, 2010 3:39 PM	If there were no government subsidies in grain production there would not be many animal welfare problems because there would not be many large animal confinement

		operations. Without the cheap government subsidized grain they are just not sustainable economically. Poor animal welfare is one of the unintended consequences of grain subsidies.
156	Mar 15, 2010 3:43 PM	Large corporate farms benefit from efficiency and scale of operation that often precludes good farming practice and quality of product
157	Mar 15, 2010 3:52 PM	In most cases, perhaps all cases when it comes to animal agriculture, the general public is not well enough informed to be making these decisions. They are "educated" by politically motivated ads and by information from each side that may or may not be accurate. The history of activist groups (such as PETA) has been to tell whatever story is necessary to advance their agenda. Too often the general public will believe whatever they are told without doing independent research, and thus vote with their hearts and not their heads. Unfortunately, the same can be said for congress as well. These decisions need to be based in science and made by informed groups or panels. If the public wants free range chicken raised on grass, worms and bugs, let them have it. If there is a demand, a market will develop and there will be producers that will supply that market. But has anyone told them what it's going to cost to buy that product? Probably not. Thanks for the opportunity to provide some input.
158	Mar 15, 2010 4:08 PM	Mandates on producers by consumers are often harmful to the producers who cannot pass the added cost of production onto the customer. Welfare concerns should be based upon science and not emotion. Producers are very concerned about the welfare of their animals. Producers will modify production methods if it is demonstrated to improve welfare and production of their animals and can be modified over time to allow the producer to stay in business.
159	Mar 15, 2010 6:36 PM	Food animal production is a business/industry, no different than building houses or selling cars or merchandise. Any involvement of those espousing "bioethical", "humane/proper treatment", who have no education or understanding of the industry from the "hands-on" level, will lead to detrimental outcomes. Initially for the producers (at all levels) and eventually for the consumers of this nation. The people who know the business need to be the ones who police the industry, not Hollywood, not lobbied legislators, and not high rise apartment dwellers who do not know the difference between an Angus and a Rhode Island Red.

160	Mar 15, 2010 7:54 PM	All of this legislation is geared to push out the small and medium farmer. Eventually, all that will be left will be big corporate farms. We need to push legislation to help the smaller farmers/producers stay afloat.
161	Mar 15, 2010 7:57 PM	I believe that the animal rights activists are using this for their own agenda. I believe in the humane treatment for all animals but I do not believe in the extremes that animal rights activists go to press their agendas.
162	Mar 15, 2010 8:06 PM	Regulations need to take into consideration the type and size of the farm, not an across the board one size fits all.
163	Mar 15, 2010 8:20 PM	The most amazing thing I see with all the interest in legislating animal welfare /food safety is that there are no farmers involved. Legislators, unless they are farmers, don't know enough about the subject to write new legislation.
164	Mar 15, 2010 8:30 PM	I do have chickens, but no huge amount of land to farm on.
165	Mar 15, 2010 9:21 PM	Controlling too much, too fast could easily backfire. Change where it needs to be changed. Use Extension.
166	Mar 15, 2010 9:34 PM	Less government intervention in production the better for the consumer in virtually every way. Private certification programs can be an asset. Government interference and intervention adversely impacts the inherent controls of the free market enterprise.
167	Mar 15, 2010 9:57 PM	I want common sense to regulate, not bureaucrats. I trust American farmers and corporations much more than government regulators. I want more good responsible food processing inspectors, not more laws and regulations. I prefer an open free market with limited regulations.
168	Mar 15, 2010 9:59 PM	I am in favor of any regulations that improve the way animals are raised, fed, treated in general, and slaughtered.
169	Mar 15, 2010 10:27 PM	Ballot initiatives and regulations most often do not involve real input from animal agriculture producers (the vast majority family farms and ranches), and fail to truly consider the impact the regulations have on the families producing food for our country. In addition, the regulations and initiatives are rarely "real world" solutions, making food more expensive and negatively impacting both quality and quantity.

170	Mar 15, 2010 10:34 PM	I am in Ohio. I am very afraid. This is a critical time for us. I fear we cannot overcome the massive propaganda machine that is HSUS. My animals are cared for and treated properly. But if someone with only the lies in their head looks at it, they may disagree. A nice barn that is dry and well ventilated is perfect, they do not need nor would they do better in the Taj Mahal. I have a soft heart and do not like the day that animals are loaded on the trailer for that last ride. But until that time comes I can treat them with care and concern. Are you ready for a vegan nation?
171	Mar 15, 2010 10:45 PM	Too many of your questions were negatively slanted. You didn't ask if there could be positive impacts on farms from ballot initiatives. Once upon a time we had a membership in CAST. We felt you were fairly anti-environmental protection in your policies.
172	Mar 15, 2010 10:57 PM	These ballots, in the past have all been sponsored by HSUS - a group dedicated to the elimination of food animal production. The ag industry needs to stand in a unified front against HSUS, listen to our customers and provide them a product that they demand. At the same time, science must rule over emotion and just because something looks better - doesn't mean it is better for the welfare of the animals or the environment.
173	Mar 15, 2010 11:02 PM	I strongly believe in humanely, raised livestock but do not think most consumers have a clue about what really goes on - be it good or bad. IMO the goal of most animal welfare and animal rights groups is not humanely raised and harvested livestock but the elimination of animal protein for consumption. I think producers should be included in discussions on how to improve humane production and reduce animal mishandling without putting family farms out of business.
174	Mar 15, 2010 11:26 PM	Policy should NEVER be written by people (the voting public OR government agency personnel) who have never raised animals for food and have no concept of how to raise and market animals and be a VIABLE (i.e. make a profit) farm entity.
175	Mar 15, 2010 11:40 PM	The prime example of unintended consequences is the ban on horse slaughter. Now we have more starving and abandoned horses than ever. Too often well intended people are led astray by groups such as PETA and The Humane Society of America. Their goal is the destruction of animal agriculture and the uninformed don't know or care.

176	Mar 15, 2010 11:45 PM	In regards to NAIS... I feel that it needs to either be voluntary (which I know it currently is) or go farther and provide carcass data and other info for public access where a producer or a consumer can look up how livestock are performing and could lead to improved meat quality
177	Mar 15, 2010 11:48 PM	We must separate animal welfare (decreasing pain, fear, and suffering) from animal rights (where to live, which other animal to breed etc)! We must separate "certified organic" (with more rules than anything ever known to man; raising price ridiculously) from "from certified no antibiotic in feed, no steroid implants, grass fed, no by-product fed" which is what reasonable people are willing to do, and which can be done reasonably. We must get government to stop applying regulations intended for industry (huge feedlots and packing plants) to individually slaughtered cattle and pigs.
178	Mar 15, 2010 11:56 PM	My farm product affects a family or two, the corporate farms product, when something goes bad, affects hundreds or thousands if something goes wrong. Why ship our jobs abroad with downsizing and NAFTA, and then constrict our ability to farm with more and more regulations? BTW I love the pass given to corporations concerning "Organic" products....any crumbs left for the rest of us?
179	Mar 16, 2010 12:18 AM	The only focus of truly effective ballot initiatives should be aimed at empowering the consumer, reducing restrictions on free commerce, and providing for increased transparency of commercial operations. It makes no sense that 2 willing parties in the US cannot buy food from each other without governmental interference and approval, and all legislation ostensibly meant to 'protect the consumer' is really focused on protecting large businesses from smaller ones. This leads directly to an increased burden on small independent growers, which forces consolidation and cost cutting measures, which are the primary drivers for the animal welfare issues we're so concerned about today. This is caused by excessive regulation, and more regulation will not make it better. In other words, an educated consumer who is empowered to buy meat and milk straight off the farm will do so, but can't right now due to regulation. We need less governmental restrictions, not more. Any proposed ballot initiatives should focus on facilitation of free market demand from informed consumers. Big Business will always game legislation and the specific requirements of cage sizes and such, but a ballot initiative that mandated that all commercial agricultural facilities be open for public inspection during

		normal business hours would allow market forces and informed consumers to decide what the rules should be between informed and consenting adults. Think about it - do you think anyone would visit one of the mega feed lots and buy beef from their on-site store?
180	Mar 16, 2010 12:24 AM	Food safety is critical.
181	Mar 16, 2010 12:29 AM	Stay off of my farm!
182	Mar 16, 2010 12:33 AM	It is important to that we farmers act as good stewards of our livestock/poultry and treat them humanely and I believe that most small producers do raise their animals that way. Unfortunately, laws that are passed to regulate the larger factory type farming often end up doing more harm to small farmers than to the targeted large producers. Instead of having animal rights groups and governmental bodies legislating how we must raise our animals I'd prefer to see farmers police themselves. I think the public is increasingly willing to purchase from farmers who do raise their animals in a humane and natural way and that's great incentive to do it right.
183	Mar 16, 2010 2:24 AM	Please stop HSUS and PETA!
184	Mar 16, 2010 2:45 AM	Consolidation, integration, concentration, and agribusiness have created pseudo farmers and destroyed the rural agricultural base.
185	Mar 16, 2010 2:46 AM	State board of health seems to be the best to judge the welfare of animals.
186	Mar 16, 2010 4:02 AM	I think most of these initiatives are a smoke screen for an agenda to do away with food animal agriculture and to impose radical views that we should all be vegetarians. I guess then, they will protest against killing plants by harvesting them. We (independent farmers) are nothing if not stewards of our land and our animals. If we didn't take care of them, we wouldn't last long in this business. We do not want more regulations. The marketplace is a far more powerful change agent than any bureaucrat.
187	Mar 16, 2010 6:13 AM	Regulation doesn't always produce the desired change. It is possible to fill the letter of the law without filling the spirit of the law. 'Over regulation' can be costly and hard for small farmers. What is more humane? A handful of chickens in a small coop with free range or those same chickens more protected from the elements and predators in a modern henhouse. I bet the chickens would pick the free range life. Also, I am 100% for humane treatment of all

		animals (including those used for food) but I am also a carnivore. I don't want a vegan from a city who has no idea about food production voting on how I should raise a chicken.
188	Mar 16, 2010 9:38 AM	Concentrated feed operations are morally unacceptable, economically non-sustainable, and their cruel animal husbandry practices and should be discontinued. (Some small/medium livestock producers have also established unacceptable practices.) These operations contribute to excess use of antibiotics, parasiticides and other chemicals which should be used strategically, not prophylacticly. California has passed legislation affecting CAFOs for chickens; Maine for hogs. I strongly suggest a model comparable to the national organic program but not limited to organic, establishing clear rules and guidance for good livestock husbandry practices, charge an annual inspection fee, permit independent NFPs as implementers, voluntary for the farmer, and so forth. While it would be better to pass a federal law affecting all farms, experience in the NOP demonstrates that the voluntary nature combined with a measured implementation has more or less improved NOP over the past several years. In addition, it seems unlikely we'd muster the political will to pass a comprehensive law affecting all livestock farmers.
189	Mar 16, 2010 9:58 AM	No CAFO, no GMO feed, no hormones, no pesticides. If a farmer does not have adequate space to allow the animals to live normal lives (eating grass in pasture, roaming around the farm, etc.) then he has no business having the animals at all. Cows don't eat grain, chickens aren't vegetarian and pigs will stay clean if given adequate space. Don't hassle small scale organic producers with hand-tying expensive regulations; they don't contribute negatively to the food safety issues that happen. Let folks sell at the corner or farmer's market and focus on cleaning-up the industrialized food system which is focused only on money and that is never a good idea.
190	Mar 16, 2010 11:04 AM	It’s a complete outrage that organizations like HSUS (humane Society of the united states) and PETA are defrauding the public and officials with untrue claims and lies. Trying to push for what they call animal rights while at the same time they don’t support any local or state Humane Societies. My opinion is that the health of the beef industry or the meat market needs to have people that know and work in the industry not some organization like HSUS that has absolutely no idea or knowledge of the industry. What HSUS and PETA are doing is using donated dollars (this is from their fraudulent or lying

		advertisement to get members) and trying to buy votes or make wild accusations with no research or proof. I believe the industry is on the right track with agricultural staff boards that know what they are doing. NOT some radical organizations like HSUS OR PETA.
191	Mar 16, 2010 11:35 AM	The best assurance of good quality and healthful food is for the customer to be able to come to the farm where his or her food is raised and see the animals and their care. Anything short of this is just window dressing.
192	Mar 16, 2010 11:36 AM	Bad Idea. Many people want unrealistic goals for animal welfare. Look at horses, none can be killed in the US so you have animals all over the country being neglected.
193	Mar 16, 2010 12:08 PM	I found this to be a poor survey. When a question is asked regarding the impact of a new regulation it is impossible to give an informed opinion when no detail is provided. I had to answer most questions as "not sure". In addition the survey appeared to be trying to create a bias against animal welfare legislation.
194	Mar 16, 2010 12:53 PM	Frankly, the initiative process to implement animal welfare regulations is sufficiently new that I don't know anyone who really knows the consequences. We've been told, by special interest groups on both sides, what the consequences will be, but their opinions reflect their special interests.
195	Mar 16, 2010 1:02 PM	We are already over-regulated. We are already good caretakers of our animals and land. Government and "groups" need to back off. Our food supply is the best and cheapest in the world. Caring for the animals is good management. Abuse by non-supervised workers on large scale farms should be reported on an individual basis, as with any animal cruelty circumstance. People who are not farmers should not be making these decisions.
196	Mar 16, 2010 1:12 PM	Without them, animals will continue suffering.
197	Mar 16, 2010 1:16 PM	Regulations need to be instituted by producers w/outside verification. Groups that have never raised animals should have input, but they should not be the final say. All groups involved in the process should lay out their sponsorships, funding and agenda's(pro-meat/vegan, etc)
198	Mar 16, 2010 1:25 PM	I THINK THAT WE HAVE ENOUGH CONTROL AS IT IS. THERE SHOULD NOT BE CHANGES AT THIS TIME. THIS IS THE FIRST THAT I HAVE HEARD OF THIS "BALLOT INITIATIVE". WHO CAME UP WITH THIS

		IDEA??? I DO NOT UNDERSTAND WHERE WE ARE GOING. MORE CONTROL IS NOT A GOOD THING, IT WILL DRIVE UP THE COST FOR EVERYONE...
199	Mar 16, 2010 1:29 PM	Ballot initiatives range from the Proposition 2 in California to Ohio's ballot initiative to current proposed changes to the clean water act. To say how "initiatives" will affect agriculture is too broad.
200	Mar 16, 2010 2:01 PM	Neither good ballot initiative nor good legislation can be accomplished by voters or legislators, respectively, who fail to craft their law upon science-based fact. This is the greatest risk to formulating appropriate regs and law on this subject. Animal producers & handlers have a moral responsibility to handle animals humanely. We must not project human-like characteristics upon animals as we seek to define 'humane'. The debate must be kept in the realm of science.
201	Mar 16, 2010 3:01 PM	Authors of any initiatives/regulations need to get out in the field and witness the daily details involved in agriculture. They need to see operations of all types and sizes at all stages of the production cycle. Hopefully that will give them the apparently missing insight into the impact of words on paper on the livelihood of farmers.
202	Mar 16, 2010 4:51 PM	Your questions were so vague that I had no idea to what you were referring. I cannot have an opinion on such vague questions. The survey would be more valuable if you have an actual amendment or law to discuss.
203	Mar 16, 2010 4:52 PM	Neither of the extremes will work.
204	Mar 16, 2010 5:03 PM	Your question: "What size is your farm?" is not a good one when linked to acreage. We have over 1,000 acres so I must answer large farm. Yet we are a small farm. In our part of the country it is common to have large amounts of acreage in forest plus some in pasture and some in crops. In other parts of the country it is the norm that all acres are in crops. Some very large farms (CAFOs) have only a few acres. Thus the answer to the question is irrelevant. I would suggest deleting or heavily commenting that question to this issue.
205	Mar 16, 2010 5:08 PM	no comment
206	Mar 16, 2010 7:56 PM	PEOPLE THAT RAISE ANIMALS FOR CONSUMPTION BY OTHERS SHOULD NOT BE PUT UNDER A GOV'T MICROSCOPE. LET US EAT AND DRINK WHAT WE LIKE. NO GOV'T INTERVENTION. WE CAN EAT FROM

		THE GOV'T ENFORCED FARMS OR EAT FROM THE SMALL FARMER.....BUT IT SHOULD BE OUR CHOICE!
207	Mar 16, 2010 7:58 PM	Less government is always better no matter what the subject!
208	Mar 16, 2010 8:04 PM	DON'T THINK THROUGH RAMIFICATIONS. Farmer's self-interest is to provide a safe, healthy environment for max production & efficiency -- animals do not perform as well in poor environments which reduces profits. Animal welfare activists have no clue - but are first to run to hospital when they don't feel good or are under stress and perform below standard. It would be to their boss's advantage to provide a safe healthy work environment!
209	Mar 16, 2010 8:07 PM	Some of the questions regarding impact on farmers, food quality, and on communities should also have asked: will the impact be negative or positive. I think communities will be positively affected. I think large producers will be negatively affected.
210	Mar 16, 2010 8:30 PM	Both ballot initiative and regulation serve to put those with the least amount of knowledge and experience in animal agriculture in control of animal husbandry, resulting in unreasonable demands and expectations being placed on those of us responsible for feeding this hungry world.
211	Mar 16, 2010 8:48 PM	The consolidation of industrialized agriculture, with its global tentacles, is ruining wholesome food in this country, in the world! The US is a net importer of food, we don't even grow enough beef to feed ourselves. Local food, and that free of regulations, is what will save communities in the case of a disaster. We have government that is too big, growing bigger every day, and ruining rural America. Lastly, the government cannot legislate morals, common-sense, or animal welfare. Can't be done.
212	Mar 16, 2010 8:55 PM	The public/consumer should be given the FACTS on how animals for food are raised including what they are fed, how they are housed, how they are slaughtered and processed. The CONSUMER should be allowed to choose where and from whom they would like to purchase their food product. The laws and regulations concerning who can sell packaged meat to consumers and how that transaction may take place are totally against the small producer. If a processor/butcher is inspected by a State agency that should be sufficient. I doubt a ballot initiation would be beneficial because consumers [thus voters] have not learned the FACTS concerning the manner in which factory farms produce 'typical' grocery store fare.

213	Mar 16, 2010 9:08 PM	Until a ballot initiative or regulation is passed nothing is affected. Government needs to do less effecting.
214	Mar 16, 2010 9:12 PM	You should be aware that there are no 'animal welfare' groups or legislation; all are animal *rights* groups and legislative efforts, and have been for some time. If you are not aware of this, you need to do some research. Animal rights groups emphatically do not represent the general population, they are extremist activists.
215	Mar 16, 2010 9:27 PM	The public needs to be educated on the dangers of CAFO's - especially the danger of contamination with fecal material. CAFO's may produce cheap meat, but at what cost to the well-being of animals and the health and safety of those who eat factory farm meat? Ballot initiatives will work only if people understand what they're voting for. Although there is increased awareness of the suffering animals raised on factory farms endure, much more needs to be done to educate the public as a whole.
216	Mar 16, 2010 9:28 PM	To have a meaningful ballot initiative, you first need someone to write it effectively. The persons responsible for this survey do not know the conventions of common grammar and language usage. Please review a reference for correct use of prepositions. Secondly, you have to have an opportunity for the voting public to become accurately educated on the issue upon which the vote will be cast. It seems that many are casting votes based on emotional sway in the media. Rural farming income is tied to animal welfare. The farming majority treat their animals very well since they are interdependent. People far removed from the actual business of farming are designing the "education" for the public. Perhaps to get an accurate referendum and an educated public we need to create a connectedness between politics and the affected. Bring the legislators to the farms. Bring the voters to the farms or take the farms to the voters via accurate, statistically significant information and video. Keep it simple, accurate and factual. Leave the emotional outcry in the daytime soap operas.
217	Mar 16, 2010 9:40 PM	I don't mind smaller scale (state by state) initiatives for better animal welfare and related topics. I am STRONGLY AGAINST any such thing as mandated premises registration or NAIS-style animal ID, which would only serve to encumber farmers with huge time and money costs while not protecting AT ALL against diseases. Science as well as common sense and our constitutional right to privacy are all against that sort of law.

218	Mar 16, 2010 10:07 PM	I think that letting the average person have a huge say in how animals are raised will be catastrophic to agriculture. The average person is so ignorant of how their food is produced that they will be led by the nose by PETA and HSUS whose goal it is to abolish all animal agriculture and pet ownership. They will also be unaware of why a bill can favor big industrial farms and penalize small farms in placing unfair requirements on them while the big farms have easier regulations. The public has the right to ask for clean, healthy food that is not too expensive. Considering how many Americans are overweight (including myself) it would not hurt us to pay more and eat less. Animals need to be treated humanely. An unstressed animal butchers out at a higher weight and has a better taste. It is in everyone's interest to be as humane as you can. A fair balance between all these factors needs to be found.
219	Mar 16, 2010 10:42 PM	The consumers and small farmers seem to be the people who suffer the most from most of the governments intrusions. The corporate factory 'farmers' seem to buy their way out of or around the regs. for the most part. The small farmer really can't afford to kill their customers and will do their best to provide a quality product. A $1000 fine could be the end of a small farmer but the big factory farmers could care less about fines. They can afford lawyers too. As I see it the rules only serve to consolidate our food supply while lowering food quality. It also lowers the quality of life not only for the people who are increasingly forced to eat what the factory farms churn out but also for the people who would like to run a small farm.
220	Mar 16, 2010 11:02 PM	Most voters and bureaucrats have no idea how their food is grown, produced or marketed. We have one of the safest and most efficient food supplies in the world and the best way to destroy it would be to allow ignorant voters and idiot bureaucrats to make farming decisions for those of us actually doing the farming.
221	Mar 16, 2010 11:06 PM	The change needed is to greatly regulate the assembly line factory farming: conditions are barbaric. Regulations should not protect the agribusiness large corporate organizations, and be detrimental to small and medium farms and ranchers. Problems with food safety are located within the slaughter and processing plants, not on the range or pasture where animals are raised.
222	Mar 16, 2010 11:30 PM	We have had a wholesome food supply so far, leave people alone. WE know what we are doing, the government does NOT.

223	Mar 16, 2010 11:31 PM	All regulations and initiatives should be local. Any food producer that chooses to export food should be prepared to have input and then follow subsequent regulations. In other words, the market for which the farmer is producing should set the standard. Ballot language should reflect the principal that animals raised for food should be clearly identified by the farm model, i.e. large, industrial, small, feed quality (organic, conventional,) etc. If that is done, and I do believe that there are many markets, all should have access to the type and quality at a price that is desirable to the consumer. We can be successful with choice, not coercion.
224	Mar 16, 2010 11:40 PM	Increased regulations won't do the job - there are always loop holes. We do NOT need a government to dictate what wholesome, natural foods we can eat. Industrial food production is poisoning our water, polluting the air, killing the people with all the abuses resulting from the unbridled greed of corporations that have total control over many of our food markets AND our legislators in Washington. Doing away with ALL regulations between local farmer and consumer (direct retail sales) is first and most important to flourishing, healthy, communities. We MUST keep our local food traditions alive. Consumers are getting smarter all the time about the hidden dangers in our food that have been put upon us without our permission, hidden behind lax labeling regs and lax "food" regs, i.e., GMOs and nano-particles in food and personal products. HFCS is everywhere and look at the diabetes epidemic that we ALL pay for.
225	Mar 16, 2010 11:41 PM	Industrial ag production methods fail to take into account the needs and natural environment of the animal. Attempts to increase production thru intensive confinement, sub-therapeutic antibiotic use and growth promotants make a bad situation worse. When these practices are brought to public attention the public is so repulsed that regulation and ballot initiatives result. The lack of respect for animals and humans in industrial ag systems needs to be eliminated and natural systems should be emphasized as much as possible. This will result in higher quality food with less risk to consumers and farmers. We are what we eat. We should not be repulsed by how food animals are raised
226	Mar 16, 2010 11:50 PM	NAIS and other animal ID programs will knock out small producers who take care of and raise healthy animals. These programs benefit corporate ag with no benefit to the animals raised on factory farms. Not sure what your goal is in this poll but govt should keep its hands off private

		enterprises such as small family farms raising quality foods and quit taking bribes from big ag to regulate small farms out of existence.
227	Mar 16, 2010 11:55 PM	I was married to a farmer in the Midwest. We farmed over 2,000 acres and had a herd of dairy cows. What put us out of business was the seed companies with their GM seeds, cost of fuel and equipment. In order to make a profit with the dairy cattle we were forced to utilize practices that were not in the animal's best welfare. We quit dairy farming, then soon after sold the farm. It wasn't worth the grief and our health problems.
228	Mar 17, 2010 12:39 AM	Many people who seek to regulate food animal agriculture are not aware of the realities of the small farmer - most work other jobs to support the farm and any extra cost can break the farmer. Factory farming is inhumane but it does keep the cost of the product to an affordable level. Unfortunately most small farmers do not have a paid lobbyist to speak for them. Farm Bureau does try but big factory [farms] have bigger voices. The closing of horse slaughter houses has created a hardship on people who have unwanted horses and has allowed inhumane transport for animals to be slaughtered in Mexico and Canada.
229	Mar 17, 2010 1:15 AM	Remember that small and medium size farms should not be lumped in with large commercial farm operations. We need cleaner, more healthy food, not irradiated, not GMO, the cleaner (lack of pesticides and plant poisons) the better. Regulations that encourage small and medium farmers to stay in business.
230	Mar 17, 2010 1:55 AM	Regulations will target small producers, not just CAFO's. Big Ag corporations will make sure the regulations are stifling enough so only they could comply, and no small producer could afford it. Speaking of affording it, costs would increase to the consumer, in our present economy food costs escalating would not be a positive effect. From what I perceive, consumers do have some choices at grocery stores. The reason they do not have more is: small producers have already been regulated out of business; and consumers do not want to pay more money for humanely raised animals, they buy what is on sale. Regarding the regulating small producers out of business: for example, I humanely raise a steer on pasture and feed. I cannot sell a single pound of that meat to anyone, even if the steer is processed at a licensed and inspected butcher shop. The butcher can legally buy my steer, and sell the meat, but I cannot. As for my free-range chickens and

		turkeys, illegal, even if I sold them to a processor. Yeah, we need more regulations !!!!!
231	Mar 17, 2010 2:00 AM	The American consumer has grown accustomed to cheap, plentiful food. Many, perhaps >50%, will resist paying more for food, even though they may agree that cheap food comes at a steep cost to animal welfare, the environment, and rural communities. There's a growing awareness by the public of this cost, and very gradually awareness has made more people willing to pay more for food that is produced humanely and sustainably. However, this remains a tiny fraction of Americans. Bottom line is that we all need to pay more for food to reflect its true cost of production. Ballot initiatives/regulations may be the only way to affect this, as our current system sure doesn't.
232	Mar 17, 2010 2:12 AM	People who know nothing about livestock (but think they do) shouldn't be making rules for people who actually do know livestock. That's common sense - something that is in very short supply in this country right now.
233	Mar 17, 2010 2:34 AM	In my experience, the general public has very limited knowledge of agriculture and cannot make informed decisions for producers.
234	Mar 17, 2010 2:39 AM	There are too many variables to lump all "ballot initiatives" together. I'm okay with outlawing debeaking or mandating a minimum cage size for chickens but believe that regulations are best made by people that know about agriculture, not by animal rights activists that are trying to use initiatives as a back-door method of discouraging animal product consumption. I am also wary of too much gov't involvement such as NAIS.
235	Mar 17, 2010 2:42 AM	It seems that these ballot initiatives are intended to curb the wretched excesses of CAFOs - which do, indeed, need curbing. However, to subject the small farmer who raises only a few animals for consumption to the same degree of scrutiny and reporting requirements as a large organization is ridiculous. Leave those of us who want to feed our families - and maybe a fraction of our communities - alone! We're not causing the outbreaks of antibiotic-resistant illnesses. We're not polluting the waterways. We're not creating lagoons of fecal matter. We are raising a small number of animals in a responsible manner, butchering them humanely, and eating food raised the way animals are meant to live. No more regulation!!!
236	Mar 17, 2010 3:40 AM	No NAIS

237	Mar 17, 2010 4:40 AM	No NAIS!!!! No animal ID is needed or wanted!!! STOP GM seeds and food products or at the very least LABEL them as GM. That is where our food is in jeopardy. Stop cloning food animals, fish, cattle, etc. and stop the hormones being added to our food supply, milk meat and anything else that they are being added to.
238	Mar 17, 2010 5:27 AM	Ballot initiatives make urban dwellers feel warm and fluffy when they go to the store to buy food but in their ignorance they fail to see the huge detriment to those who actually produce the food
239	Mar 17, 2010 10:38 AM	I saw the movie "FOOD INC.". That is absolutely horrible. Then you wonder why we need regulations. Those regulations aren't even enough. We are in a no win situation. If you add harsher regulations you will most likely put the farming industry in greater jeopardy. Since we are considered a "Global World" we will have to be dependent on countries across the ocean where their regulations don't exactly meet ours. For example, China. When do you think these large poultry industries are going to close doors and move overseas to save costs? I saw enough in the auto industry. I always try to buy American made products even though it costs a tad more. I always buy local or grown in USA. I hope I didn't go too far off the topic. Thank you.
240	Mar 17, 2010 10:49 AM	Commodity groups and Extension personnel working together should be able to develop safety and best practices for consumer safety and at the same time, maximize production while keeping production costs and consumer costs at a minimum.
241	Mar 17, 2010 12:38 PM	I believe that large factory farms and special interests are best served by additional government regulations BECAUSE increased costs to comply will drive small farms out of business. Small farms ALREADY take sufficient care of their animals; they HAVE TO, because losing any number creates a financial hardship or noticeably decreased profit. Large/factory farms are where disease perpetuates due to inhumane conditions. MORE regulation/oversight by IMPARTIAL parties is needed for LARGE farming operations ONLY.
242	Mar 17, 2010 12:50 PM	While it may be well intentioned, the fact is that these animal welfare initiatives will be negative, as they have been in Europe, and that larger entities (able to affect regulations at their writing in the US) will be better able to handle the additional fees and paperwork than small scale truly decent growers. The independent farmer does not need certification, just the opportunity to market their wares

		without undue influence. These initiatives are not going to improve access to good, quality, non GMO, food for consumers. I could go on for hours with stats and international examples, but suffice to say, let people be the deciders without regulation. We are smart enough to eat without a bureaucrat involved.
243	Mar 17, 2010 12:56 PM	We need small farmers and diverse crops and NO gmo products. No NAIS programs that are intrusive. Keep PETA and Humane Society people out of the equation as they are mostly city people without a clue on what farms need or how they are run.
244	Mar 17, 2010 1:16 PM	The only way a producer can make money is to take GOOD care of her livestock. When those without adequate knowledge of animal husbandry get involved in dictating how producers handle their livestock, it can only lead to higher prices, loss of small producers and more concentration into the hands of a few. The purpose of some of these advocates of “animal rights” is actually only interested in stopping all animal agriculture. This is unfortunate for our eating enjoyment, our health and the livelihood of our producers.
245	Mar 17, 2010 2:11 PM	It is imperative that before regulation of food production leads to elimination of "small" (less than $30K per year) profit farms - the reason why CAFOs are being expanded should be addressed. In a nutshell - why is the DOJ investigating large agricultural concerns and the effect on small farmers/producers? Where there is smoke - there is fire.
246	Mar 17, 2010 3:03 PM	I was disappointed that your survey's question 2 asking who should regulate farms and food production- whether it should be by state legislature, producers' groups, ballot initiative, or market forces, provided no "not sure" response, as there was for most other questions. I did not want to answer the question, because I do not feel that any one of these answers is appropriate in all circumstances. The voice of concerned citizens is important in animal welfare and food safety issues, so ballot initiatives have their place. States have food safety standards to uphold, so legislatures need to weigh in from time to time. Market forces influence food production as a matter of course. But of course in most cases it is the farmers and producers who are best qualified and most knowledgeable in self-regulation. That said, I totally distrust big agribusiness and large-scale producers to self-regulate and consider large agribusiness a threat to small-scale agriculture and to food, human, and animal safety and welfare. Any regulations

		should focus on larger, rather than smaller producers, as they are the source of most of the problems we see in agriculture, they threaten smaller farmers, and they routinely violate animal welfare and food safety standards. It is important that regulations do not have the unintended effect of hurting smaller producers, as these are generally the producers with the highest standards of food and animal safety, and they benefit local economies, rather than multinational corporations.
247	Mar 17, 2010 3:25 PM	The ballot initiatives put to a vote have the support of the people and are not arbitrary rules and regulations enacted by politicians or government workers that do not know a thing about farming and especially small scale environmentally friendly family farming and the consequences of excessive regulations and rules on them financially.
248	Mar 17, 2010 3:49 PM	There are too many regulations that are not appropriate for small operations and not enough help with infrastructure projects, regulatory fees and labor costs that are the result of these regulations. My ducks are being counted and treated like cattle - which has put me in a position of CAFO with the Dept of Agriculture. I have been told by different sources that I have too small an operation (under 500 total poultry and waterfowl) to even make a dent in the local aquaculture [sic] however I must spend over $500 annually in licensing fees to keep my farm since they threatened to take it away if I don't cooperate. I didn't think that communistic governing was alive and well in the USA.
249	Mar 17, 2010 4:16 PM	DEMAND EFFICIENCY of grain used in any state for animal production! BEEF INDUSTRY uses the MOST GRAIN and is LEAST EFFICIENT w/ LOWEST HEALTH benefits. Grains and grasses fed to a cow will get you one pound of meat. THE SAME amount fed to a rabbit gets SIX POUNDS of meat. READ the 29 True Facts about RABBITS: http://www.ardengrabbit.com/facts.html A rabbit breeding female can DOUBLE body weight in edible protein meat in just 4 MONTHS which includes the 31 days gestation. This is the same as a 1,000 pound 2 yr heifer giving you 2,000 lbs of packaged meat in 4 months? NOT! Cow gives birth to a 150 lb calf in 9 months, by that time the rabbit will have doubled itself AGAIN ! More details at: http://permacultureactivist.net/articles/rabbits.htm
250	Mar 17, 2010 4:33 PM	Having a legislator make rules/laws about farming is like having a dental hygienist make rules about brain surgery. Nuf said

251	Mar 17, 2010 4:34 PM	Ballot initiatives allow the consumer to voice their views. Other methods strongly favor the positions of large businesses and organizations which have the resources to hire lobbyists and lawyers. Regulations frequently are rigged to favor large businesses by imposing the same requirements on small farmers and homesteaders.
252	Mar 17, 2010 4:45 PM	Unnecessary regulations inflict increased costs on small farm growers/producers while adding nothing to the end product quality, supply, or security.
253	Mar 17, 2010 6:06 PM	Breakup the large factory farms since they are not good for people or animals. Their waste is put into holes that overflow during rains thus contaminating surrounding areas. Stress of the animals in their setting is great and really doesn't make the meat better. Though tests have not been really done, I feel that the various chemicals given the animals to keep them from getting sick as well as the space limitations cause the animals/fowls to have to lay or stand in their own feces making conditions unsanitary.
254	Mar 17, 2010 6:07 PM	People in urban areas, that know little about animal agriculture should not have the right to decide what regulations are best for farmers. Allow the state agencies to regulate the aspects that they feel need to be mandated. I don't tell them how to do their job, and I would appreciate the same respect from them. They must realize that most farmers go above and beyond adequate care for their animals. It is just the natural nature of a farmer. We are good people, and do not need outside advocate groups telling us we are not.
255	Mar 17, 2010 8:09 PM	The public is stupid. Ballot Initiatives only work for the extremely well funded - whatever side they are on.
256	Mar 17, 2010 9:17 PM	The current problems with food safety and agriculture in most cases are the effect of improper to no oversight at the large slaughter and packing houses; not the farms themselves. More regulations just drive the diversity out of farming and ranching and consolidate it into the larger corporate farms and ranches. It makes our farms and agriculture much more vulnerable to safety issues as well as susceptible to outbreaks. This has been proven to be the case in other countries. Why would we in the USA want to emulate the failed programs of others?
257	Mar 17, 2010 11:29 PM	The only people who are educated and qualified enough to regulate what happens on an agricultural operation are farmers and ranchers who have worked with these animals every day of their lives. We have spent the majority of our lives studying and caring for our animals. It is crazy to think

		that a person who does not have any knowledge or experience with any kind of animals is qualified to regulate our operations. If you research any of these animal rights groups you will quickly find that many of their leaders do not even own pets. We raise food animals for consumption, that does not mean we do not care any less about them and for us to have to justify the things we do that are in the best interest of these animals to someone who does not even have a cat is stupid. If we need a regulatory board then fine, but write bylaws that require the members to have a lifetime of experience in animal agriculture. The United States is a strong country because we have a strong agricultural industry. That industry is under attack from a minority of people armed with false advertising who are deliberately trying to destroy agriculture. They are elitists who believe they know better than anyone else when they have no idea what they are doing. We are an industry of family businesses, not big corporations like they would have you believe. We live with these animals. Just from something as simple as a moo we can tell the difference between a mother cow calling her calf, one that lost her calf and one that is fighting for her calf's life. That is something you can't learn in college. There is no person better qualified to care for these animals than farmers. Let us take care of them.
258	Mar 17, 2010 11:33 PM	Too much regulations and stupid little laws that help out the big guys and keep the small guys paying higher prices to produce!!!
259	Mar 18, 2010 3:26 AM	The government or any so called organization should keep out of this business. The problem that exists, is we need to go back to old farming methods. Lower the cost of all farming from feed, grain, fuel, fertilizers, etc. and let the farmer go back to raising animals that will produce without drugs or fancy regulated methods. I traveled to Panama recently and visited many farms and they are farming just like my father did back in the 50s. It was hard work but we had good clean animals and they produced naturally. Let's take a chicken for example: I ate a chicken in Panama that was raised from eating on open ground and the skin was almost orange and the flavor of the eggs, as well as the meat was so delicious. But if you buy a chicken in the grocery in the states it has been pumped with so much hormones and garbage that it has hardly any flavor and Very likely not good for you to eat. I blame this on the bleeding heart organizations, as well as those idiots we supposedly elected to run our country. Thank you for letting me put my input in.

260	Mar 18, 2010 4:01 AM	The most damaging thing that can happen to small farmers who are raising healthy food animals in a low stress environment is the national animal identification system. The best thing that can happen is to promote local food supply by not adding costs and work to local producers.
261	Mar 18, 2010 9:47 AM	Most farmers know that to get the most out of their livestock, they must use humane practices. Animal do not have rights. People do.
262	Mar 18, 2010 11:48 AM	We have to be savvy to what the consumer wants. As farmers we need to do a better job connecting with consumers/farmers. The vertical integration in agriculture has given black eyes to agriculture in the eyes of consumers. Rural America prospers when there is a diverse agricultural production that fosters agribusiness that support rural communities and ultimately preserves a local food supply to consumers. We have to come together...
263	Mar 18, 2010 11:56 AM	These were terrible questions. The proposed welfare measures do not improve the welfare of the animals and most producers like me will not go back to pens and fighting sows and the problems that are associated with that. We have already 'been there and done that'. The independent producers are planning exit strategies and are not planning on bringing the next generation back to the farm. Large, integrated producers will be able to brand and market their supposed 'efforts' to improve animal welfare. Others will get out of sows and production leading to more foreign production from Russia, Asia and South America. If changes are better for the animals, they will be adapted readily by producers; if not, then it is strictly marketing and my conscience will not allow me to do it. Change should not be dictated by activist groups who are only after money and a public that has no idea of how animals are produced. This dialog should include producers, food animal veterinarians, animal behavior specialists and university specialists. The current debate includes none of these.
264	Mar 18, 2010 12:09 PM	Farmers love their animals whether they are large or small. Because of financial pressure animals lose because farmers may have to cut labor or other animal welfare aids temporarily because the farmer has no place to pass these expenses on to. If consumers want farmers mandated to perform certain levels of animal welfare then farmers deserve price discovery based on higher costs of production. Farmers should not be subsidized for this by a

		Government who is broke. The marketplace must return the proper sustainable levels of income back to the farm.
265	Mar 18, 2010 1:23 PM	(States which don't allow ballot initiatives SHOULD.) As for ballot initiatives creating changes in food animal agriculture...the voting public is less corruptible than the legislature...
266	Mar 18, 2010 1:39 PM	The ballot initiative is not the enemy of animal welfare advocates and producers. While the public will continue to make ignorant decisions, so too with legislative bodies. It is important to demonstrate to these people, the advances in welfare the industry and veterinary medicine have made to improve the lives of our food animals as well as the humans they feed. I think producers must acknowledge the need for progress which will facilitate a productive and economically viable future rather than simply holding up our hands and saying "what can we do?" when animal rights groups target our livelihood. It is our job to decide what to do and we have the knowledge and capability to demonstrate and advertise the good work we continue to do and the better work we aspire to.
267	Mar 18, 2010 5:07 PM	I think legislative regulations need to be driven as much if not more by what farmers and producer groups and Cooperative Extension are saying as by consumer and regulatory agency (FSIS, etc.) concerns. Consumers, even rural consumers, for the most part are so distant from farm life that they really are ignorant about what we and our livestock require to have constructive, healthy lives and provide good quality food. We have a crisis with a loss of small scale slaughterhouses to service livestock farmers with local or instate market demands, and yet regulatory agencies still keep mandating more and more regulations that fit large slaughterhouses and processors and make small processors even more uncompetitive. A one size fits all approach does not make sense. Animal welfare certification organizations spend too much time mandating what conditions animals should be raised under regardless of how practical without looking at the mortality rates, incidence of disease etc. of individual farms. The Temple Grandin approach to certification and scoring which counts actual symptoms or measures (air quality etc.) makes a lot more sense.
268	Mar 18, 2010 5:41 PM	Public does not have enough understanding of animal husbandry, animal behavior, farm conditions or food production economics to make informed decisions at the ballot box.

269	Mar 18, 2010 5:49 PM	There is a BIG difference between "animal welfare" and "animal rights". HU and other so-called "animal protection" organizations are in the "animal rights" category (and in fact HU is the "animal rights" INDUSTRY leader). Their initiatives are aimed at disrupting the human/animal bond and making use of animals more expensive and more difficult. They are less concerned with "animal welfare" than they are with the "animal rights" agenda of gradually eliminating human use of animals, whether for food, clothing, or companion. There are plenty of websites out there now that are exposing the "animal rights" organizations and their agendas. The more people who know about them, the fewer will be taken in by their "propaganda mill" BIG LIES.
270	Mar 18, 2010 6:15 PM	A problem because a few people can cause changes that the majority of people do not understand or want to fund. Example -- egg laying chickens having more room.
271	Mar 19, 2010 1:26 AM	Grange should support reasonable animal welfare initiatives. Farmers benefit both themselves and their consumers when humane conditions are maintained. One other important point: The more exercise an animal gets, the healthier the meat.
272	Mar 19, 2010 3:49 AM	Government needs to stay out of private enterprise and let the markets work. We need not to worry about foreign markets and imports, take care of ourselves first and if we run short of product we buy, if we have more than we need we sell. The United States has and will always have the best products in the world, bar none. We have the best farmers and ranchers in the world bar none. We don't need some foreign so and so telling us how to run our business.
273	Mar 19, 2010 5:01 AM	Most generally, non farmers are making the rules and regulations that farmers have to work under and this is creating a huge problem for those who are ACTUALLY doing the farming. Yes, farmers are one of the hardest working groups in the world and often find it VERY difficult to make time for political activity, but they will when against the wall. What is and has been going on with governmental regulations is all wrong and backwards. Big businesses, governmental agents/agencies, politicos, business folks and the like make the rules farmers have to operate under and it is becoming near impossible to continue producing food and fiber. But government in general is WAY out of line and creating a deadly situation on many fronts in our lives.

274	Mar 19, 2010 1:08 PM	People behind them are largely city dumb axxxx that have no idea what they are talking about.
275	Mar 19, 2010 1:27 PM	They are necessary to make sure that producers are following the will of the people, however it is important to make sure that the public is fully informed as to the reasons behind the current practices and what some of the consequences will be to changes - financial as well as for the well being of all the animals. By eliminating farrowing crates we will allow the sow to have greater movement and more natural behavior, however, that natural behavior includes lying on and smothering a number of her piglets. A slow and painful way to die. This will also decrease the number of weaned pigs the farmers raise, therefore increasing the cost of pork. So this change impacts more than just the welfare of the sow.
276	Mar 19, 2010 2:41 PM	It is in all producers' best interest to provide the best welfare to the animals in their care, both morally and financially. If you really want to test the product quality of some of these new initiatives, start buying free range eggs and as you break them open to cook count the number of eggs that have blood in them. Compare this to the same number of " factory farm" eggs. If you care not to see this you can just trust me. This is a health issue of the animals because a herdsman cannot treat animals and harvest produce in a timely manner.
277	Mar 19, 2010 3:04 PM	Small farmers who supply a local food exchange should be able to do so without government involvement and/or restrictions. When the consumer can go to a farm and witness how animals are treated and the quality of cleanliness/management first hand, then the farmer should be free to do his/her work freely (after all it is America, where we are supposedly free people). When a large corporation produces meat where the consumer cannot inspect their food source directly, that is the ONLY time that there should be regulations and management from an outside entity.
278	Mar 19, 2010 3:38 PM	If educated people, by educated, I mean in all phases of Agr., make those regs. Most producers can live [sic]
279	Mar 19, 2010 3:50 PM	Change should be market driven. If consumers are willing to pay the higher cost of production for the use of different animal welfare standards, then the industry will respond and be able to afford those changes. If they are not willing to pay for additional animal welfare practices then why implement them? Who will pay the additional costs?

280	Mar 19, 2010 5:18 PM	I believe your questions are loaded in favor of protecting industrial agriculture.
281	Mar 19, 2010 5:58 PM	Invasive government control will destroy small farm and homesteader agriculture through the ballot box is obscene. Having a pen in Washington does not make a legislator into a farmer! Stop animal and vegetable farm tracking and registration regulations through the balloting for idiot, so called political representatives.
282	Mar 19, 2010 10:11 PM	While I appreciate your attempt to gather this information, I think that many of your survey questions and answers are poorly worded and/or incomplete. For example, on question 2, a respondent might not think that any of the listed responses are a proper source of animal welfare regulations, or might have other specific sources of regulation in mind, and the categorical responses force an answer choice that might not really tell you how respondents feel. There were many other such examples in your survey. It would be better to have a Likert-type or semantic differential scale and ask respondents to rate different options rather than to choose among them as answers.
283	Mar 19, 2010 11:29 PM	Regulating small farmers out of business is ultimate suicide for the USA as a free republic. The freedom to grow food without government interference is the bedrock of a free society. V. Lenin, the founder of the Russian revolution made this very clear: '"The Socialist Revolution in the US cannot take place because there are too many small independent farmers there. Those people are the stability factor. We here in Russia must hurry while our government is stupid enough to not encourage and support the independent farmership.' V. Lenin, the founder of the Russian revolution" The Committee for Economic Development after WWII decided there were too many farmers here in the USA and in 1964 took steps to reduce "excess human resources engaged in agriculture" by two million, or by 1/3 of their previous number. CED's plan was very successful and resulted in widespread social upheaval throughout rural America, ripping apart the fabric of its society destroying its local economies. They also resulted in a massive migration to larger cities. The loss of a farm also means the loss of identity, and many farmers' lives ended in suicide. I am old enough to remember before CED implemented their plan in 1964, when neighbor helped neighbor and no one bothered to lock the doors. Now I still live in a farming community however I now have three drug dealers, a murderer and several thieves for neighbors and none of the kids can even add 7

		plus 8. Tell the CED to take their social re-engineering plans to some other country and leave us alone. Get us OUT of the World Trade Organization and the United Nations. I am not interested in being a "global citizen" with a bunch of megalomaniacs running my life.
284	Mar 20, 2010 1:18 AM	In no way should we allow (big Brother) the Government, to do any mandatory tracking or ID'ing of animals. In no way should we allow the government to have that much control. Where would it stop, ID'ing people??? To protect the food supply we need to grow as much of our own and not purchase outside our country and we need more USDA regulators at the processing plants. Now that would be a good regulation! We need to protect the small to medium farmer that cares for their animal's welfare and the welfare of the consumer! Protect the rights of the people to grow their own food, and not the Big business who only wants money.
285	Mar 20, 2010 1:38 AM	The outlawing of horse slaughter has had a detrimental effect on agricultural producers. Horses are livestock, not pets. This ban has cost me and others income that could have been realized from old horses that since have had to be put down. I am afraid that this is just the first step that radical animal rights advocates and groups are going to take in their attack on animal agriculture. I believe in animal welfare, that animals should be treated good and cared for, but I do not believe that animals have rights as humans do.
286	Mar 20, 2010 2:44 AM	I do not know your goals in this poll but we do not need animal tracking or IDs, and most items that you would want to push might help some but it will hurt those that are already using good practices. Also your use of the word ANIMAL WELFARE is the same as animal RIGHTS now and that equates to Animal RADICALS.
287	Mar 20, 2010 2:09 PM	No matter what the issue, ballot initiatives support a narrow perspective. They are brought by minority interests that cannot advance their issues through the normal legislative process.
288	Mar 20, 2010 4:49 PM	Where I indicated I was unsure it was b/c it depends. i.e. the impact of rules on rural communities depends on whether that industry is a large economic driver in a given community. Changes in layer housing rules, for example, had little impact on rural communities in California except those where there were layer houses.... many of whom are looking to move out of the state now. Ultimately that will impact the other CA communities by changing tax

		revenues etc. The rule making question does not allow the answer of a combination of entities, but ultimately that is appropriate; producers who raise animals, consumers who choose to spend money on the products, ...
289	Mar 20, 2010 5:37 PM	If laws are not made by people that will at least consult with the agriculture community, agriculture could change for the worse very quickly. There has to be more than self-regulation, so all groups have to work together to judge the impact.
290	Mar 20, 2010 6:28 PM	No comment.
291	Mar 21, 2010 3:56 AM	In general, smaller producers are harmed more due to the ability of larger companies to acquire financing to meet regulatory requirements, and have the scale to better implement process changes to meet these needs.
292	Mar 22, 2010 12:48 AM	Ballot initiatives should not be used at all. When the total population is making decisions about how we are to operate our private businesses (and we are less than 1% of the population), that is a problem. Regulations are intrusive, generally don't address any real problems, and cause us to spend time ticking boxes rather than caring for our animals. In today's world of information sharing, producers of any product get consumer messages quickly. The producer has every incentive to care for animals in the best possible way, as our profitability depends on it. Government intervention props up the bad producers at the expense of the good ones. The lack of understanding of what it takes to produce is a big concern, and educating non-producers is vitally important for our future.
293	Mar 22, 2010 2:25 AM	It's in animal ag's best interest to work with humane organizations to enact compromise reforms rather than waging a battle in the ballot box. Whether anyone likes it or not, consumers/voters are siding with humane groups so let's be proactive and work with these organizations in phasing out systems that many in the egg, pork, and veal industries are already moving away from.
294	Mar 22, 2010 11:06 AM	Ongoing regulations of the food industry will destroy our ability to feed our own country. When we get to the point of relying on foreign countries for food we will be in dire straits. There needs to be a minimal amount of regulatory rules to insure that correct practices are in place. Placing undue burdens on the backs of our producers and then paying low prices for products produced creates a hole in the industry of epic proportions.

295	Mar 22, 2010 2:28 PM	Our Land-grant Universities need to be proactive in the support of animal agriculture. What was the purpose of the land-grant university? If they are unwilling to support animal agriculture, then funding should be removed from their budgets. So often the administrators try to castrate their faculty and field people in the name of tolerance especially when it comes to real agriculture issues. This is a critical issue that is important for rural communities. If farmers in the U.S. are unable to efficiently produce livestock, then we will be sending production overseas where there are no regulations on residues or treatment. We sent good jobs to China and we have no voice in what/or how things are produced. The crop producers will suffer as well because animal agriculture and crop production are tied together. The U.S. was based on choices, not socialism, regulations, requirements, mandates, etc. If a person wants a certain production, then seek out that type of system and pay accordingly--don't legislate it. Too much oppression will ultimately lead to revolution.
296	Mar 22, 2010 2:59 PM	This survey should be disregarded. This is the xxx for the National Grange trying out this survey in order to communicate the process of using this survey to our members.
297	Mar 22, 2010 4:10 PM	Consumers most often purchase the lowest priced, comparable quality item. And yet, consumers do not want to buy sports shoes created through abusive labor practices even when these shoes are cheaper. By the same reasoning, consumers do not want to buy food produced under conditions that do not promote reasonable animal welfare. Consumers do want assurance that their product choices are safe, wholesome, environmentally friendly, represent fair labor practices, and do not cause undo suffering of innocents. Therefore, they should not "vote" at the checkout line of the grocery store for animal welfare friendly products or fair working condition footwear. They should vote at the ballot, for the standards they demand for fair labor practices or animal welfare standards and then be allowed to use price comparisons once an ethically sound baseline has been established.
298	Mar 22, 2010 4:56 PM	Farmers responsible for producing any products related to food animal agriculture should have a primary role in any proposed regulations because they will be the entity most affected by these changes. Unless the general public has received accurate and comprehensive information on the impacts of regulatory changes, especially regarding

		increased prices for food products, they can't make informed decisions via voter ballot initiatives. I am also strongly opposed to elected legislative bodies making changes in regulations for a number of reasons. Increased government control is not likely to result in anything more than increasing the burden of cost already undermining the ability of the American farmer and rancher to continue producing the excellent quality of agricultural products at reasonable prices that the American public currently receives and expects.
299	Mar 23, 2010 5:16 PM	Government needs to keep their nose out of farming. Doubtful most government types have ever seen a real farm animal that wasn't on their plate.
300	Mar 23, 2010 6:30 PM	While I understand the desire to help and create safeguards through mandates I also have seen more and more small farmers being forced out of the competition by overreaching mandates and certifications. These ultimately help Agri-business drive out competition while they themselves are unharmed. A perfect example would be the combination of "ORGANIC" certification with the fact it is ILLEGAL for a product label to say GMO free.
301	Mar 23, 2010 11:02 PM	While I don't disagree with the good-hearted intent of larger laying cages or gestation crates, the groups pushing these ballots have a hidden agenda that will eventually drive out even small growers such as me. If I put chickens in a movable pen and give them access to pasture, I still have confined these poor creatures - according to the PETA and HSUS supporters. And God Forbid I actually EAT them! I may hurt their feelings and deny them the opportunity to live out a "full life" whatever that is to a chicken. So where would be the point in raising heritage livestock if we can't cull undesirable stock, sell their byproducts, and actually use them for sufficiency? And I don't kid myself that everyone can afford to eat at the prices passed along for meeting endless regulations and paperwork.
302	Mar 24, 2010 2:37 PM	It is the uneducated majority making the decisions for those who are on the front lines. If the public was to be required to make informed decisions then ballot initiatives would be more balanced.
303	Mar 24, 2010 3:38 PM	Regulation is not the way to handle animal welfare problems, market demand and education is a much better option.

304	Mar 24, 2010 5:17 PM	We need to get this stopped. It is going to cause food costs to rise too high for most Americans.
305	Mar 24, 2010 7:03 PM	Animal welfare groups are awful and have no idea about farming and animals. PETA and HSUS are prime examples. Big AG is bad news, CAFO's need to be gotten rid of, but An. Wel. paints ALL farmers with the same brush. Small farmers HAVE to care about their animals as one illness/death can destroy their breeding program/profit for the year. Personally, industrialized nations waste more food than they ought-and use too many instant meals. Maybe if food prices went up a bit there would be less waste. And that certainly would be a plus for all concerned. Ballots-NO WAY!! Non farmers are clueless. REGS for BIG AG only!
306	Mar 24, 2010 7:58 PM	Farms do not need any further regulations from the government. Government regulates too much now. People who do not know anything about agriculture do not need to be telling people who grow our feed how to do it or what they can or cannot do. Keep the do-gooders out of agriculture. Farmers know how to look after their animals, and if their income depends on good production, they will do what is necessary to properly care for their animals.
307	Mar 24, 2010 8:03 PM	ANY INITIATIVE THAT REQUIRES FARMERS TO CERTIFY AND TAG ANIMALS IS A VERY BAD IDEA.
308	Mar 24, 2010 8:16 PM	The current U. S. food production system is broken and needs a major overhaul. The only way this is going to happen is via consumers speaking out and it appears the paradigm shift has begun.
309	Mar 25, 2010 7:57 PM	Smithfield put the small swine producer out of business and created corporate farms. This devastated many rural communities. Pilgrim’s Pride chicken purchased a chicken plant in Douglas Ga. and shut it down devastating Coffee and surrounding Counties. These are the things that concern producers. The government usually only muddies up the water when they get involved and do not care about farmers since they make up only 2% of population.
310	Mar 25, 2010 10:57 PM	We do not need change and regulations in animal agriculture that is imposed by a public that is easily swayed by falsehoods, emotion and misrepresentation. Change is not always good. Case in point, our present administration!!!!!!
311	Mar 26, 2010 1:16 AM	I think the majority of our population does not understand modern agriculture and I fear that having a ballot initiative would give them the idea that what we are doing now is

		wrong and voting yes or no will make it better. The initiative would appear that the government is going to impose more regulations to make sure the consumer has a better product. Without knowing the added cost to consumers, lost income for farmers, and less tax revenue just to name a few things, who would vote against it?
312	Mar 26, 2010 2:30 AM	Ballot initiatives may tend to play on emotion, misconceptions, and misinformation, rather than proven science.
313	Mar 26, 2010 2:35 PM	I do not see the purpose to the media, of the ballot to regulate our animal food supply. Consumers want a safe, high quality, and affordable product and I believe that today's regulations provide this. I believe that approaching the mass population about how the animal food industry would be detrimental for those of us that make our livelihood. The general population doesn't have a cursory understanding of how the end product is derived; therefore, asking for a consensus would not be mode to advancing the industry. The market will dictate the direction.
314	Mar 26, 2010 8:27 PM	Any mandate animal tracking programs would have a severe impact on agriculture and particularly on the small producer as they need to add genetically different animals to their herds to keep from inbreeding undesirable traits and sometimes these additions come from out-of-state. Voter approved animal care mandates have a severe impact on animal caretakers as these mandates are largely decided upon by an uneducated and emotionally charged public who respond to emotional pleas, instead of well-thought-out discussions on the subject.
315	Mar 26, 2010 11:02 PM	none
316	Mar 28, 2010 6:07 PM	We need not change, government needs to stay out of it.
317	Mar 29, 2010 5:50 PM	How can laity and especially elected officials keep up with the latest improvements and technology in animal agriculture? We live in a specialized society in which it is prudent to let the experts do what they do best. We don't want inexperienced or untrained mechanics, plumbers, electricians, doctors or any other specialist, so why would we want untrained animal caretakers dictating policy?
318	Mar 29, 2010 9:10 PM	Regulations should be based on science and best practices. The best care of animals is in the best interest of producers and consumers.

319	Mar 30, 2010 5:03 PM	I think some food animals live in terrible conditions, laying hens for example, I don't believe the general public is educated properly about animal welfare issues to make informed decisions. My example is farrowing crates, outlawing farrowing crates is good for sows but not for newborn piglets. Farrowing crates should only be used for a short time and while uncomfortable for the sow, they are life saving for piglets. Consumers should have a choice about how their food is raised and the market will help dictate production. Production standards should be set by producers, farm agency groups and scientists working in behavior and animal welfare. If a practice is deemed inhumane, research should be conducted to find a solution between production costs and treatment of animals. For example, veal calves do not need to be kept in the dark in tiny pens to raise quality veal.
320	Mar 30, 2010 8:51 PM	Unfortunately, the general public is not educated on the good production practices, they are only made aware of the problems in production agriculture. There are penalties for abuse, and producers, breeders, etc. make the most money when they treat their animals with care. I wish the general public knew and realized this, and were TOLD this by media sources.
321	Mar 31, 2010 9:33 PM	The general populous is highly disconnected with the business risk, general animal care provided, and actual cost/return associated in food animal production. The U.S. consumer has false expectations of proper animal care and elevated costs associated with "natural" production methods. The government and consumer had better realize they are walking a tight rope between imposing "acceptable" standards and the exit of livestock producers in the U.S. Realistically, the consumer won't care if milk comes from New Zealand, lamb from Australia, beef from Brazil, etc. But they sure want to see the cows in the meadow.
322	Apr 1, 2010 9:32 PM	Ballot initiatives and regulations allow for people who are unrelated to and uneducated regarding food animal agriculture to set the rules by which food animal producers must live. Unfortunately, these regulations are often NOT in the best interest of the producer OR THE ANIMALS. People closely related to food animal agriculture with a broad understanding of the industry should (AND DO) work together to formulate guidelines for producers to follow.
323	Apr 2, 2010 2:21 AM	The NAIS is a way for government to obtain a data base whereby we get closer to a communist way of producing food. It does nothing to improve animal welfare and

		nothing to keep our food healthy and safe. It only gives the government a way to confiscate animals without cause. There is nothing in NAIS that addresses prevention. It is only about laying blame even when they are wrong. It is just like closing the gate AFTER the pigs are out on the road. If the gate was closed prior to the pigs getting out they would still be in their pen.
324	Apr 2, 2010 2:35 PM	Individuals that do not care for their animals are not farmers. Farmers go out of business because they cannot compete with these individuals, and the farmers that are left are put out of business by more regulation. Simply enforcing the rules that are in place would be fine however that is not being done. Applying more rules with no enforcement does not help anyone or anything.
325	Apr 2, 2010 11:43 PM	Scary to think that the general public who may not have any idea about how to farm or ranch could have the power to put ranchers/farmers out of business with a vote that is based on mis-information, emotional advertising by animal rights groups, and is not based on sound scientific evidence. This US citizen and third generation rancher is worried about where this nation is headed and if there will be any agriculture production opportunities for the next generations to provide the safe, wholesome, nutritious products that the United States consumers and world customers are accustomed to.
326	Apr 3, 2010 11:03 AM	Someone is going to have to be in a position to regulate animal welfare issues. It should be based on science and fact.
327	Apr 4, 2010 12:22 AM	Consumers need to understand there is a reason for the way things are done on the farm for the safety of farmers and animals. There are times things go wrong and things look bad, but we always try and be the best stewards of the land and animals that we possibly can.
328	Apr 6, 2010 2:01 AM	Regulations, that curb the CAFO mind set and promote small diversified farming, are the only way to address the current unacceptable, non-sustainable food animal practices. Regulations are needed to trim the agri-giants' monopoly and assure the recovery of small farm soils and the survival and resurrection of small, local meat producers, through more federally supported local USDA-inspected meat processing and regional food distribution infrastructure.
329	Apr 8, 2010 3:54 PM	I am not in favor of a ballot initiative. We should be concentrating more on making the food supply affordable and safe for the consumer and less on animal rights.

330	Apr 8, 2010 5:54 PM	It is necessary to treat food animals humanely. What a city person thinks is humane and what actually is humane are not necessarily the same.
331	Apr 10, 2010 3:29 AM	The profit margin for the small operation farmer is not huge. When different restrictions are added on, requirements that add cost to production, it gets to a tipping point of no longer being worth the effort. People who are interested in sustainable farming- vs. the factory farms- are dropping out because of this. The huge operations are not impacted and will take over the industry to the detriment of humane, natural animal care. All of which gets transmitted to the meat, milk and other products offered to the public.
332	Apr 10, 2010 7:29 AM	Better regulations and treatment of food animals is an absolute must! God created these most beautiful and innocent creatures as well as us and we must recognize and respect them as such. The provide us with sustenance, the least we could do is treat them humanely and with kindness.
333	Apr 10, 2010 3:31 PM	Need to educate consumers about the dangers of industrial agriculture, chemicals, drugs, feedlots, free stall barns, etc. Need bans on large manure lagoons and the odors generated. Need more grass based farms and compost barns. More on-farm sales of meat, milk, produce and fruit.
334	Apr 10, 2010 6:12 PM	All initiatives should be discussed with animal oriented groups (producers, veterinarians, animal health professionals, extension, etc) BEFORE they become initiatives.
335	Apr 13, 2010 3:51 PM	The care of livestock animals should not revolve around the bottom line. Animals are not machines and there must be some consideration for the fact that they are sentient beings.
336	Apr 18, 2010 2:44 AM	I am all for the humane treatment of our farm livestock, however, the proposals that have been made, in the name of "food safety" and "animal rights", largely puts a disproportionate burden of cost of regulation on the small farmer/producer. The irony of it is that most small producers take much better care of their stock and produce a much healthier product than the "agroindustrial" producers (I refuse to call these "farms") with less negative environmental impact. IMHO it is the massive

		"agroindustrial" producers alone that need to be heavily monitored. Unfortunately, there is such a disconnect between the modern consumer (voters), our "law makers" and farmers (large of small). Most voters only see the sensational stories that the media puts out about farm animal welfare and food safety, giving the voters a very slanted view of how their food is grown, making most voters confused and not seeing the differences between "agroindustrial" producers and small/moderate farms. The "law makers" are, in turn, influenced by the monetary power of "agroindustry", ignoring the impact on small producers, making decisions that are biased and shaped to appeal to the voting public. So far, the proposed regulations, drafted by "law makers" and supported by voters, end up being "knee-jerk" regulations that create hardships for small farmers while doing little to change or improve conditions for "agroindustrial" livestock.
337	Apr 20, 2010 3:27 PM	Future of agriculture needs to be in the hands of farm organization groups and legislatures. Mandates and regulations need only to be applied from state and federal regulations. Currently there are more and more people removed and being removed from the farm. We should therefore provide food/agriculture awareness classes in our general education requirements for institutions of higher learning. This would eventually help with the consumerÆs perspective and bring light to where their food comes from, and why we practice certain practices in agriculture. We should also be educating (such as through extension programs) the grocery buyer of family households. They are the person that is playing the most important role of influencing our future consumers.
338	May 3, 2010 12:27 AM	Most ballot initiatives are by those who are determined to eliminate animal agriculture in this country (vegans). If they do not wish to eat animal products that is their choice, but do not try to force everyone to that lifestyle by enacting phony (animal welfare) regulations. I do not condone animal abuse in any way shape or form, but I do believe those involved in animal production know far more as to how animals should be cared for. Those who do not care for their animals properly will not remain in production long!!
339	May 4, 2010 9:05 PM	Ballot initiatives and regulations hamper creativity and progress. Allow the free market to work and reward those producers and processors to meet the needs of customers and consumers.

340	May 5, 2010 1:08 PM	Ballot initiatives do not usually work well. Education is better for informed choices.
341	May 5, 2010 1:59 PM	Ballot initiatives offer an opportunity to educate the general population regarding issues concerning food production and animal welfare. The difficulty that arises is that there are few "credible, unbiased" information sources engaged in voter education. The resources available to voter education pales in comparison to the expenditure of position promotion funding (advocacy) on all sides of an issue. Some Land Grant Universities engage in such policy education, but it is not something that is done universally or consistently.
342	May 5, 2010 3:32 PM	We live in a society built on the representative government system. To turn important, complex questions over to the electorate is irresponsible. It is one thing to ask the electorate if they want to allow people to purchase lottery tickets. It is quite different to ask them to weigh in on the nuances of food animal husbandry and welfare implications. Regardless of the irrationality of these ballot initiatives, agricultural experts must set aside differences and cooperate in educating the voters so that the best, logical outcome is reached.
343	May 5, 2010 3:43 PM	The public needs to understand the consequences to them, the environment, the community, and the animals when specific ballot measures are initiated without concern for the scientific evidence that may not support measures listed in the initiative. The effects are often not thought of by the general population. Individuals who have the goal of eliminating animal agriculture totally, understand that these initiatives will make it harder for the general population to have a safe, affordable source of the world's safest food; which is their ultimate goal - cessation of animal agriculture in the U.S.
344	May 5, 2010 3:53 PM	I am most concerned about regulations being implemented by animal rights activists and the general public instead of objective science-based information. We need to get the scientific community more involved.
345	May 5, 2010 3:58 PM	In my view, state ballot initiatives that seek to establish regulations regarding the welfare of food animals are by and large an unwelcome intrusion into commercial animal agriculture by animal activists. The groups behind such initiatives DO NOT have the interests of agriculture in mind, in that their stated goal is to virtually eliminate commercial production of animals for food. Because they know that American consumers would resist overnight

		increases in the cost of food, the activists have developed a long-term goal of slow strangulation of the industry by advocating increasingly onerous regulations, state by state by state. If the industry underestimates these activists, it will be at its own peril.
346	May 5, 2010 4:00 PM	It is my experience that when more pressure is added to farmers while decreasing their available funds (profit) and amount of product that the quality of life and product decrease. Too much pressure on farmers without help will not improve welfare or the farming industry. However, increasing the prices in the grocery store will decrease the quantity bought by the consumer. We need to find the happy medium.
347	May 5, 2010 4:08 PM	In my opinion, ballot initiatives originating from the uninformed lay population are typically politically rather than scientifically driven, often impractical or cost-prohibitive, and largely unnecessary. Animal welfare programs should be developed by experts in the species-specific animal husbandry and health fields and should be under the regulatory jurisdiction of the state departments of agriculture.
348	May 5, 2010 6:15 PM	If there are going to be state ballot initiatives dictating housing systems, there needs to be money added to these initiatives for grants to farmers helping them meet these mandates.
349	May 5, 2010 7:51 PM	Ballot initiatives allow non-scientific individuals to dictate what is best for animals. Animal agriculture can't compete with the pocket books of HSUS which often is the only source of information the public is exposed to, especially in urban areas. If consumers feel passionate about laying hens not being raised in cages, then let them pay more for cage-free eggs. Don't make the rest of us pay more based on nothing more than a slanderous ad campaign funded by people who don't believe we should eat animal products (meat, milk, eggs) in general. Animal welfare regulations need to be based on sound science not emotions.
350	May 5, 2010 8:45 PM	Having the public vote for initiatives that they do not fully grasp the consequences of is detrimental to the farmers and to the animals. Having a legislative body decide what changes need to be made could work if the producers are allowed to inform them of how things are in a real world situation. Changes that sound like they will benefit animals in reality may make people feel better about buying the products, but in actuality may not improve the livability or comfort of the animals being produced. The end result will

		be more expense, decreased production and potentially an increase in the discomfort of animals so people can feel better about eating them.
351	May 5, 2010 8:50 PM	I believe that using a ballot initiative is a step in the wrong direction. Too many people who are misinformed or totally uninformed would likely be voting. Those who are involved in the areas of food production, who know what the impact on production labor and cost further regulation can many times be, many times are too busy to get informed of the probable impact of the regulations they would be voting on. Basically, the regulations, some of which may need updating, are probably already on the books. However, they also need good knowledgeable people to enforce them. One thing we do not need is a group of uninformed do gooders getting involved in making regulations.
352	May 5, 2010 9:48 PM	Ballot initiatives are inappropriate because they put the power of the public in effect at the wrong place. The public, as consumers, should choose using educated decisions to buy products that they think are safer and more animal-welfare friendly. Changes should only be market driven and the knowledge spread to the public should come from those that are involved in animal agriculture such as veterinarians, producers, and animal scientists. Whenever the public votes for a ballot initiative they are extremely underprepared in knowledge of the subject at hand. If someone with no knowledge of the way that food animals are produced is posed a question concerning that production, how can they honestly know the choice they are making? Logically, most people vote YES that animals should have more welfare protections thinking it is a good thing. However, they do not realize at the time that what they are doing will put food production decisions into the hands of animal rights activists and politicians while ultimately driving the price of their food items up.
353	May 5, 2010 11:56 PM	Consumers are constantly misinformed about the conditions of livestock facilities based on biased media coverage from animal rights organizations. Food animal producers DO care about the welfare and health of their animals and want what is best for their respective animals. The traditional approach to use the latest science based production models is still valid, and research currently in the works should provide the answers we seek in terms of housing and rearing livestock. It is clear the groups posing the legislation in regards to food animal agriculture are pushing an agenda by their actions to pass legislation first in states with little to no animal agriculture. The public is misinformed that animals are treated inhumanely and vote

		based on emotion instead of based on facts. Many do not realize the potentials for increased food costs.
354	May 6, 2010 1:30 PM	Ballot initiatives to regulate food animals are nothing more than a way to dupe the general population. Truth is never at the center of the argument. The corporate advocacy groups have more money and resources to spend on this than agriculture does and they have become masters at this tactic. Agriculture has foolishly allowed the corporate advocacy groups to take over these important issues. Agriculture needs to pool their resources and overcome petty differences and talk with ONE COMMANDING VOICE!
355	May 6, 2010 1:44 PM	If changes and initiatives cannot absolutely prove they improve animal welfare or food safety then they should not be allowed to progress especially when funded by out of state wealthy animal rights groups whose ultimate goal is to eliminate animal agriculture not to improve welfare of food safety.
356	May 6, 2010 3:19 PM	Ballot initiatives are like most politics i.e. who has the TV message that most impacts (emotional) and motivates the voter and really has nothing to do with a science-based examination of the issue.
357	May 6, 2010 4:08 PM	Guidelines and legislation are inevitable but changes need to be based on science and real animal welfare, not on politics and animal rights organizations. People who have no actual experience raising farm animals should not have a voice. They have no real basis for making judgments. Use available science!
358	May 6, 2010 4:59 PM	I don't agree with the limited choices of answers of some questions. Decisions are market, legislative, and animal management driven based on science and animal care. Currently consumers with no knowledge of animal care except pets or of management are making decisions based on information from groups that have even less information than consumers and all want black and white decisions. In life there are not black and white decisions. Most decisions being forced by consumers are an attempt to create a no liability situation. The result will be a limited choice of foods and if animal rights groups no animal products. The ballot initiative gives ultimate power to those that have no knowledge of the consequences of the decision. The regulations if only legislative gives power to a group who know not much more and are willing to vote the decision based on the consumers demands. In either case farming in the US is the only original product marketed to other

		countries that reduces the balance of trade today and provides jobs in the US and those jobs are getting less. With less farm products will be less trade and less reason for jobs in all industries and less finances for supporting the high outgo of capital to other countries.
359	May 6, 2010 5:07 PM	Ballot initiatives on a state by state basis and not all language being the same create unfair production practices and cost of production.
360	May 6, 2010 5:31 PM	There is an important issue out there that needs addressing as we go forward. It is unfortunate when production systems collapse because of ill-planned and poorly thought out solutions. It is hoped that scientific research which includes human and sociological factors will be funded to help avoid major mis-steps.
361	May 6, 2010 6:01 PM	These generally are poor ideas devised by animal rights groups to slowly push animal agriculture out of business. Ultimately, they don't care how animals are raised for human consumption, because they don't want them raised as food at all. The goal is to slowly wean people off meat by making animal products more and more expensive to purchase. That is what these non-science, purely emotion based initiatives would accomplish.
362	May 6, 2010 6:09 PM	Regulation is only needed because people won't use common sense. If it's bad for the animal, it is bad for the producer. Regulation has forced the animal industry out of Ohio. It started with our Worker's Compensation rates, once the highest in the nation and the packing houses all moved west. So did the livestock. There is not enough livestock left in most counties of Ohio to worry about. I would like to be a larger hog farmer but it is about impossible.
363	May 6, 2010 7:01 PM	"What are the unintended consequences of current and proposed animal welfare ballot initiatives on the structure of agriculture?" The list of choices includes a decrease in the number of producers. I do not believe that this is an unintended consequence but rather an intended consequence. HSUS is trying to eliminate animal agriculture and they are doing it one step at a time. The more producers they can eliminate from the ranks means the fewer they have to fight for the next battle. We need to be fully aware of their agenda.
364	May 6, 2010 7:26 PM	I don't believe that the constitutional amendments are the appropriate venue for animal welfare legislation and many other issues.

365	May 6, 2010 7:40 PM	It fabricates false information to the majority of body that has never experienced farm life. That large corporate farmers can consume the changes to laws to keep on producing and they are the farms that do not have the time and it creates welfare issues. They like kalmbach swine even get around permitted facilities laws having more than 2500 sows at their facilities. They should be permitted but are not.
366	May 6, 2010 10:10 PM	I have spent 36 years associated with development of better designs of livestock buildings and providing education information to farmers and the public on good operation and management to provide a better environment for the animals. The current focus of most groups pushing ballot initiatives is not animal welfare but making money for the organizers and people working for them.
367	May 7, 2010 1:25 AM	These ballot initiatives and regulations that are in favor of the farmer, are better than having no legislative protection at all for our livestock and crop operations. The animal welfare groups we as farmers are battling today have much money and lee way to make their plans or bogus ideas a reality. This is why we as producers need to continue to go straight to our legislatures and prevent their vegan ideas from becoming a reality and we need to continue to educate our consumers on what WE really do and teach them what groups such as HSUS are really about.
368	May 7, 2010 2:42 AM	Due to the lack of knowledge about modern agriculture by the general public, many unintended negative consequences can occur. The public can be manipulated to believe falsehoods about agriculture as we have seen in previous elections. People have good intentions when voting, but when you use emotion in this or any decision the results usually do more harm than good.
369	May 7, 2010 11:53 AM	Unintended consequences of regulations will cause less food produced in the US and more, less regulated food imported resulting in a less secure food supply and fewer jobs.
370	May 7, 2010 12:32 PM	Regulations are most easily handled by large farms that have the resources and capital available to comply with the regulations. A great example is the dairy industry which has been the most regulated since milk inspection began in the mid-1900's. We have seen a slow, but steady decline in the number of small dairy operations and an

		increase in the number of large dairy operations. Further regulations of the dairy industry will result in even more small dairies going out of business. Regulations will also have the same result in the other livestock operations. This not only affects the individual farmer, but the agribusinesses that serve the area and the rest of the rural community. Just count how many rural communities can still consider themselves a dairy area compared with just 20 or 30 years ago. The regulations doesn't immediately put them out of the business; but in retrospect the advent of milk inspections is when the dairies began to get larger and the small farmer simply got out of the dairy business.
371	May 7, 2010 12:41 PM	If we continue to allow the voter to decide (based on emotion rather than fact) the direction of regulatory action against animal agriculture, we could see the decline of animal production as it stands today to a point we will have to rely on other countries to provide our food sources and in turn have no control on price, safety or quality as well as animal welfare issues.
372	May 7, 2010 12:56 PM	Ballot initiatives serve special interest groups alone and are solely driven by emotion rather than science. The agricultural industry in the United States feeds not only our domestic population but also the rest of the world. Special interest groups like HSUS are solely interested in the eradication of animal agriculture in favor of their veganistic choice. Their well funded machine allows them to promote and force their life choice on others via emotional propaganda without any true science. Furthermore, when our agricultural producer population is less than 2% of our total population how fair is it to allow emotional propaganda from any special interest group to determine the fate of our food choices and food production systems?
373	May 7, 2010 1:08 PM	I feel that a ballot initiative becomes a popularity contest not a decision based on sound science. We are at a point that the level of knowledge of the non-farm sector on how their food is produced is at an all time low. If we mandate changes based on perceived information we will just strengthen the position of the larger operators due to their economies of scale. Let's first put education back into our schools to show people how our food is actually produced. We have taken too big of a step away from life skills education in the past 30 years and at the same time we have gone through rapid vertical integration in our animal production units in the name of cheaper food. Our food is safer than anywhere in the world. People live longer and are better fed. However our eating habits have taken a nose dive and we need to correct that also with a sound

		education policy put back into our schools. The answer lies not in legislation but in education.
374	May 7, 2010 1:17 PM	I have been a Pork producer for over 30 years. I grouped sows together for many years. The boss sows bullied the timid sows. Timid sows do not get to eat as much as they would like, this is not humane. I now use gestation crates, and sows are much better off. It is disappointing those not involved in animal agriculture think they know what is the most humane way to raise livestock.
375	May 7, 2010 2:20 PM	Ballot initiatives etc. are not the correct avenue for seeking changes in the animal agriculture industry. Most voters are ignorant of many farm industry practices and the rationale for their adoption. There is much false information and misrepresentation on behalf of the animal rights organizations designed to mislead consumers and voters. The ultimate goal being conversion of all to vegetarianism.
376	May 7, 2010 3:22 PM	Regulations used to improve the livestock industry are needed however they must be partially controlled by those who know the industry. The general public is so far removed from livestock production in our country that their knowledge of proper animal care and production is more emotional than factual. The board set up in Ohio to produce guidelines for animal production is necessary, however it seems to be made up of a few more university and extension personnel than livestock producers. Even though they have the education behind them, their day-to-day hands on experience is not current or in some cases practical. Perhaps a better blend of producers would be beneficial.
377	May 7, 2010 3:59 PM	Critical thought must be given to this; be careful what you wish for, you may get it.
378	May 7, 2010 5:02 PM	Ballot initiatives are often controllable by zealots with money. This could be a large corporation or group, but it certainly isn't a small farmer or small farm organization.
379	May 7, 2010 5:46 PM	It seems very hard to believe that an anti farming/animal use organization, such as HSUS, should be able to even propose any ballot initiative or regulation when their ultimate agenda is to do away with agriculture.
380	May 7, 2010 6:07 PM	We have the safest food supply in the world. Let's not "regulate" animal agriculture to a point where the price of production causes consumer prices to raise above the purchasing power of lower income people in the USA. I do not mean we should sacrifice any USDA standards below

		today's scale. In fact there are some areas that standards should be initiated or made stronger.
381	May 7, 2010 6:22 PM	I think this survey makes the false assumption that all animal welfare ballot initiatives are created equal. The initiative in Ohio was to create a board to determine livestock care standards instead of having regulations forced by an outside organization (even though that organization is trying to revoke the board's privileges before they get started). Bottom line is any ballot initiative that PASSES will lead to regulation of some kind, but the extent of that regulation varies and therefore, has a varied effect. Regulations in my opinion directly affect large operations the hardest first, but once adjustments are made to infrastructure they are back in business. Most small farms have less of an issue with confinement which seems to be the first component attacked in regards to welfare.
382	May 7, 2010 6:23 PM	Not all ballot initiatives are created equal. Through a ballot initiative in 2009, Ohio created a Livestock Care Standards Board that defines a process to address issues related to livestock care in the State. On the other hand, Ohioans for Humane Farms (HSUS) is working on a ballot initiative to ban gestation stalls for sows, veal stalls, and cages for laying chickens, along with regulating on-farm euthanasia practices and prohibiting the transport, sale or receipt of downer cattle. Prohibition without a viable alternative can create unintended consequences, including additional welfare issues. Focusing on animal behavior as the sole indicator of animal welfare fails to take into account the complexity of agriculture and the importance of other factors such as food safety, food availability, and food affordability. Food policy decisions should be made by experts and should be based on science and fact, not emotions.
383	May 7, 2010 6:43 PM	If we lose cages for laying hens, the egg quality and quantity will suffer dramatically. Ohio is now the #2 egg producer and will fast go to at least 20th. If you have never raised hogs you cannot appreciate the safety for the sows and safety and convenience for the caretakers when the sows are in gestation and farrowing crates.
384	May 7, 2010 7:07 PM	It is a terrible way to dictate production practices.
385	May 7, 2010 7:46 PM	I am very concerned about negative consequences when the uninformed public determines management practices for livestock operations. The people closely associated with food animal agriculture are best suited to determine

		which management practices work best in each individual farm or system and to implement them appropriately. I am proud to be a food animal veterinarian and I am proud of the way our producers care for their animals. Because American farmers treat their animals humanely, they are able to provide a safe and plentiful food supply for people around the world.
386	May 7, 2010 9:31 PM	On the positive side - adopt the Ohio way of dealing with HSUS and the like. We must get ag related issues away from people that think milk comes from the grocery store.
387	May 9, 2010 3:03 PM	We all need to step back, and take the common sense approach.
388	May 9, 2010 5:31 PM	Wrong approach. Voters do not realize unattended effects
389	May 10, 2010 12:52 PM	Consumers need to understand that every industry or group has a bad apple or two but that doesn't mean we have to dump the whole apple cart to get rid of the few bad apples. The industry needs to stand up for itself and strongly punish those that are not providing the excellent care that is the norm. Unfortunately many of these bad behavior documentations have been sensationalized to make it appear as if it is common place....it's not.
390	May 10, 2010 2:42 PM	Costs of additional regulations and initiatives are not being offset by consumers paying for them in the market place. Cost is driving most/all of consumer purchases.
391	May 10, 2010 2:52 PM	We must be proactive and take part in the development of these initiatives and regulations. We must take an active part so that they will not be created and developed by those without an appreciation for our professions.
392	May 10, 2010 3:05 PM	The problem with most ballot initiatives, and especially this topic, is that voters are motivated by emotion rather than clear reasoning. Consumers have always driven the market and it has historically proven to be a very adequate method of making producers meet those demands. We seem so concerned about protecting minority rights in this country lately, why should we eliminate choice from some segment of the consuming public just because they might happen to be in the minority in one certain election?
393	May 10, 2010 3:20 PM	Ballot issues increase costs in the area or state where the issue passes. Processors and some farms move to neighboring states without ballot issues.

394	May 10, 2010 3:32 PM	The animal rights organizations (HSUS, PETA, etc.) have more money, time, and anti agricultural agendas than the farmers that are raising and producing our nation's food. We need to be sensible and follow the WELFARE guidelines set by professionals that KNOW animal welfare...e.g. AVMA, AAEP, Animal Behaviorists such as Temple Grandin, etc. rather than let those that feel animals should never be used for food/fiber/competition dictate and impart their RIGHTS agenda on farmers and to the public that don't know any different. Unfortunately, the public has been exposed to falsehoods and propaganda by heavily funded RIGHTS organizations and they are very far removed from actual ag animal and food production.
395	May 10, 2010 4:19 PM	Only do ballot initiatives that make it easier to farm - perhaps a farmer's bill of rights or a right to farm amendment.
396	May 10, 2010 6:41 PM	Several questions are difficult to interpret. Not a very well constructed questionnaire.
397	May 10, 2010 7:00 PM	Ballot initiatives are an inappropriate approach to develop food animal regulations. The public is not well-informed about current technology, livestock care and husbandry and cannot be expected to make sound decisions which impact food animal production.
398	May 10, 2010 7:09 PM	I worry about the role of advertising/marketing in ballot initiatives.
399	May 10, 2010 8:07 PM	Ballot initiatives will have a negative impact on food animal agriculture. They allow for a well funded HSUS to dominate public policy in a way that will be detrimental for the consumer.
400	May 10, 2010 8:54 PM	Ballot initiatives nor regulations are an effective means to create a positive change in animal agriculture.
401	May 11, 2010 3:15 AM	Ballot initiatives should not be used to impose regulations. Such initiatives or constitutional amendments result in regulations that are one-sided and not well vetted. Campaigns for such initiatives result in sensationalism which tugs at heart strings but is not necessarily representative of most real world care. The process underway in Ohio utilizing a Livestock Care Standards Board is a thoughtful, inclusive and rational method to develop comprehensive standards for animal care.
402	May 11, 2010 12:13 PM	Large and small producers realize that for animals to be productive, they must have a good environment and be

		comfortable. Animal welfare advocates play upon the concern of citizens who do not know agriculture, which is most of America.
403	May 11, 2010 2:03 PM	Food production needs to double by 2050. Good animal care is essential to produce more high quality protein. Producing animal protein so it is affordable and nutritious, must be balanced with the proper care. The animal rights groups continue to play on public emotion to carry out their agenda of eliminating all animals from man, while not caring about the malnourished and starving people of the world. Thanks.
404	May 11, 2010 2:18 PM	I don't think that I have enough knowledge about the entire situation to make an intelligent response. I do know that I do not eat the cattle we raise because they seem like pets. When I eat a steak from the store, there is no sentiment. Slaughter of any animal makes me sad, but animals and grain have been a means of income in my family for many years. For an animal to give its life to nurture mankind is a supreme sacrifice. I don't think the world is ready to become vegan at this date. Thank you.
405	May 11, 2010 4:03 PM	While the perspective and perceptions of those outside agricultural production are important to understand, I do not believe these groups should be those making decisions relative to the business or related animal welfare. To the extent that their buying decisions influence market demand, they do have a voice, but that is where it should end relative to policy. That said, it is important for those making decisions within their own ag industry to listen well to the comments and concerns of a buying (or non-buying) public to adjust and be prepared for the PR backlash of those who disagree with methods or policies. To the extent that they can influence greater demand by shifting the sentiment of the massive consuming market, they are a force to be reckoned with.
406	May 11, 2010 4:03 PM	Unfortunately the groups that are bringing these initiatives forward are not truly as concerned about the welfare of the animal as they are about moving their vegan agenda forward by regulating animal agriculture out of the U.S. They say they are only concerned about the "basic care" of the animal. This is what animal caretakers have been doing since the beginning of time. What they are asking for are extreme measures with no regard to the unintended consequences. Producers in the U.S. are currently providing consumers with all the options they are asking for. If they are willing to pay for those options that's great,

		but my choices shouldn't be limited because their view is different than mine.
407	May 11, 2010 4:06 PM	97% of the population knows little or nothing about farming. A vote made from bad information could have a very negative effect on our future food supply. Ballots and regulations should be made on facts not emotions.
408	May 11, 2010 4:29 PM	I think the initiative route is very dangerous as the public does not necessarily have the information to make knowledgeable decisions that will have unintended consequences. The industries must be willing to commit to using best practices as they are identified through scientific research. The agricultural community must commit to educating the public about where their food comes from. We must protect American agriculture or the food supply in this country will become expensive and scarce. We do not want to depend on outside nations to produce our food. This is an economic, national security and health concern.
409	May 11, 2010 5:13 PM	More regulation = More regulation More regulation = more opportunity for corruption Who has the power to regulate? How did they get the power? I don't believe that regulation = public protection anymore. Regulation is an opportunity to add cost to production and extort money from the producers. The only way for producers to protect themselves from regulations is to control the markets in order to be able to cover their costs of production. The small producers cannot do this therefore we have very few small producers anymore. Regulations = Mega farms. I am finding it more difficult to classify a Mega farm as agriculture. It is an animal factory; not run by a farmer but by a board of directors.
410	May 12, 2010 1:21 PM	The public needs to understand that our food is ALREADY the safest in the world and we do treat animals humanely. The public needs to understand that animal rights groups are only wanting to do away with animals used for meat purposes and transform more people into vegans. The supposed concern for animals is a decoy to their true goals. Animal welfare groups already are in place along with commodity groups and the universities to ensure safe, wholesome food production from farm to plate. There is always room for improvement, but it must be research based and be financially sound for producers to use - not a scare tactic decision made by uninformed voters. The public voting on these matters is like me voting on hospital regulations i.e. how treatment is given, how many people are to be placed in beds in one room, what can/cannot be served for meals, etc. I simply do not have the knowledge

		to make those decisions and therefore rely on those in the profession. The public needs to stop being frightened into not trusting the professionals in the animal production world.
411	May 12, 2010 4:30 PM	Food safety programs are more than adequate. Price and demand will take care of animal welfare, for the better!
412	May 12, 2010 4:52 PM	Most voters are uninformed of the issues and are swayed by the advertisements. The ballot box is not the place to make laws, rules or regulations. The ballot box is the place to determine the direction and framework for the elected officials to make laws.
413	May 12, 2010 5:28 PM	The livestock industry must take necessary actions to upgrade their quality of production and methods of production with input from the consumer. Production techniques have developed because of demand for product at a reasonable price. I do believe there is a growing audience that cares where and how their food is produced and will pay more knowing that the food they are eating is coming from a family farm, raised in a humane method, by people that take good care of their animals, good conservationist, and take pride in handing the farm to the next generation in better shape. Grass-based beef producer.
414	May 12, 2010 5:28 PM	People who have no idea how their food ends up on their plate should not be telling farmers how to do their job.
415	May 12, 2010 5:29 PM	I have been a veterinarian for 35 years and a small farmer for just as long. The ballot initiatives are a direct result of lack of improvement in food animal agriculture and handling by the industry itself. The argument has always been economic. That has been disproved by the increase in consumer pricing of all food animal agriculture products, almost all of which is going to the retailer. The handling of the animals should be better, regardless of the cost.
416	May 12, 2010 5:38 PM	I think that ballot initiatives in this form were unintended for Constitutional changes.
417	May 12, 2010 6:16 PM	Neither the legislature, nor the general public knows or understands what it takes to produce good, cheap food. Yes, there are cases that animals are mistreated, but most farmers love their animals, and furthermore animals that are mistreated are not profitable to the farmer. There is legislation that prohibits child abuse, and there is still unreported and unpunished child abuse. Look at the horse industry. What can be more abusive than disowning horses

		because people cannot feed them, instead of using them for food?
418	May 12, 2010 6:52 PM	Just is more Gov. in our lives. No longer the free nation we were, more socialism and costs.
419	May 12, 2010 9:32 PM	I believe it was prop 2 that was voted in, in California that is going to force most egg producers to leave the state. The tactics they used to pass the bill were downright wrong. They showed the packing house with the downed dairy cow (had nothing to do with the prop.) They showed egg farms that had to be illegal, there are several egg ranches in my community, they do not resemble the one in the Adv. at all. They play on the uninformed's emotions without playing fair but that is their MO after all.
420	May 12, 2010 10:47 PM	Imperative that we keep HSUS out of animal agriculture as they are trying to regulate us out of business. Thank goodness Ohio had the wherewithal to come up with the standards board. We must educate the non-agriculture community (billboards, local media outlets, print media, and web-based information) about ourselves as no one else is going to do it. The misconceptions about producers (farmers) are appalling and it is due to lack of information to the general public. HSUS spends thousands spreading their muck on television. Why don't we? Good luck with your survey. I will look forward to viewing the results. Signed B and D.
421	May 12, 2010 10:50 PM	I believe it to be a sad state of affairs when DC advocates try to snowball the public in to their vegan beliefs and hide behind their names. Science based info is more valuable than emotions when it comes to your food. This is still America and if people want to live a vegan life that is their choice but they have no right to force their vegan ways on everyone else.
422	May 13, 2010 12:18 AM	Such a large percentage of the (voting) population not only is not involved in production agriculture, but has little to no understanding of it, so they really shouldn't be the ones making these decisions. Food animal agriculture is in this way not unlike things like taxes or defense or space exploration that the government wouldn't think of allowing the voting public to direct.
423	May 13, 2010 1:47 AM	Question #2 did not (by my read) provide for a group of people designated by the governor (or director of ag) to determine welfare standards which I think may be more appropriate

424	May 13, 2010 1:51 AM	Market conditions should be the deciding factor. Consumers have a choice if they want cheap or high quality food now. Stupid is as stupid does. Why is that government's responsibility to fix? It is none of the government's business how I raise livestock. The regulations can determine who wins and that by who picks the regulators. Maybe we should regulate the petitioner's lifestyle? IF you want cheap eggs from chickens in a cage or good free range chicken eggs why is that any of the government's business? Buy local and all this stuff goes away. You will know what you get.
425	May 13, 2010 10:30 AM	Must be careful not to make to restrictive or too vague or too full of mandates which can be full of loopholes any organization can manipulate to their advantage.
426	May 13, 2010 12:06 PM	Advice to voters, Understand what you are voting for or against. Be careful what you ask for-you may get it.
427	May 13, 2010 12:15 PM	Stop the creation of "Livestock Welfare Boards" that are voted into law to simply increase the stronghold of the factory farms and grain/livestock lobbying groups like Farm Bureau and National Cattlemen’s Beef Association. They get the board positions filled with their own lobbyists instead of independent citizens. Animal welfare needs to be improved but not by having the decisions made by lobbyists or large agribusiness corporations who care more about keeping themselves in power, rather than actually doing something.
428	May 13, 2010 8:21 PM	Voters are not intelligent enough to make decisions on animal welfare and look at the emotional side without realizing unintended economic ramifications. For this reason change in food animal agriculture should be dictated by consumer decisions in the market place and not mandated.
429	May 13, 2010 10:13 PM	The producers know what is going on and should be very capable of providing safe and wholesome product with education. The ballot results in too many uninformed and emotional responses.
430	May 14, 2010 1:29 PM	1) HSUS and California left wing liberals should stay in California and out of Midwestern agriculture. Too often the vocal minority tries to control the silent majority most of whom aren't to blame. 2) The federal govt (bureaucracy) should leave it to individual states. 3) One or two bad-apple factory farms blow it for the thousands of conscientious and ethical producers and processors who strive to deliver a safe wholesome product at a fair price. 4)

		The market should lead this reform and let the consumer decide with his/her food dollar.
431	May 14, 2010 3:14 PM	It is interesting that the clear implication from the possible responses available to questions about impact of animal welfare initiatives (#5, 6, 7, and 9) is that, in the opinion of the survey creator anyway, the impacts are all negative. You do not allow for a positive response, but when I answered "change in quality" to the question (#9) about "unintended consequences", I in fact meant that the changes in quality would be for the BETTER.
432	May 15, 2010 5:26 PM	Agriculture, especially food animal production, does not need more regulations. The markets and supply and demand have made production ag what it is today, and that will continue.
433	May 17, 2010 12:38 PM	Ballot initiatives are bad as they are usually very broad and non specific causing confusion and followed by overregulation. They are feel good proposals, but are detrimental for production.
434	May 17, 2010 1:27 PM	Outside groups such as HSUS need to quit meddling in the affairs of state regulatory agencies and policies. Farmers as a whole do not abuse the animals that provide a source of the farm's income. Any effort to thwart HSUS is a good effort.
435	May 17, 2010 3:53 PM	Specifically related to pork production, If you "ask" the sow if she wants to be in a crate or if she wants to fight with the group, we have overwhelming evidence that the sow prefers to be protected from other sows - crated during gestation. I believe the research should look to the animals for answers and not to the people who do not understand how or why we raise food animals the way that we do. Additionally, there are researchers who specialize in animal welfare. They continually look for new ways to handle animals - they need funding so they offer unrealistic answers when it is obvious that the current system is working.
436	May 17, 2010 7:24 PM	States that allow the use of ballot initiatives, in general, believe that they provide an opportunity for the public at-large to be more engaged in the political process. I can definitely see the merit in that thinking. Ballot initiatives in regard to animal agriculture may or may not be harmful to the industry and supporting industries depending on the premise of the ballot language itself. In general, the risk is always present that the outcome of a ballot initiative will be decided by a vote of a rather largely uninformed public that

		is susceptible to the persuasions of political messaging through the use of mass media and new media. This is especially problematic with issues highly technical in nature in which emotional arguments may carry the day that are not necessarily rooted in sound science.
437	May 18, 2010 12:26 PM	No one group whether it is HSUS or AFBF should have the ability to go into a state or any other government sector and be able to make policy and influence laws!!! I do not believe that our country is supposed to operate like that and it should not!!!
438	May 18, 2010 5:18 PM	No hog farming in Florida due to ballot initiative - we regulate farming with the state constitution
439	May 18, 2010 5:28 PM	Any change in U.S. law should apply to imported products as well or all you do is put our producers out of business and promote foreign unregulated food animal production. Example, there are no labor restrictions on producing vegetables in Mexico whereas in the U.S. there are a host of labor regulations driving up cost and putting our farms out of business while allowing unrestricted access to our markets for production in Mexico without minimum wage or child labor laws...so it all gets pushed to unregulated areas since everything is allowed to be imported without the same restrictions we have. We should have fair trade not unrestricted access to our markets.
440	May 18, 2010 8:17 PM	none
441	May 18, 2010 10:56 PM	THE BALLOT BOX INITIATIVE ALLOWS PEOPLE THAT ARE NOT EDUCATED IN OR FAMILIAR WITH BEST MANAGEMENT PRACTICES OF AGRICULTURAL PRODUCTION TO FORCE REGULATIONS AND CERTIFICATIONS ON PRODUCERS. REGULATIONS SHOULD BE SCIENCE BASED AND RESEARCHED BEST MANAGEMENT PRACTICES THAT ARE ACCEPTED IN AN INDUSTRY. ORGANIC FARMING; SMALL COMMUNITY GARDENS; AND TRUCK FARMERS DO NOT HAVE THE SUSTAINABILITY TO LITERALLY PRODUCE TO FEED THE WORLD POPULATION. ONE MAJOR STATE OF OUR NATIONAL SECURITY IS BEING ABLE TO EFFICIENTLY FEED OUR POPULATION. IN MANY CASES LARGE INTEGRATED POULTRY AND SWINE PRODUCERS IN RURAL AREAS HAVE SAVED THOSE FARM PRODUCERS WHILE ALLOWING LOCAL COUNTY GOVERNMENTS THE REVENUES TO SUPPORT SCHOOLS, ROADS, ETC.

442	May 19, 2010 2:35 PM	We shouldn’t allow ballot measures that are outside the scope of protecting individual rights. We don't need any animal agriculture measures to go before voters. These should be handled by elected officials with input from interested groups.
443	May 19, 2010 3:27 PM	The use of a ballot initiative is detrimental to food animal producers in the sense that you are using a voter base that, in general, has no firsthand knowledge of the practices, or methods utilized in a 21st century animal production enterprise. This "voter" base is very easily influenced by outside organizations, and can vote, due to these biased influences, to place both unfair and unrealistic regulations upon the food animal industry.
444	May 19, 2010 5:25 PM	I love agriculture, I love my animals and because of a few in the industry we have people that don't realize how many of us try to do everything in our power to take proper care of our animals. Yes we produce them for consumption, however we do care for them, they are God's creatures and deserve our best.
445	May 19, 2010 7:36 PM	This is another dumb idea and whoever is promoting this, is clueless about the rule of unintended consequences. They also are not interested in food for the hungry or under nourished. This is a political power play and ruse using food animals. Study the HSUS, or Peta and then tell the food consumer with a straight face that there is a legitimate concern for animal health and welfare.
446	May 20, 2010 3:31 PM	Use of ballot initiatives and regulations to create change in food animal agriculture is a gamble. Marketing campaigns by groups with ballot initiatives can be very strong and persuasive depending on the money behind the group. The general public needs to be made aware that HSUS is not their local humane society and that their goals/objectives are much different than the local societies.
447	May 20, 2010 8:28 PM	Change must come in food animal ag. There is too much waste and overproduction of food animals; too many restaurants (e.g. chicken wing places) that are not necessary and are created merely for economic reasons at the expense of raising animals for slaughter. Like our consumer mentality with purchasing, we are an unthinking society (the majority) expecting to have it all. It is selfish, wasteful and a lack of compassion in behavior.
448	May 21, 2010 6:36 PM	Animal production practices that are utilized today have been developed over the years from farmers and veterinarians improving the efficiency, safety and comfort

		of the animals. These decisions are best left in the hands of people who work with these animals and whose livelihood depends on their production. Should we have ballot initiatives to tell doctors how to care for patients or for auto makers how to build cars when the majority of the people voting know very little about these industries?
449	May 21, 2010 6:36 PM	Need to be closer to production of animals for food than just being a voter.
450	May 21, 2010 6:49 PM	Question #9 is rather ambiguous, as it states "...unintended consequences..." Why not just state "...intended consequences..."?
451	May 21, 2010 7:10 PM	The HSUS and PETA are of no help to animals. They just stir up trouble to keep donations coming in, so the leaders get well paid. There are no controls on non-profits including those of the humaniacs. HSUS has 11,000,000 donors and PETA has 32,000,000. Signed: A
452	May 21, 2010 7:19 PM	Based on my observations of our nation's "general" voting public, most are uninformed on issues concerning food production and how complex factors may affect the nation's food supply system. Of those voters who have a position on the issue of animal welfare, many are misinformed basing their opinions on biased propaganda that has targeted their emotional psyche. Stereotypes and negative stigmas cloud the opinions of consumers who equate American animal agriculture producers to Nazi dictators. They don't realize that given current trade policies American producers will be quickly replaced by foreign competitors who won't have to play by the same rules. Our nation's food security will be lost and with it so will we lose one more piece of our sovereign independence.
453	May 21, 2010 8:06 PM	Small farms which sell locally should not be required to microchip their animals and register their farms.
454	May 21, 2010 8:14 PM	Regulations will control the availability of food for the public and increase the cost. The public is accustomed to cheap food. Only the land owners will be able to produce their own food and have good nutrition at a reasonable cost, if the unreasonable regulations continue. We need to tell the consumer that if they continue to support this type regulation, they will someday not be able to afford the food they have been accustomed to enjoying.

3. A. Ethical Implications of Animal Biotechnology: Considerations for Animal Welfare Decision Making

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Ethical Implications of Animal Biotechnology: Considerations for Animal Welfare Decision Making

Animal Agriculture's Future through Biotechnology, Part 9

Abstract

Animal biotechnology—which includes both genetic engineering and mammalian cloning—has expanded rapidly in recent decades. These technologies already have been applied in biomedical research and now are nearing application within the food system. Both the U.S. Food and Drug Administration (FDA) and the European Food Safety Authority recently have concluded that meat and milk from cloned animals are safe, but public perceptions will continue to have a significant impact on the development and commercialization of animal biotechnology applications.

Public opinion studies regarding animal biotechnology reveal that people are concerned about the purpose of the applications, the methods of research, and the objects of manipulation. Additional public concerns include the moral status of animals, the boundary between what is considered "natural" and "unnatural," and the consequences of genetic modification, particularly the long-term impacts on human health and the environment.

Three broad categories of ethical issues are associated with animal biotechnology: (1) the technology's impact on the animals themselves, (2) the institutions and procedures that govern the research and applications within the agrifood system, and (3) the relationships between humans and other animals.

Among the world's largest religions, there are very few clear-cut taboos prohibiting animal biotechnology, although ethical implications can be drawn from the general role

Animal behavior scientists are working to identify and reduce excessive animal stress on the farm to improve health and productivity. (Photo courtesy of the USDA Agricultural Research Service.)

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of animals within the religious tradition and from beliefs and practices that address animal care and use, animal breeding, and human diet.

In the United States, animal biotechnology is regulated primarily by the FDA and the U.S. Department of Agriculture. Because U.S. regulators do not view biotechnology as being inherently "risky," regulations generally apply only to the products of biotechnology. But this regulatory strategy has ethical ramifications. The scope of the issues, impacts, and practices deemed relevant to decision making reflect a norm or evaluative judgment about what will and what will not be addressed in the regulatory process. The U.S. regulatory discussion does not focus on whether cloning, genetic engineering, or other biotechnologies are appropriate methods—or even whether the resulting products are socially or economically valuable or ethically appropriate—but rather on whether the products are safe for use.

In contrast, European regulators view biotechnology as a novel process that requires novel regulatory provisions. This "process-versus-product" method means that the technology does not go forward and/or importation is delayed while the general approach to regulatory evaluation is being debated. Even if regulators ultimately make decisions similar to those made in the United States, the European approach provides a forum in which open debate can cover the range of issues, impacts, and practices that ultimately will be decisive. The European method still provides opportunities for product-specific ethical debate when a product is about to be commercialized. In contrast, the political tradition of the United States emphasizes ethical debate within the legislative process. Congress has not seen fit to provide a clear place for it in regulatory decision making.

Two main international protocols affect animal biotechnology: The Codex Alimentarius Commission sets international safety standards for foods; the Cartagena Protocol on Biosafety to the Convention on Biological Diversity—primarily an environmental treaty—protects biological diversity from risks posed by living modified organisms, taking into account potential risks to human health.

There have been relatively few formal efforts to bring science, ethics, religious tradition, public opinion, and legal practice into dialogue regarding animal biotechnology. Decisions about the future development and use of animal biotechnology may be more effective and widely accepted if parties from various disciplines increase their commitment to frequent and sustained cooperative efforts to analyze the multitude of complex facets of this issue, including knowledge of the science of animal biotechnology, philosophical reflections on the moral significance of animals, religious traditions of animal use, and research on public attitudes to animal biotechnology.

Introduction

The last two decades have seen the development of new genetic technologies for nonhuman animals (hereafter, simply "animals") that already have been applied widely in biomedical research and now are nearing application within the food system. Genetic engineering—the manipulation of animal genomes using techniques derived from deoxyribonucleic acid (DNA) to produce recombinant DNA (rDNA) (artificial DNA engineered through insertion, rearrangement, or deletion of one or more DNA strands)—has the potential to introduce new traits into familiar animal products. The technologies also are envisioned to create nonfood uses for traditional livestock species that may present challenges for the animal products industry and consumers. Mammalian cloning almost certainly will be used in connection with genetic engineering and may have additional uses for livestock breeders who desire a means to improve the genetics within their herds. These two techniques encompass what is here referred to as "animal biotechnology."

The focus of this paper is to survey some key ethical, religious, and legal issues associated with animal biotechnology in traditional livestock species. Issues relating to biomedical research animals are not discussed, although some technologies using traditional farm animals (i.e., pigs, cows, and sheep) are included. On the one hand, the word "ethics" is associated with highly personal and subjective feelings or judgments. For many, ethical principles are grounded in religion or cultural tradition and depend on belief systems that are viewed as distinct from, or even at odds with, those of modern science. On the other hand, many specific ethical principles are common to almost all human cultures and traditions. Philosophical methods of analysis and

debate articulate the bases for cross-cultural agreement on many key ethical commitments understood to underlie a well-ordered society, and all of the world's major religions have endorsed the view that ethical dialog can be conducted both within and across theological traditions (Thompson 2007).

This paper begins with a review of animal biotechnology techniques, including some examples of how these techniques currently are being used. As of this writing, no animal biotechnologies are in widespread or general use for agricultural purposes, although experimental animals have been produced and reports note a few instances in which engineered or cloned animals may have been released, sometimes inadvertently, into the food chain. Following that discussion, key ethical issues raised in connection with animal biotechnology will be outlined, followed by an evaluation of the ways some religious traditions have viewed animals and speculative comments on how these views relate to animal biotechnology. This paper also summarizes public opinion research on the ethical issues associated with animal biotechnology as well as the current legal and regulatory framework for animal biotechnology. The concluding section evaluates how these multiple threads present both challenges and opportunities for the ethical development of agricultural animal biotechnology.

Animal Biotechnology Science

General Overview

During the twentieth century, scientists developed a number of techniques for manipulating DNA in cells. These techniques originated in research intended to understand better the role and function of genes in heredity, in the control of biological functions, and in disease. When combined with methods for regenerating organisms from single embryonic or other cells, these techniques can be used to create living plants and animals that have a specific genetic constitution. Genetic engineering is the alteration of an animal's traits through addition or subtraction of genetic constructs that control specific biological functions through the use of these new techniques for manipulating DNA. Cloning uses these techniques to create a cell that is a genetic copy of another cell.

For vertebrate animals used conventionally as food sources (e.g., cows, pigs, chickens, and fish), the ability to engineer embryonic cells genetically dates back to the 1980s, but difficulties in regenerating live animals from these cells have limited the usefulness of this process beyond pure research applications. In theory, however, this process could confer an ability to develop breeds or varieties of livestock with many novel traits. In fact, the theoretical applications of genetic engineering seemingly are bound only by the imagination. They include applications intended to limit both disease and clinical signs, to create animals that produce novel products in their milk or blood, to mitigate environmental impacts, and to lower the costs of livestock production.

Cloning of livestock embryos through a process not unlike that of "twinning" that occurs naturally also has been possible for several decades. But only in 1997 did it become clear that cloning might be used to regenerate animals from the DNA in cells from adult individuals of livestock species. As will be discussed, there still are challenges to accomplishing cloning of livestock species, but techniques have been developed that have practical applications. One key application is in conjunction with genetic engineering, where cloning is used to make the regeneration of genetically transformed animals less costly in time and money (Wilmut, Young, and Campbell 1998). Another application might be for livestock owners who wish to generate a clone of a particularly valuable individual animal.

The next section begins with a discussion of how genetics are used traditionally in animal breeding. It is followed by a considerably more detailed discussion of the DNA-based techniques that have been developed during the last 40 years, including a discussion of both known risks and possible beneficial applications of these techniques within the context of food animal production. Although this scientific discussion is critical for an adequately informed understanding of regulatory issues, readers interested primarily in ethical issues may choose to skim through discussions of the more complex technical issues.

Genetics in Conventional Animal Breeding Programs

The value of animal agriculture enterprises (poultry, livestock, and fish) in the United States was estimated at $173 billion in 2007 (USDA 2008), with the value expected to increase together with increases in both world population and standard of living (Pinstrup-Andersen and Pandya-Lorch 1999). Although techniques for cloning and producing transgenic animals are becoming more efficient, only commercial production of transgenic fish is poised to affect availability of animal protein in the near future.

Modern breeds of livestock have achieved high production efficiencies as a result of traditional animal breeding programs. Between 1945 and 1995, for example, milk production increased threefold; the number of eggs produced by laying hens increased from 134 to 254 per hen per year; production time of broiler chickens to 3 pounds (lb), 15.4 ounces (1.8 kilograms [kg]) body weight decreased from 84 to 43 days on one-half the feed; and growth of pigs, sheep, goats, and cattle was faster and resulted in leaner meat (NRC 2002, 2004).

These increases can be attributed to various factors depending on species and production systems, including

- the use of statistical models to predict breeding values of bulls coupled with sire testing and selection;
- cross-breeding and artificial insemination (AI) to capture the best genetics from males;
- synchronization of estrus and ovulation to enhance use of AI;
- superovulation, AI, and embryo transfer to take advantage of desired genetics from females;
- artificial incubation of eggs of poultry species to increase hatching rates;
- improved nutrition;
- effective disease control through improved animal health;
- control of seasonality or photoperiod to enhance production effi-

ciencies in specific species such as poultry;

- improved housing to avoid stress resulting from adverse effects of weather; and
- sex reversal in fish to either all female or all male to achieve desired production efficiencies in farm-raised fish.

Since the 1960s more advanced biotechnologies have been used to a limited extent. These biotechnologies include assisted reproductive technologies (in vitro maturation of *oöcytes*[1] and in vitro fertilization), embryo splitting to achieve identical twins (clones), sexing sperm, and *blastomere nuclear transfer cloning* (Norman et al. 2004).

Cloning

Cloning, a term originally used in horticulture to describe asexually produced progeny, is the process of making a copy of an individual or, in cellular and molecular terms, groups of identical cells and replicas of DNA and other molecules. Monozygotic twins are clones. Animal cloning in the late 1980s resulted from the transfer of nuclei from blastomeres of early cleavage-stage embryos to enucleated oöcytes, but it also can be achieved by transferring a nucleus from a *somatic cell* into an oöcyte from which the nucleus has been removed (Wilmut, Young, and Campbell 1998). Although there has been controversy over the validation of experimental results, *somatic cell nuclear transfer* has been used in experiments claimed to produce embryonic stem cells (i.e., undifferentiated stem cells genetically matched to the recipient for research and therapies for recovery of function that do not require reproductive cloning of animals).

The progeny from cloning using nuclei from either blastomeres or somatic cells are not exact replicas of an individual animal because of cytoplasmic inheritance of mitochondrial DNA from the recipient egg and other factors in the cytoplasm of oöcytes that may influence "reprogramming" of the genome of the transferred nucleus and subsequent development of the cloned organism (Cummins 2001; Jaenisch and Wilmut 2001). Cloning from blastomeres and somatic cells may result in large calves and lambs, the so-called "large offspring syndrome" (Sinclair et al. 2000; Young, Sinclair, and Wilmut 1998), as well as more serious abnormalities (Sinclair et al. 1999).

Cloning can be accomplished by (1) embryo splitting to achieve genetically identical individuals, (2) embryonic cell nuclear transfer, or (3) somatic cell nuclear transfer. With embryo splitting, the genome is established and the success rate for producing twins with identical genomic DNA is high. Embryonic cell nuclear transfer involves transfer of a nucleus from a cell in which the genome may be *totipotent* and requires little reprogramming for development of a new individual. Somatic cell nuclear transfer is problematic because the genome of cells of an adult animal requires that *cytoplasmic factors* from the recipient oöcyte reprogram the genome for development of a new individual(s).

Epigenetics is defined as influences on a cell that do not alter the genome, such as cytoplasmic factors of the oöcyte. Epigenetic reprogramming of the genome in nuclei of adult cells often is abnormal such that cells of the embryo and placenta express some proteins incorrectly. This incorrect expression often leads to high rates of embryonic, fetal, and neonatal deaths, as well as abnormal development of the placenta. The fetus and newborn also may suffer from an enlarged liver, hemorrhaging, and abnormalities of the respiratory, immune, nervous, and digestive systems (Young and Fairburn 2000).

Nuclear transfers resulting in calves whose meat and milk have entered the food chain have been from transfer of nuclei from cells of embryos. Through 2001, the number of registered Holstein clones that resulted from embryo splitting was 2,226 (754 males and 1,472 females), and 187 were from nuclear transfers (61 males and 126 females). On the basis of measures of total milk yield, fat content, protein content, somatic cell score, and productive life span, cows selected for cloning were superior genetically for milk yield, but the values for clones resulting from embryonic nuclear transfer and embryo splitting were similar to and slightly less than values for noncloned *full sibs*, respectively (Norman et al. 2004). Calves also have resulted from fetal fibroblasts (cells from fetuses), skin biopsies (cells from adults), and cumulus and granulosa cells (cells from adult ovaries and cells surrounding embryos, but not embryonic themselves). In fact, several companies specialize in producing nuclear-transfer-derived calves from skin biopsies sent in by their customers.

Cloning Animals for Animal Agriculture

Cloning livestock species for use in animal agriculture is for genotype replication; that is, to increase the number of males or females with a desired genotype and phenotype such as milk production. Cloning also may be used for genetic conservation of a unique animal that may, for example, be highly resistant to disease or parasites. Conservation of genetics of early ancestors of a species such as the Texas Longhorn or Criolla cattle from South America may be used to obtain animals for studies to understand the genetic basis for desirable traits.

Gene Targeting and Cloning for Expression of Proteins by Mammary Gland

Genetic engineering may be used to create animals such as goats and cows whose milk can produce valuable pharmaceuticals. The animal is genetically engineered to express a gene for a protein with pharmaceutical value only in milk, including enzymes and clotting factors (Colman 1996; Murray and Maga 1999). But this technology also can be used to produce many bioactive proteins or commercial products such as silk, using genes from spiders. Transgenic animals used as *bioreactors* to produce pharmaceuticals in milk likely would be cloned to replicate the desired genotype.

Somatic Cell Nuclear Cloning and Gene Targeting

Pigs are being genetically engineered so that their organs can be used successfully for organ-replacement therapies in human medicine (i.e., xenotransplantation) (CAST 2004).

[1] Italicized terms (except genus and species names) are defined in the Glossary.

Humans produce antibodies directed against *sugar moieties* present on the surface of pig cells (Sandrin et al. 1993), resulting in acute rejection of organs from pigs. Therefore, pigs are being engineered to silence appropriate functional genes for the sugar moieties (Lai et al. 2002) so that their organs can be used successfully for xenotransplantation. Pigs or other species used for xenotransplantation could be cloned to replicate the desired genotype, although they also could be reproduced by conventional breeding.

Cloning for Biomedical and Medical Research

Cloning has great value to researchers who study animals that have essentially the same genotype regarding their response to such issues as growth and development, aging, cancer, and various diets and nutrients. Animal models for biomedical research also include those with specific *gene knockouts* that mimic human disease (e.g., sheep carrying a mutated collagen gene can serve as a model for studies of human connective tissue diseases) (McCreath et al. 2000).

Position of Regulatory Agencies on Cloned Animals

In January 2008, both the U.S. Food and Drug Administration (FDA) (cattle, swine, and goats) and the European Food Safety Authority (EFSA) (cattle and swine) concluded that meat and milk from clones were safe. The FDA indicated that clones of cattle, swine, and goats and the offspring of clones from any species traditionally consumed as food are as safe to eat as food from conventionally bred animals. But they contended that they had insufficient information to reach a conclusion on the safety of food from clones of other animal species, such as sheep.

Ectopic DNA to Alter Phenotype

Biotechnology can provide methods for modifying the endocrinology of domestic animals to affect reproduction, lactation, and growth. Ectopic DNA, for example, refers to DNA introduced into muscle cells that will increase circulating levels of hormones such as growth hormone (GH) and insulin (Khan et al. 2002). This technology has been used in pigs and rats to increase circulation levels of GH and insulin-like growth factor 1 (IGF-1) in the mothers, which results in offspring that are heavier at birth and at weaning (Draghia-Akli et al. 2002). This is one example of the use of biotechnology to affect reproductive and endocrine systems during critical development periods, thereby enhancing growth and development of the fetus during gestation to ensure its survival and well-being as a newborn, and to enhance the mother's milk production.

Sperm-Mediated Gene Transfer for Production of Transgenic Animals

Sperm-mediated gene transfer is based on biotechnologies that allow DNA to be taken up by sperm and used in breeding programs to produce transgenic pigs (Lavitrano et al. 2006). This biotechnology is inefficient, as uptake of DNA and its expression ranges from 0 to 88%; it is attractive, however, because it is inexpensive and the transgene that is integrated is stable. The major disadvantages include random insertion sites of the transgene, the uncontrolled number of copies integrated into the genome, the effects of the transgene on other genes may lead to undesired effects, and the expression vector may have lethal effects on sperm or early embryos.

Biotechnology for Identifying Desirable Genotypes

Sequencing and mapping genomes of livestock allow scientists to identify genes and understand their regulation in the context of improving production characteristics and health of animals. One outcome is the establishment of linkages between inheritance of a desirable trait (e.g., milk yield) and segregation of specific genetic markers coupled to that trait. *Single nucleotide polymorphisms* (SNPs) are specific differences in DNA that can be used as gene markers to assist in selection of *quantitative trait loci* (QTL) responsible for the desired trait.

There are examples of QTL for production traits in cattle and swine. A QTL related to actions of growth hormone is expected to increase annual milk production by about 441 lb. (200 kg) per lactation and decrease milk fat from 4.4 to 3.4% (Pitman 2003). A QTL in pigs is associated with increased litter size and increased survival of piglets (King et al. 2003), and an SNP in beef cows is associated with growth traits and production of twin calves (Allan et al. 2007). Additional QTL and SNPs will have a large impact on the livestock industry. This technology can be coupled with biopsy and genetic analyses of embryos to allow selection of embryos with the desired genotype to enhance genetic progress in breeding programs. In addition, embryos can be sexed to benefit the animal production enterprise (e.g., all females for dairy farms), or semen can be sorted as X chromosome and Y chromosome sperm to achieve desired sex of offspring.

Ethical Issues Overview

The ethical issues associated with transgenic animals and mammalian cloning (as these techniques are applied to traditional food animals) fit into three broad categories. First are issues that pertain to the impact of this technology on the animals themselves. Second are issues that relate to the institutions and procedures that govern the research and applications context within the agrifood system. Finally, there are issues that relate to the relationship between humans and other animals; the way that humans think of or act in regard to nonhumans, irrespective of the effect that human conduct has on the animals. The underlying ethical principles within each of these three domains are distinct, and the following discussion will treat them as such. Yet arguably, the very diversity of these issues contributes to the sense that animal biotechnology challenges the moral order of society. It is therefore important to recognize that introducing this analytic framework may itself seem to impose a rational ordering on the discussion of animal biotechnology, undercutting concerns that are difficult to express

clearly but still may be the basis of negative reactions.

Impacts on Animals

Most cultural traditions have accepted the view that at least certain kinds of harm to nonhuman animals are morally significant. Traditionally, these views have stressed prohibitions of cruelty. Within recent decades, there have been attempts to articulate more carefully the basis for these views, and, in some instances, to introduce dramatic reforms in the way that ethical duties to animals are conceived. In particular, philosophers and animal advocates have inveighed against a view associated with Rene Descartes, who saw animals as "machines" without ability to register sensory impressions or feel pain. Although this view may have been quite influential in the biomedical sciences, Bernard Rollin, a professor of both philosophy and animal science, has argued that those who manage livestock for a living have never doubted that animals have subjectively felt needs and are capable of feeling pain. Effective husbandry always has recognized an implicit ethic that regards animals as moral subjects, but the terms in which duties to animals are specified remain largely unspoken within that ethic (Rollin 1989).

Three philosophical strategies have been proposed as a way to articulate the basis of ethical duties to animals. The animal welfare strategy usually is associated with the work of Peter Singer, a professor of bioethics. Singer argues that people should attempt a rough estimate of the pain or suffering in dealings with animals, then weigh this against the benefit derived. Practices in which benefits are offset by the suffering of animals are viewed as ethically unacceptable (Singer 1993). This approach generally is understood as a version of ethical utilitarianism.

The animal rights strategy associated with philosopher Tom Regan is intended to block this kind of trade-off reasoning by proposing that animals are wronged when they are treated simply as a means to an end, as a practice that justifies animal suffering in light of benefits derived presumably would do. Regan argues that animals possess a form of individual identity, coherence in their subjective experience that deserves ethical respect (Regan 2003). This view would prohibit any use of animals that is contrary to the interest of the individual animal, including many common agricultural practices such as the slaughter of animals for food.

Rollin also uses the term "rights" to convey the fact that people do regard themselves as having duties to individual animals, but he regards the basis for these duties as residing in a social consensus on moral duty, noting that whereas this consensus forbids certain exploitative practices without regard to the benefits derived, it nonetheless continues to find the use of animals for food to be morally acceptable (Rollin 1993). This third strategy can be called the new social ethic for animals.

Of these three philosophers, only Rollin has written extensively on animal biotechnology. He has argued that transgenic and cloning technologies would be ethically unacceptable if they resulted in greater animal suffering or frustration than would be experienced by animals of the same species and breed under similar husbandry (Rollin 1996). If there are no adverse impacts on individual animals, however, there is no basis for an ethical objection to animal biotechnology. It seems likely that Singer's animal welfare approach would reach a similar conclusion. Although an animal rights view might provide a basis for opposing experimental work on animals intended for human benefit, it is difficult to see how even this view could articulate an objection to successfully accomplished transgenic or cloning work, provided the resulting animals led functional and cognitively satisfying lives. Of course, an animal rights advocate might object to the research phase of animal biotechnology, and the objections would be supported by animal welfarists if the path to a successful transgenic or cloned animal involved its suffering.

Institutions and Procedures

As discussed more fully in the section on "Regulation of Animal Biotechnology," animal research in the United States is subject to the provisions of the Animal Welfare Act (AWA) of 1966. Although agricultural animals technically are exempt from the Act, the majority of both for-profit and nonprofit research organizations use the provisions of the Institutional Animal Care and Use Committee (IACUC) to oversee research. The IACUC committees are regarded widely as having an ethical as well as legal function. Applying a rough test commensurate at least with Rollin's new social ethic to projects involving animal biotechnology would be among these functions.

One of the key ethical questions associated with an IACUC is: Has the committee been constituted so that animal interests will be taken into account when experimental protocols are reviewed? Although U.S. Department of Agriculture (USDA) procedures for IACUC oversight require membership of nonscientists and unaffiliated parties (i.e., people who are not employed by the organization conducting the research), some organizations have recruited committee members who have a declared interest in ensuring that research goes forward (such as members of groups that advocate for specific disease cures), whereas others have appointed members from humane societies or other "pro-animal" groups. Arguably, the latter choice represents a more ethically appropriate way to discharge institutional responsibilities associated with IACUC procedures.

Currently, no comparable institutional approach governs the care and treatment of agricultural animals in production environments. But several trade organizations (such as the National Pork Board and the United Egg Producers), as well as large retail interests who buy animal products (such as the National Council of Chain Restaurants), currently are developing new entities and practices to address ethical issues associated with commercial animal production. These entities include advisory councils and the incorporation of ethical recommendations into husbandry guidelines that long have been promulgated by such groups. Because transgenic and cloned animals are, at present, rare within the context of commercial animal agriculture, these nascent institutional approaches have yet to consider the ethical issues that

are the subject of this Issue Paper. If and when transgenic and cloning applications become more common, it will be important that these emerging entities for animal ethics adjust their procedures to address issues relevant to biotechnology.

A final category of institutional issues addresses the need for consumers to retain the ability to lead lives consistent with the diverse values that exist throughout society. As other sections indicate, it is reasonable to expect that some individuals will resist animal products from genetic engineering or cloning, perhaps for religious or even arbitrary reasons. Is a food system ethically justifiable if it makes it impossible for people who have a strong preference for avoiding these products to do so? Here, the safety or animal health implications of biotechnology may be irrelevant to a given individual.

Yet, as discussed in the section on "Regulation of Animal Biotechnology," current regulatory approaches are unrelated to an individual's ability to make dietary choices based on personal values. The USDA Organic Standard may be the only recourse for such individuals, even though other aspects of organic food may be of little interest to them. As such, there are critical ethical questions about the institutional structure of animal products markets as they relate to an individual's ability to express values in animal product consumption decisions.

Relationships between Humans and Animals

Some of the most strident ethically based opposition to animal biotechnology focuses on the ways modern technologies have caused the traditional relationship between humans and farm animals to change. The willingness to deploy techniques such as genetic engineering and cloning in research programs that change, in some views dramatically, both the nature of animals and the way they are used can be seen as ethically problematic in this light. Researchers' attitudes then are viewed as a form of domination, pride, and manipulation, even when no individual animals are harmed. Here, the ethical focus is on the moral character of the people or the society that undertakes these projects rather than on the ethical acceptability of what is done to the individual animal. Thus, whereas an animal rights view would object to any practice that sees the animal merely as the means to an end, the objection here is focused more on the venality or corruption of character either within the scientific and animal production community, or perhaps within society at large.

Sheila Jasanoff, professor of science and technology studies, has characterized this type of ethical issue as a challenge to society's moral order. She sees religiously based objections that characterize genetic engineering as a form of "playing God" in similar terms. The point is not that this science violates specific religious precepts. Rather, the point is that human beings have set themselves and their interests so far above those of the creatures in their care as to have violated implicit expectations that frame our understandings of civility, humility, grace, and charity. The specific scientific interventions may be less characteristic of this ethical failing than is an overall attitude or manner of conduct regarding the development and governance of the technology. The fact that regulatory agencies are unable to intervene against specific technologies deemed to meet standards of animal, human, and environmental health can be interpreted, in this regard, as part of a general societal failure to regulate human conduct in light of moral expectations (Jasanoff 2007).

Here, too, the large scale and automation of husbandry associated with concentrated animal feeding operations (CAFOs) is undoubtedly a component of the concern. Although CAFOs currently in use do not in any way use biotechnology, they are the end result of scientifically based studies on animal nutrition, reproduction, and husbandry, combined with principles of agricultural engineering. As such, it is not unreasonable for someone not personally involved in science or animal agriculture to perceive a pattern of change in livestock production and to interpret developments in animal biotechnology as elements in this broader pattern. Thus, without regard to whether biotechnology will improve or materially affect the welfare of animals within a CAFO system, it is possible, particularly given no reason or evidence to draw a contrary conclusion, for a member of the public to associate ethical concerns with the general drift of science-based animal husbandry, and to see animal biotechnology as a particularly cogent example of this drift.

Religious Views on Animal Biotechnology

Among the world's largest religions, there are actually very few clear-cut religious taboos prohibiting transgenic and other animal technologies. Religions typically draw on traditions involving several centuries of religious teachings. Because biotechnology is a creation of recent decades, it is not surprising that traditional religious sources do not address it directly. Ethical implications of religious traditions, however, can be drawn from the general role and status of animals within the religious tradition, as well as from traditions that address animal care and use, animal breeding, and human diet. On a few occasions individuals or groups representing religious traditions have issued opinions on the ethics of animal biotechnology, although even these opinions are understood as advice to religious authorities rather than as definitive pronouncements.

Western Religions

The traditional approach of many Western religions—those based on Christianity, Judaism, and Islam—permits animal biotechnology because humans are the instruments through which God works toward bringing creation to final perfection. Whereas animals are God's creatures and have their own moral value, they are at the service of men and women, so that humans also can achieve their overall development through them. Humans cannot use animals indiscriminately, but if animals are used to provide a significant human benefit, that use is permissible. Thus, creating and using animals through biotechnology is permissible as long as the need is sufficient and animal welfare is respected. But this view is balanced by

other considerations. Some religious leaders in all three major Western religions have opposed animal biotechnology as an impermissible usurpation of God's role as Creator. Other leaders have opposed some aspects of biotechnology because of its potential threat to biodiversity or "the integrity and ecological balance of creation" (UMC 1992).

The result is that there is no consensus about general permissibility of animal biotechnology within Western religions and even within denominations. For example, Jewish theological reaction to cloning animals has been mixed, although cloning generally raises fewer issues than transgenics because cloning does not involve mixing species. In Islam, Shiite leaders generally have been more open to animal biotechnology than Sunni leaders, but even within sects there has been considerable division. The Church of Scotland, which has studied aspects of animal cloning extensively, supports the use of animal biotechnology for therapeutic purposes, but rejects uses of animal cloning for meat and milk production as an inappropriate commodification of animals (Church 2002).

Although there has been little specific religious discussion about the implications of animal biotechnology and even less joint discussion, American religious leaders acted with one voice opposing the patenting of genetically engineered animals. In May 1995, a group of religious leaders representing more than 80 faiths and denominations joined Jeremy Rifkin, an economist who has attacked expansion of biotechnology through patent law, in a press conference denouncing the patenting of genetically engineered animals, and human genes, cells, and organs. Their statement said: "We believe that humans and animals are creations of God, not humans, and as such should not be patented as human inventions" (Crawford 1987). The statement did not take a stand on the permissibility of genetic engineering itself, nor did the overall group oppose patents on techniques involving genetic manipulation. Although the statement garnered considerable media attention, it did not have any impact on American patenting law.

Eastern Religions

Eastern religions such as Buddhism, Hinduism, and Confucianism do not use the concept of animals in the service of humans. Instead, these religions give animals a moral status that often is almost equal to that of humans. Humans have a higher status only to the extent that they are more capable of achieving the philosophical ideals of spiritual wisdom and liberation. For Hindus, incarnations of the Gods include animal forms (Crawford 2003). Both Buddhism and Hinduism have a belief in cross-species reincarnation. Most Eastern religions embrace the idea of continuing evolution of humans, animals, and plants as an ideal, and the fact that such evolution is man-made is not a barrier.

There also is a pervasive notion, however, that there must be a balance of nature in human, plant, animal, and environmental interactions (Epstein 1998). This interpretation means that animal suffering would be balanced equally against human benefit (Crawford 2003). But there is no consensus among scholars of Eastern religions about the religious permissibility of animal biotechnology. Some religious scholars believe technology can be used on an animal only to benefit that animal, and most biotechnology is a violation of that principle (Epstein 1998). Other scholars believe that animal biotechnology may be used if it is necessary for life but not to enhance pleasure (Crawford 2003).

Asian religious traditions notably are distinct from Western traditions in the breadth and variety with which ethical teachings are interpreted by practitioners of the faith tradition. Thus the key ethical questions about animal biotechnology from the Asian perspective may have less to do with the ultimate permissibility of genetic engineering or cloning than with whether practitioners of a particular variety or sect within a faith tradition have had ample opportunity to discern how and whether the technology is relevant to the often-complex dietary and household practices believed to affect fate and fortune. As such, information about animal biotechnology and the opportunity to study the implications of transgenic or cloned animals may be deeply important to these traditions, even when no specific prohibitions are made.

Views on Food Use

There are specific religious concerns involving food use of animal biotechnology. For example, most Hindus attempt to be strict vegetarians, and there could be concerns about the extent that animal DNA is mixed in with genetically modified (GM) plants. Because Hindu bioethics is concerned with sentient life rather than DNA, however, this concern seems diminished. Both Jewish law and Islamic law have food restrictions that may be affected by biotechnology. Although the U.S. Islamic Jurisprudence Council has ruled that GM plants currently on the market that may contain animal genes are permissible, or halal, the permissibility of foods using genes derived from swine or more significant species mixing has not been determined (Mirza 2004).

Jewish kosher rules also are unclear when it comes to transgenic animals; the use of transgenic animals with some genetic mixing, even swine, has been found acceptable for food use as long as the genetic change is not visible to the naked eye (Reisner 2000). Jewish law also includes the prohibition kilayim, which forbids the mixing of different species of animals and plants. Kilayim forbids the act of mixing species, but does not forbid receiving the benefits of that mixing. Moreover, Jewish law has been interpreted to mean that the act must be a sexual act, which would exclude in vitro laboratory genetic manipulation.

Public Perceptions of Animal Biotechnology

Animal biotechnology has been expanding rapidly in the last three decades. Public perceptions have played, and will continue to play, a significant role in the development and commercialization of its applications. Technologies do not develop in a vacuum; rather, their trajectories take place within a cultural context. This context includes public opinions that, like other social factors, can play a role in the pace and direction of technology development.

Public Opinion Studies

Two key questions can be gleaned from public opinion studies on agricultural biotechnology generally, and on animal biotechnology particularly. These questions underlie the views of many publics: What is the purpose for the specific application? How is the work carried out? Many public opinion studies reveal a fairly consistent hierarchy of purpose: Applications intended to generate health and medical benefits are viewed most positively, followed by applications with environmental benefits. European surveys have found a consistent ordering, in decreasing favorability, for "genetic testing for heritable diseases; drug production using bacteria modified to contain human genes; bioremediation using GM bacteria; medicinal human cell or tissue cloning; use of plant genes in GM crops; animal cloning to produce drugs in their milk; and for producing foods to make them higher in protein, keep longer, or change the taste" (Gaskell 2000). The percentage of survey respondents seeing usefulness ranged from 83% to 54%, and moral acceptability from 74% to 36%.

The way research is carried out—including the object of manipulation—also influences public perceptions. In this regard, public acceptability also exhibits a hierarchy. Work on microorganisms generates the least concern, followed by work on plants. More objections are registered for genetic modification of animals (Frewer and Shepherd 1995; Frewer, Howard, and Shepherd 1996; Hoban 2004). Whereas approximately one in five persons in the United States thinks that creating hybrid plants through genetic modification is "morally wrong," more than half feel that way about GM animals (Hallman et al. 2002). This disapproval of GM animals seems to cut across gender, age, and educational categories among Americans, although more women than men have expressed disapproval (Table 1). Although health and medical benefits provided by genetic modification are supported most frequently, that support sometimes is modulated by how the benefits are obtained. For example, U.S. and Canadian respondents view drugs and vaccines produced through animals less favorably than drugs and vaccines produced through plants (Decima 2004).

Table 1. Acceptance of plant-based and animal-based genetic modification, by gender, age, and education (adapted from Hallman et al. 2002)[1]

	Approve (percentage)		Disapprove (percentage)		Unsure (percentage)	
	Plant	Animal	Plant	Animal	Plant	Animal
Sex						
Male	65	36	32	59	4	5
Female	53	21	40	74	7	5
Age						
<35	63	31	34	65	3	4
35–54	56	27	38	67	6	6
55+	55	21	37	71	8	8
Education						
High school graduation or less	51	24	43	73	6	3
Some college	65	27	31	66	4	8
College graduation	64	36	29	59	7	5

[1]Note: "Approve" includes those who "strongly" and "somewhat approve"; "Disapprove" includes those who "somewhat" and "strongly disapprove." N=1203. Question: "In general, do you approve or disapprove of creating hybrid (plants) animals using genetic modification?"

These opinion patterns are similar internationally. Consumers in 10 countries were surveyed about different biotechnology uses. More than 80% supported using biotechnology to develop human medicines; 75% supported using biotechnology for environmental clean-up. Slightly more than 50%, however, indicated support for GM animal feed that resulted in healthier meat products, whereas 40% supported the use of cloned animals for medical research. It is noteworthy that almost 75% of consumers in these 10 countries opposed the genetic modification of animals to increase productivity (Hoban 2004).

There are additional nuances to public views on animal biotechnology that need to be considered, including the moral status of animals. The advocacy of animal rights and animal welfare groups and the incorporation of pets as part of the family circle have made the status of animals a mainstream concern (AEBC 2002). Investigations into public views on animal experimentation, for example, have shown that people are concerned with (1) knowing the purpose of the experiment, (2) avoiding potential unnecessary suffering of the animals, (3) ensuring that requirements for protecting animal welfare are met, and (4) determining whether alternatives are available (AEBC 2002; Knight 2007).

A second concern is the boundary between what is considered "natural" and "unnatural." Many people feel that the crossing of species' boundaries is unnatural, and this cross-species work becomes especially problematic when higher life forms are involved (AEBC 2002; Gaskell 2000; Hallman et al. 2002; Verhoog 2003). The process of genetic engineering also is associated with images of the "unnatural." A third concern relates to the consequences of genetic modification, particularly the long-term impacts of GM crops and animals on human health and the environment.

Public Awareness

In general, public awareness of plant and animal biotechnology is low, although more people are aware of biotechnology in plants than in animals (Table 2). The majority of Americans—at least two-thirds—are unaware that foods produced through biotechnology currently are in the supermarket

Table 2. Americans' awareness of plant and animal biotechnology (IFIC 2007)

	Plant Biotechnology (Percentage)	Animal Biotechnology (Percentage)
Heard or read about		
Some—A lot	37	22
Little or nothing	63	78
Overall impression		
Somewhat—Very favorable	33	24
Neither favorable nor unfavorable	30	26
Not very—Not at all favorable	18	23
Don't know	19	27

(Hallman et al. 2003; IFIC 2007). An International Food Information Council survey asked about three approaches to animal biotechnology: (1) genomics ("animal biotechnology that uses knowledge about the genetic make-up of animals to aid in conventional breeding and selection"); (2) genetic engineering ("animal biotechnology that allows us to move beneficial traits from one animal to another in a more precise way"); and (3) cloning ("animal biotechnology that retains desirable traits by producing an animal that is an identical twin"). The numbers of respondents who were at least somewhat favorable were 40, 35, and 22%, respectively (IFIC 2007), suggesting that cloning still may be associated with the negative side of biotechnology (Einsiedel 2000).

Influencing Factors

Certain factors help to explain perceptions and attitudes toward applications of agricultural biotechnology. The risk–benefit calculus is certainly one influencing factor. Some studies have found that it is the perception of benefits that acts as an important decision rule, leading individuals to determine whether perceived risks are more or less significant (Gaskell et al. 2004; Knight 2007). It also is important to note that quite often, publics do not always interpret risk and benefit in purely utilitarian terms. "In the public mind, risks go beyond issues of health to include moral hazards (is it right to do this?), democratic hazards (who is funding and controlling biotechnology?), and uncertainties (will there be as-yet-unknown adverse consequences?)" (Gaskell et al. 2003; Marris et al. 2001).

Another factor that has some influence on public views is knowledge or understanding (Allum et al. 2008). Significantly, the explanatory role of knowledge is not as simple as "information acquisition leads to acceptance." Depending on the application, more knowledge can indeed influence opinions—sometimes in the direction of more positive attitudes and sometimes in the direction of a negative or more precautionary stance (Hallman et al. 2003; Scholderer and Frewer 2003).

One of the more consistent predictors seems to be trust in the managers of a technology, including its regulators (Hornig Priest, Bonfadelli, and Rusanen 2003). A study of consumers in five European countries demonstrated that "proactive consumer protection" was related positively to consumers' evaluation of food risk management quality, whereas "opaque and reactive risk management" was related negatively to food risk management quality (Van Kleef et al. 2007).

Regulation of Animal Biotechnology

When the biotechnology industry became an economic reality in the early 1980s, the White House Office of Science and Technology undertook a study to determine how science and industry should be regulated. In the *Coordinated Framework for Regulation of Biotechnology*, it was determined that the new technology was not inherently risky and could be integrated into existing statutory and regulatory structures under the auspices of the FDA, the Environmental Protection Agency (EPA), and the USDA (Coordinated Framework 1986). These agencies derive their regulatory authority from an assortment of statutes,[2] none of which anticipated the specific issues of biotechnology. As a result, there are gaps in—and overlaps of—authority, as well as considerable ambiguity.

Regulatory Responsibility

Animal biotechnology primarily is regulated by the FDA and the USDA. The FDA is responsible for food safety issues for food animals created through biotechnology and for drug safety issues for transgenic and otherwise modified animals used for pharmaceutical production. The USDA, through the Animal and Plant Health Inspection Service (APHIS) and the Food Safety and Inspection Service, regulates food products created by animal biotechnology. Until recently, the FDA was the sole agency responding to issues regarding animal transgenics, but that responsibility now is being shared with APHIS, whose role may grow. Nonetheless, although the APHIS Biotechnology Regulatory Services considered new regulations for transgenic animals as part of an initiative dealing with all genetically engineered organisms (USDA–APHIS 2009), the FDA took the lead role with guidelines issued in January 2009 (USFDA–HHS 2009). The FDA also determined that meat and milk from cloned cattle, swine, and goats are as safe to eat as those from conventionally produced animals (USFDA–HHS 2008). Although animal biotechnology may raise environmental issues, the EPA currently

[2] Animal Health Protection Act of 2002, United States Code, vol. 7, sec. 8301-8320; Animal Quarantine Laws, United States Code, vol. 21, sec. 101-135; Animal Welfare Act, United States Code, vol. 7, sec. 2131-2159; Egg Products Inspection Act, United States Code, vol. 21, sec. 1031-1056; Federal Meat Inspection Act, United States Code, vol. 21, sec. 601-691; Food Drug and Cosmetic Act, United States Code, vol. 21, sec. 301-399; Health Research Extension Act, United States Code, vol. 42, sec. 201-300gg-92; Public Health Service Act, United States Code, vol. 42, sec. 262, 264; Poultry Products Inspection Act, United States Code, vol. 21, sec. 451-471; Virus, Serums and Toxins Act, United States Code, vol. 21, sec. 151-159.

does not regulate in that domain; environmental assessments of specific products are undertaken by the FDA.

Product-versus-Process

In determining the use of existing statutory and regulatory structures to regulate biotechnology, the Coordinated Framework also essentially determined the focus of the regulatory review. Because U.S. regulators do not view the process of biotechnology to be inherently risky, generally only the products of biotechnology are regulated. This product-versus-process distinction is based on the fact that a significant amount of American federal law regulating biotechnology draws its jurisdictional authority from the commerce clause. For example, under the Food, Drug and Cosmetic Act (FDCA), the FDA's authority to regulate the use of animals for food or pharmaceutical use may be limited to "articles" whose commercial distribution the FDA can regulate (FDCA 2006). The FDA's legal authority to regulate those articles is grounded in its power to regulate their distribution in interstate commerce. Hence, the process is implicated only to the extent it affects the final product.

"Animal Drug" Regulations

The FDA bases its authority to regulate genetically engineered animals under the FDA's "animal drug" regulations, because like a drug, the engineering is intended to "alter the structure or function" of the animals (Pew Initiative 2004). This involves stretching the statutory definition considerably because the FDCA implies that drugs work through chemical action, and unlike a typical drug, the engineering continues beyond the affected animal to its progeny (FDCA 2006; Pew Initiative 2004). Thus, at the very least, the FDA's authority under this rubric is questionable. The Supreme Court, however, has allowed fairly broad interpretations of FDCA drug definitions when the FDA has sought regulatory authority over some segments of the industry (*United States* 1969). Moreover, the FDA's assertion of authority is unlikely to be challenged, as the biotechnology industry has embraced the animal drug rubric because it is anxious to have regulations in place to ensure consumer acceptance and promote growth of the industry (Gottlieb and Wheeler 2008).

This regulatory focus on products rather than process has ethical ramifications. Other than in issues raised by the AWA, which is itself limited, much ethical review does not occur until a product is far along in the development process, and most of that ethical review tends to be about whether the article is safe for its intended purpose. Thus, the discussion does not focus on whether cloning, genetic engineering, or other biotechnologies are appropriate methods—or even whether the resulting products are socially or economically valuable or ethically appropriate—but rather on whether the products are safe for use, or "generally recognized as safe" (GRAS).

Postmarket and Labeling Regulations

Once a product created by animal biotechnology comes to market, it is subject to FDA and APHIS labeling requirements. These requirements, however, center on the function of the product rather than on the method whereby it was created. In food biotechnology, a product that is considered GRAS and substantially equivalent to food products already on the market is not required to be labeled. Thus, the FDA rejected labeling requirements for milk products derived from cows given *recombinant bovine somatotropin* (rBST), and the FDA Risk Assessment considering food products derived from cloned animals or their progeny also does not recommend labeling the products as such. The exception to this pattern may be irradiated foods, but the FDA's contention there is that the irradiation at least minimally modifies the food. Moreover, the FDA recently has recommended that labeling requirements for irradiated foods be relaxed (Irradiation 2007). Foods created through genetic engineering that changes the animals' genome, however, would not be substantially equivalent, and those products presumably would be subject to labeling requirements.

To date, attempts to have state laws label food created through biotechnology as such have failed. The U.S. Court of Appeals for the Second Circuit rejected an attempt by Vermont to require rBST milk products to be labeled (*International Dairy Foods* 1996). That decision, however, may be flawed, and new attempts through federal or state statute to label food derived through cloning methods may be successful. The ethical question implicated by such labeling is whether consumers have a right to know, apart from FDA safety assessments, the process by which food is manufactured. But supporting such a right to know causes other problems. On one hand, transparency is an ethical goal; on the other, labeling could needlessly frighten or confuse consumers. The FDCA currently does not give the FDA authority to consider that question; FDA's authority is limited to safety issues.

It is not clear what kind of postmarketing requirements the FDA can impose on biotechnologically derived animal production. The FDA has secured voluntary commitments from product sponsors to conduct postmarket research on rBST (Pew Initiative 2004), but it is uncertain whether the FDA has authority to require such research. In addition, it is not clear what kind of tracking systems the FDA or APHIS can impose on GM animals. Several companies engaged in livestock cloning have introduced a tracking system for cloned livestock and their progeny, but that program is voluntary (Pollack 2007). Under current law, neither agency has authority to regulate all animals that might be used under that technology; therefore, there are certainly potential gaps.

Animal Welfare and Institutional Animal Care and Use Committees

The AWA regulates the treatment of animals used in experimentation by research facilities that receive federal funds or transport live animals in interstate commerce. The word "animal" includes warm-blooded animals such as dogs, cats, nonhuman primates, guinea pigs, and rabbits; but excludes birds, rats, mice, and farm animals used for food or for improving animal nutrition, breeding, management, or production efficiency, or for improving the quality

of food or fiber (AWA 2006). Thus, depending on how broadly that definition is interpreted, quite a few animals used in biotechnology may be excluded. The AWA is enforced by the USDA, a fact that has a certain irony, given that many of the animals that fall under the USDA's traditional scope are not included in the Act's definition.

The AWA requires research facilities to create IACUCs (AWA 2006) to inspect animal care facilities and to review experimentation and care of animals. The IACUCs must have at least three members, one of whom must be a veterinarian, and another who may not be associated with the institution. The legislative history of the AWA encourages the use of the ethical construct of the "three Rs": Reduction in the number, Refinement of techniques, and Replacement (*Congressional Record* 1991; Russell and Burch 1959). Institutions that receive federal funding for their research are subject to additional broader guidelines (PHS 2002), and many entities choose to seek accreditation from the Association for Assessment and Accreditation of Laboratory Animal Care (AAALAC).

Importantly, although the AWA does set standards for the use of animals in experimentation, it does not regulate the purpose of experimentation (AWA 2006). Thus, under the AWA, an IACUC's ethical review is limited considerably. For example, because of the three Rs construct, IACUCs may determine that an experiment is impermissible because of redundancy (i.e., other similar or identical experimentation already has tested a hypothesis such that additional use of animals is not ethical). Similarly, IACUCs will make sure that animals born with considerable deformities are euthanized. IACUCs may not determine, however,—beyond the humane requirements of the AWA—that a cloning or genetic engineering technique is unethical. If that review occurs, it occurs outside the IACUC rubric, and usually only because the research facility has voluntarily elected to do so.

European Union

In contrast to the American approach to biotechnology, European regulators view biotechnology as "a novel process requiring novel regulatory provisions" (Gaskell et al. 1999). The European Medicines Agency is responsible for the approval of pharmaceuticals derived through animal biotechnology, and the EFSA is responsible for approval of food derived from animal biotechnology. The interaction of these agencies and member states is beyond the scope of this paper. Some directives are required to be passed into legislation by member states, and some issues, especially those with moral implications, are left to member states' discretion. In certain circumstances, member states also may require stricter regulation than required by the European directives.

Pharmaceutical or other biomedical use of biotechnology is much less controversial in Europe than food use, and the level of regulation reflects that attitude (Gaskell et al. 2006). There is also only a tiny industry involved in food biotechnology. For example, until recently, only Spain was truly involved in genetically modified organism (GMO) plant production. Therefore, many GMO regulations actually are directed at importation of GMO products, and this focus has had an important effect on the evolution of the regulation.

Regarding regulation of food biotechnology, the EFSA is responsible for scientific risk assessment; risk management policy is handled by the European Parliament and member states (Podger 2004). That division of labor insulates the scientific assessment from political meddling. Directive 2001/18/EC regulates the distribution of GMOs and GMO use in food products, but there are no specific European regulations for food products derived from biotechnology, such as cloning that does not involve genetic modification. No distinction is made between animal or plant products (Directive 2001).

Directive 2001/18/EC requires notification before a GMO is placed on the market. The Directive also provides for a period of public comment; an assessment report, including an environmental risk assessment; and a "step-by-step" introduction into the market. Each step requires additional assessment and evaluation. The Directive also requires that each GMO product be labeled with the words "This product contains genetically modified organisms." Postmarket monitoring also is required, including complete traceability and immediate adverse event reporting.

Directive 2001/18/EC resulted in a European Union (EU) moratorium banning importation of all GM products. The Directive adopted a precautionary approach allowing for such a ban if there was a potential risk to human health or the environment. Because the trigger for a moratorium required only a potential risk rather than a proven risk, such a moratorium was an almost certain consequence of the language of the directive. In response, the United States and Argentina filed a complaint with the World Trade Organization (WTO), and the WTO ruled against the European ban. The EU has chosen not to appeal the WTO ruling, and there are some indications that EU citizens are poised to embrace biotechnology more fully (Gaskell et al. 2006; Zika et al. 2007). Whether that new enthusiasm will extend to food use of animal biotechnology remains to be seen.

Interestingly, the process taken by the EU does not mean a broader ethical review of biotechnology. Instead, at least so far, the process approach combined with the precautionary principle simply means that the technology does not go forward or importation is refused. The specific ethical debate still becomes kindled only when a product is about to be commercialized.

China

China currently is the sixth largest producer of GM crops, and its government has made a strong commitment to both plant and animal biotechnology. Animal biotechnology in China is governed primarily by three agencies: the Ministry of Health, the Ministry of Science and Technology, and the Ministry of Agriculture. A review of regulation in China is particularly difficult because there is relatively little formal legislation in the Western sense. But the government will affect patterns of practice significantly through funding initiatives as well as through informal means such as the cultivation of expectations and a cultural climate

(Döring 2004).

Although there are regulations regarding human cloning (Leggett 2003), there are no specific regulations regarding animal cloning. The human cloning regulations specifically ban research for human procreation, but they leave open virtually all other research. Generally, research endeavors are controlled much more lightly than clinical or commercial applications. An attempt to formally regulate animal welfare was abandoned in 2004 (Li 2004). New efforts to do so recently have begun, but no regulations have been proposed yet.

The most extensive regulation is centered on biosafety issues. Animal biotechnology that involves genetic modification is governed by six instruments that apply equally to plants and animals: A State Council of China general regulation on biosafety of GMOs, four Ministry of Agriculture decrees, and complementary customs regulations (Connor, Boucher, and Li 2006). These regulations require a full risk assessment of food safety and environmental impact for both importation and production of GMOs (Wang 2007). Labeling requirements reflect an approach that is at least partly process based. Although all these regulations formally apply to animals, there are few indications of enforcement; almost all enforcement involves plant importation and production.

Despite apparently conservative ethical thinking regarding human reproductive cloning (Döring 2004), it probably is fair to say that the Chinese government takes a very liberal stance regarding biotechnology ethics. There is little regulation of research, but there is considerable funding support and positive media reporting on technical achievements. The public shows little opposition (Yang 2004).

International Protocols

There are two main international protocols that affect animal biotechnology. The Codex Alimentarius Commission (Codex) and the Cartagena Protocol on Biosafety to the Convention on Biological Diversity. The Codex, jointly administered by two United Nations agencies—the World Health Organization and the Food and Agriculture Organization—sets international safety standards for foods. Before a food produced by biotechnology can be marketed, it is subjected to a pre-market assessment that evaluates both the direct and unintended effects on food safety and nutritional aspects that might arise because of the use of technology (Codex 2003, 2007). Although it is a thorough risk assessment of the food safety issues, the Codex does not address the environmental, ethical, moral, or socioeconomic impacts of the technology.

The Cartagena Protocol on Biosafety to the Convention on Biological Diversity primarily is an environmental treaty (Cartagena 2000). Its main purpose is to protect biological diversity from risks posed by "living modified organisms" (LMOs), taking into account potential risks to human health. Although the Cartagena Protocol thus far primarily has focused on plant biotechnology, its definition of LMOs equally encompasses animals. The protocol adopts a precautionary approach; if a potential but not yet scientifically proven risk might exist, that potential risk may be used as a reason to limit the importation or use of an LMO. There are 157 parties to the Cartagena Protocol, including most European countries and China.[3] The United States and Australia are not parties.

Conclusions

Decisions about the development and use of animal biotechnology can be based on multiple factors. Knowledge of the science of animal biotechnology is needed to understand exactly what animal biotechnology involves and to appreciate its possible areas of applicability. Philosophical reflections on the moral significance of animals can inform the way applications of genetic engineering are evaluated, with respect both to their impact on animals and to the way that attempts to modify and control animals are viewed from an ethical perspective. A review of religious traditions of animal use highlights specific applications of biotechnology that may arouse sensitivities among adherents of those traditions. Social science research on the public's attitudes toward animal biotechnology illuminates the way that philosophical or religious attitudes toward animals and biotechnology may be reflected broadly throughout the public. This kind of research can be used in making inferences about those applications of biotechnology that are most likely to spark opposition or consumer resistance.

When science, ethics, religion, and social science are viewed concurrently in light of previous attempts to regulate animal biotechnology, it becomes apparent that society is struggling to develop public policies that appropriately reflect the diverse set of considerations that bear on applications of animal biotechnology in agriculture and the food system.

This review paper does not prescribe rules or principles that should be applied in making decisions about animal biotechnology. Its purpose has been to highlight some of the considerations that might be taken into account when decisions are made about genetic engineering or cloning of agricultural or food animals. No precise method for drawing simultaneously on science, ethics, religious tradition, public opinion, and legal practice has been specified. There have been relatively few formal efforts to bring these domains of human practice into dialogue for animal biotechnology. It is the authors' belief that decision making will be improved if more frequent and sustained efforts to consider and reflect the full range of ideas represented in this paper are undertaken in the future.

Glossary

Bioreactors. Animals used to produce pharmaceuticals or commercial products such as silk, usually by the mammary gland.

Blastomere nuclear transfer cloning. A cloning method using the nucleus from a cell from embryos at the blastocyst or earlier stage of development.

[3] For a list of the status of the ratifying Parties, see The Convention on Biological Diversity, Parties to the Convention on Biological Diversity, Cartagena Protocol on Biosafety, http://www.cbd.int/information/parties.shtml.

Cytoplasmic factors. Factors in that portion of a cell outside the nucleus.

Full sibs. Offspring from mating between the same sire and dam.

Gene knockouts. Individuals in which a gene has been rendered nonfunctional.

Oöcytes. Unfertilized eggs ovulated from ovarian follicles.

Quantitative trait loci. Regions of a chromosome with a genetic marker associated with a desired production trait (e.g., milk yield).

Recombinant bovine somatotropin. A hormone produced by microorganisms such as bacteria or yeast into which the gene for bovine somatotropin or growth hormone has been introduced.

Single nucleotide polymorphism. Variation in one or more nucleotides at a specific region of DNA; these may be associated with genes for differences in appearance or performance characteristics of an individual.

Somatic cell. A cell of an organ or tissue of the body that is not a gamete, i.e., sperm or oöcyte, or precursor cell of a gamete.

Somatic cell nuclear transfer. Cloning by using the nucleus taken from a fetus or an animal post-birth.

Sugar moieties. Sugars such as glucose and galactose attached to a protein that in some instances are required for biological activity.

Totipotent. A nucleus with genes capable of encoding for a fully developed offspring when transferred into an enucleated oöcyte.

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4. A. World and U.S. population growth: How can we feed everyone?

Jeff Simmons, Elanco Animal Health
Presented by William Weldon

TECHNOLOGY'S ROLE IN THE 21ST CENTURY:

Food Economics and Consumer Choice

Why agriculture needs technology to help meet a growing demand for safe, nutritious and affordable food

Jeff Simmons, Elanco Animal Health
Presented by Bill Weldon at CAST Symposium, June 2010

Introduction

Today there are nearly 1 billion hungry people around the globe. Yet in only 50 years, our growing global population will require an estimated 100 percent more food than we produce today. Unfortunately, we will certainly not have 100 percent more high-quality land available to grow twice the amount of grain or two times more livestock. The U.N. Food and Agriculture Organization (FAO) reports that added farmland will help produce only 20 percent of the additional food our planet will need in 2050, and 10 percent will come from increased cropping intensity. Accordingly, the FAO concludes that 70 percent of the world's additional food needs can be produced only with new and existing agricultural technologies.

The consequences of failing to use these science-based technologies and innovations will be disastrous. Food producers in industrialized and developing nations alike require technology to ensure a sustainable supply of safe, nutritious and affordable grains and animal protein to satisfy a rapidly growing demand. For this reason, and many others, we all share in the responsibility to ensure that new agricultural technologies—as well as those proven safe and effective over decades—continue to be available.

Key Data

In **50** years, the world **population** will require ▶ **100%** more **food,**[1] and ▶ **70%** of this food must come from efficiency-improving **technology**[2]

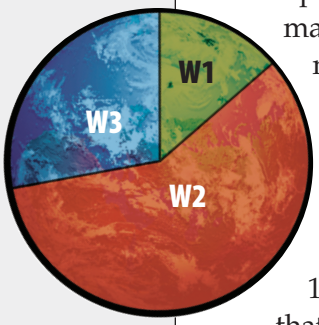
Executive Summary

- The U.N. projects world population will reach 9+ billion by mid-century and has called for a 100 percent increase in world food production by 2050. According to the U.N., this doubled food requirement must come from virtually the same land area as today.
- The U.N. Food and Agriculture Organization (FAO) further states that 70 percent of this additional food supply must come from the use of efficiency-enhancing technologies.
- Driven by food production efficiency, agriculture can achieve the *"ultimate win"* for consumers worldwide — affordability, supply, food safety, sustainability and ample supplies of grain for biofuels. Three key concepts — *collaboration, choice* and *technology* — emerge as the pathway to this success.

Feeding Our 3 "Worlds"[9]

Economists classify our world into three socioeconomic groups:

First World (W1): Affluent, industrialized nations and regions including the United States, Western Europe, Japan, South Korea and Australia.
Total estimated population, 2008: < 1 billion.



Second World (W2): Nations where the key challenge is balancing resources and needs; these include China, India, Eastern Europe and Latin America.
Total estimated population, 2008: 3-4 billion.

Third World (W3): Nations that are consistently in dire straits, such as Bangladesh, Haiti and most of Africa.
Total estimated population, 2008: 1-2 billion.

Population estimates used for this graphic:
W1 = 0.9B, W2 = 3.8B and W3 = 1.8B

Will global population growth outpace our ability to meet the demand for food?

Some argue it already has. In December 2008, an estimated 963 million people around the world didn't get enough to eat.[3] About 42 percent of these chronically hungry people live in two of the world's most populous developing nations: India and China.[4] Because of malnutrition, one in four children in second- and third-world nations (W2 and W3) is underweight for his or her age.[5]

This is an unacceptable situation today and will require a new approach to food production to avert an even worse scenario in the coming decades.

That's because world food demand is expected to increase 100 percent by 2050.[1] Consequently, the U.N. FAO projects that global production of meat and dairy protein will almost double by 2050.[6] This increased global demand will be driven by a steady increase in population growth from today's 6.7 billion to 9+ billion at the midpoint of the 21st century.[7]

This rise in population will be characterized by a growth in affluence, primarily in W2 nations, that will create the largest increase in global meat and milk consumption in history. Much of this increase parallels a rise in living standards in developing nations where more people can afford to replace low-cost grains in their daily diet with higher-cost sources of protein. China is a prime example of this trend. Compared to other W2 nations such as India, China has made more progress in reducing hunger among its growing population. In 1985, meat consumption in China was roughly 44 pounds per person per year. By 2000, this had increased to 90 pounds per person annually, a figure that's projected to more than double again by 2030.[8]

Land: the one resource we can never produce more of

Coinciding with increases in worldwide demand for animal protein is the reality of growing constraints on natural resources, with land a key limiting factor.[13] Based on U.N. FAO projections,[2] 13 percent more land in developing countries will be converted to agricultural use over the next 30 years. On a *global* basis, this represents a net increase in available cropland of only 1 percent—from the 39 percent of global land area used in 2008 to a total of 40 percent. This land expansion will account for only 20 percent of future increases in food production. According to the U.N., 70 percent of the rest must come from increased use of new and current yield-enhancing technologies. About 10 percent will come from increased cropping intensity (harvesting more crops per year from every acre).[2]

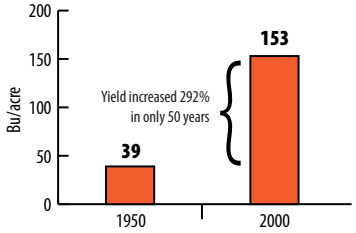
With respect to increasing output, there is good news. During the last half of the 20th century, agricultural productivity in many W1 nations expanded at a phenomenal rate. For instance, the average yield of corn in the U.S. rose from 39 to 153 bushels per acre[14] (Figure 1). In addition,

a comparison of U.S. farm output for 1948-1994 showed substantial productivity increases for all livestock and grain products, including an 88 percent increase in meat production and a 411 percent increase in the output of eggs and poultry. Combined, these improvements resulted in a 145 percent increase in total factor productivity (TFP)* for the U.S. agriculture industry (Figure 2).[15]

Figure 1

U.S. Corn Yield per Acre: 1950-2000

(USDA Economic Research Service Data)



The USDA calls new technologies a "primary factor" in improvements in agricultural productivity, such as a 292 percent increase in U.S. corn yields from 1950 to 2000.[14]

A Growing Consensus:

The growing challenge of feeding the world

What a few experts have to say:

"Science and technology must spearhead agricultural production in the next 30 years at a pace faster than the Green Revolution did during the past three decades."

– Dr. Jacques Diouf, *Director-General, Food and Agricultural Organization of the United Nations*[10]

"Policy responses to protect the poor from food price rises are urgent and need to be designed in a way that is conducive to stimulating greater agricultural production in the long run."

– Dan Leipziger, *World Bank Group Vice President for Poverty Reduction and Economic Management*[11]

"Backyard vegetable gardens are fine. So are organics . . . But solutions to the global food crisis will come from big business, genetically engineered crops and large-scale farms."

– Jason Clay, *World Wildlife Fund*[12]

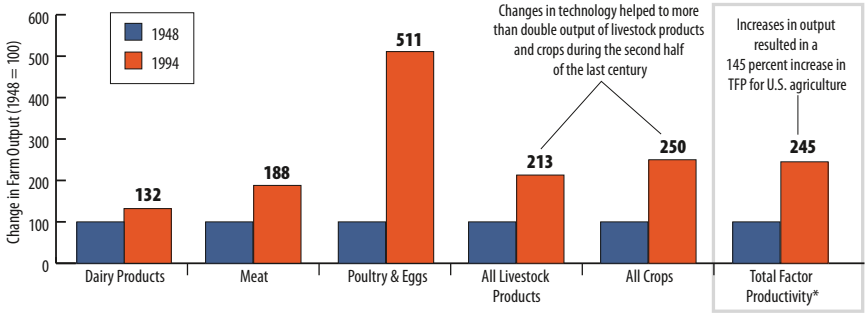
This should give us ample reason to believe we can meet the world's growing need for food. Why? Because according to the USDA Economic Research Service, the development of new agricultural technologies—including advances in genetics, nutrition, disease and pest control and livestock management—was an important factor in these 20th-century productivity improvements.[14,15] Refining these technologies, and discovering new ones, will be critical to our success in expanding on productivity improvements in this century.

With respect to *optimizing* land use for agriculture in the coming decades, however, the news is not so encouraging. The reasons for this are many and complex, but two of them are of paramount importance. First is the growing need to balance the use of agricultural land with the need to minimize the impact of agriculture on the global environment—particularly with regard to greenhouse gas emissions, soil degradation and the protection of already dwindling water supplies. Few would argue against the imperative to employ only those agricultural technologies that have a neutral or positive impact on our environment. To do otherwise is to sacrifice our long-term survival in favor of short-term gains.

Figure 2

U.S. Farm Output & Productivity: 1948-1994

(USDA Economic Research Service Data)



With 1994 farm output for livestock and grain products more than doubling the baseline output of 1948, total factor productivity (TFP) for U.S. agriculture during the last half of the 20th century improved by nearly 150 percent. According to the United States Department of Agriculture (USDA), this difference in TFP resulted from factors including changes in technology, efficiency and scale of production.[15]

*Overall rate of productivity is most commonly expressed as total factor productivity (TFP), a ratio of outputs to inputs (both measured as an index). TFP captures the growth in outputs not accounted for by the growth in production inputs.

The second reason involves the conflicting pressure to reallocate the use of current cropland from growing food to producing grains for biofuels (see sidebar on page 4).

Successfully responding to both these additional challenges—protecting the environment and balancing the world's need for energy and food—will require a complex and multifaceted approach. For now, regardless of how we respond to these challenges, both will inevitably affect the cost of food in W1, W2 and W3 nations alike.

FARMING IN 2050 WILL OCCUPY ONLY ABOUT 1 PERCENT MORE LAND THAN IS USED IN 2008.

– BASED ON U.N. FAO PROJECTIONS

The consumer perspective

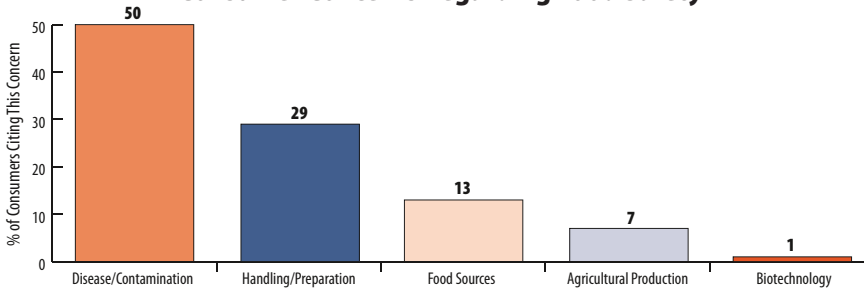
When it comes to the global food supply, what does the average person think about? Does he or she worry daily about food safety and agricultural technologies and methods? Experts continue to debate the answer to this question.

On the one hand, food contamination scares—such as those involving milk from China, peppers from Mexico, beef from some U.S. meat processors and peanut products from Georgia—have created understandable consumer concern about the safety of the world's food supply.

On the other hand, a 2008 survey by the International Food Information Council revealed that when consumers are asked about specific food concerns, half indeed cited "disease and contamination" at the top of the list. Yet only 7 percent reported that they worry about agricultural production methods, and 1 percent cited biotechnology as a top-of-mind concern (Figure 3).[17]

Figure 3

Consumer Concerns Regarding Food Safety



Though research shows most consumers aren't overly concerned about food safety, when asked to share potential worries, 50 percent cite disease and contamination. In contrast, only 1 percent cite biotechnology as a food safety concern.[17]

Research also shows that most people are not greatly concerned about food safety, nor about modern food production technologies. U.S. and international consumer research, involving a total of 45 focus groups conducted in 2001, 2004 and 2008[18]—and including a quantitative survey of 741 Americans taken in 2008—revealed that most consumers (nearly 70 percent in 2008) assume the meat and poultry they buy is safe. The research also showed that consumers care little about the origin of meat they purchase. And only 17 percent of the consumers surveyed in 2008 expressed a strong interest in knowing about modern food animal production, while nearly 60 percent had little or no interest, preferring instead to trust the food supply chain to ensure the food they consume is safe.

Whom do consumers trust most to ensure science-based food safety? Perhaps not surprisingly, it's the food producers—those who rely on modern technologies to help them grow food safely and efficiently. Interestingly, consumers trust producers to help maintain food safety to a much greater degree than they trust advocacy groups (Figure 4).

Grain for Food or Grain for Fuel:
Can we have both?

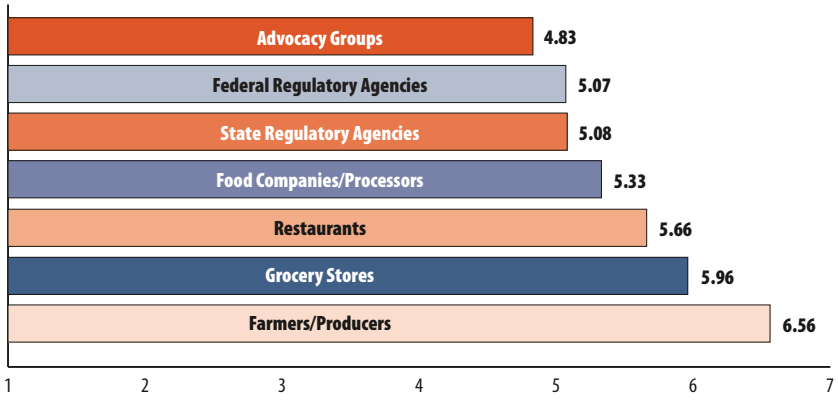
The USDA projects that about one-third of the 2009 U.S. corn crop will be converted into ethanol.[16] Still, this new technology for revolutionizing energy production has also produced worldwide debate about the trade-offs in using cropland to produce fuel rather than food.

Consider: when U.S. ethanol production began ramping up in 2005, corn was less than $2/bushel. Within two years, this had doubled to $4 and a year later peaked at nearly $8/bushel, resulting in significant pressure on the food industry.

Can we raise enough food to feed the world while helping the U.S. and other nations achieve a higher level of energy independence? If history is any guide, the answer is yes, but only as long as we continue to invest in the technology necessary to make ethanol production, grain production and food production even more efficient.

Figure 4

Whom Do Consumers Trust to Ensure Food Safety?
(1 = Trust Least, 10 = Trust Most)



With regard to ensuring food safety, consumers put the most trust in farmers and food producers.[22]

Protecting the confidence and trust consumers place in the food supply chain is critical. Although consumer confidence remains relatively strong, research shows it is decreasing slightly.[17] High-profile food recalls almost certainly helped to erode this confidence. But is the emergence of genetically modified (GM) foods also to blame? Probably not.

Research reveals that, unprompted, consumers do not put GM products high on their list of food worries.[19] Moreover, in the EU—an area of the world that typically champions organic farming—few consumers actually avoid GM foods when shopping. In fact, regardless of what consumers say about GM foods in opinion polls, the vast majority of them readily buy the few available GM foods without apparent hesitation.[19] It should be noted, however, that global demand for organic products continues to grow. Worldwide sales of organic products doubled from 2000 to 2006, with the EU emerging as one of the top three import markets for organic goods.[20]

Consumers want high-quality, affordable food

So if most consumers trust their food to be safe and accept GM foods with little concern, what do they worry about? When asked open-ended questions about what they want most in their food, consumers consistently say they want it to be high-quality and affordable. As one example, recent polling in the U.S., U.K., Germany, Argentina and China found that taste, quality and price were the top considerations when choosing food products.[21]

Of these, affordability continues to move to the forefront as the global economy remains in a state of heightened volatility. According to an October 2008 survey by the Center for Food Integrity, 60 percent of respondents are more concerned about food prices than they were just one year ago[22]—"the highest level of concern…since World War II" according to the Center's CEO, Charlie Arnot.

Lessons from the European Center of Competitive Excellence

In 2003, a think tank called the Center of Competitive Excellence was assembled to assess a number of challenges. One of these was to evaluate the European meat industry and develop strategies for enhancing its competitive position across Europe and in the global marketplace. Surveys and panel discussions by highly respected agricultural experts, veterinarians and food producers from across Europe were conducted by the Center. Three key insights emerged:[25]

1. **It's crucial to have a credible, authoritative regulatory body.**
   The model for this is the U.S. Food and Drug Administration (FDA), a regulatory body that, despite some criticism, remains a highly respected authority by consumers in the U.S. and around the world. A central authority such as the FDA helps maintain consumer confidence—something Europeans recognized the need for as they addressed food contamination and animal disease issues. Ultimately, they created the centralized Food and Veterinary Office (FVO) and the European Food Safety Authority (EFSA).

2. **Allow use of approved technologies and modern farming techniques to continue.**
   As an example, U.K. farmers learned in the 1990s that rewriting laws to appease the political demands of a vocal minority is a recipe for economic disaster. A decade after yielding to pressures to ban (or not approve) growth enhancers, biotech products, GMOs and certain production practices, the U.K. has transformed from a key global leader and competitor to a high-cost, low-productivity domestic producer that now relies on poultry and beef imports to meet consumer demand.

3. **Food producers should avoid "differentiating on the negative."**
   Labeling food products with claims such as NO additives, NO this, NO that, etc., results in a costly contest among manufacturers to "out-NO" each other while only confusing consumers who neither understand, desire, nor prefer these types of foods. Further, this practice can create an unfounded fear among consumers that products without such labels are less safe when, in fact, they can be even safer to consume. In any case, it's the consumer who should make the final decision about which food products to purchase.

RECENT POLLING IN THE U.S., U.K., GERMANY, ARGENTINA, AND CHINA FOUND THAT TASTE, QUALITY AND PRICE WERE THE TOP CONSIDERATIONS WHEN CHOOSING FOOD PRODUCTS.[21]

Figure 5

Consumer Agreement That Today's Food Supply Is Safer Than It Was During Their Childhood

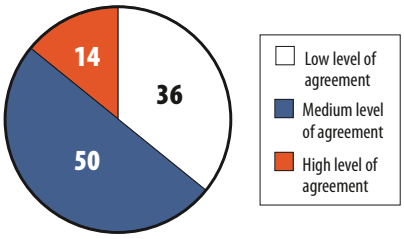
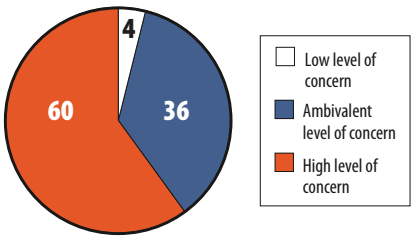


Figure 6

Consumer Concern About Food Prices



Sixty-four percent of Americans believe today's food supply is even safer than it was when they were young, though 60 percent express a high level of concern about food prices.[22]

Consumers want choice

Of course, affordability matters less to some consumers, particularly those in affluent W1 countries where food costs account for only 10 percent of the average income.[23] This includes consumers who prefer foods that are produced organically, i.e., with the use of few (if any) modern agricultural tools and technologies. Organic food production, however, typically requires *more* resources and produces *less* food—which currently makes it a questionable solution to meeting the world's growing food supply needs. As we prepare to enter the second decade of the 21st century, most organic foods remain a high-cost luxury that three-quarters of the world's population cannot afford, particularly those in developing nations where food costs consume 50 percent of the average income.[23]

Needless to say, consumers who desire organic foods—which help the food industry satisfy demand and capture more value—should have that choice. Likewise, consumers who need an abundance of efficiently produced, high-quality and affordable food deserve that choice as well. All consumer preferences can and should be protected. Most of all, the undernourished in developing nations who are improving their diets by increasing consumption of animal proteins, deserve the affordable foods that can be produced with carefully monitored, efficiency-improving agricultural technologies.

High food prices will worsen the global food crisis

The question of how food is grown became even more relevant in 2008, when the entire world saw pressures on food production accelerate as never before. According to the International Monetary Fund (IMF), world market prices for food commodities rose more than 75 percent from early 2006 to July 2008.[23] Of course, any increase in grain prices inevitably causes meat, egg and dairy costs to rise, because grain is used to feed livestock. As painful as these increases are in

industrialized (W1) nations, they can be devastating in poor nations where even modest increases in food prices can mean the difference between sustenance and starvation.

Josette Sheeran, head of the World Food Programme, reports that from 2002 to 2007 the cost of procuring basic foods for her program increased by 50 percent—and then by another 50 percent only one year later. As a consequence of these unprecedented cost increases, Sheeran warns that "high food prices are not only causing a humanitarian crisis but also putting at risk the development potential of millions of people."[24]

The challenge of helping these millions of people requires us to ask ourselves: Can we afford *not* to use the technologies at our disposal to produce food as efficiently as possible?

Why is technology such an important key to meeting the global demand for food and consumer choice?

There are a wide variety of answers to this question, and here are three of the most important:

1. Technology enables food producers to provide more high-quality grains and protein sources using fewer resources.

Ironically, those who believe "all-natural" farming techniques (e.g., pre-1950) were superior to those used today could not, in many ways, be more mistaken. For example, a combination of modern feeding practices and efficiency-enhancing feed additives enables today's cattle growers to use two-thirds less land to produce a pound of beef as it takes to produce a pound from "all-natural" grass-fed cattle.[26] In addition, we can now produce at least 58 percent more milk with 64 percent *fewer* cows than dairy farmers could produce in 1944.[27] Researchers have also found that nationwide use of an FDA-approved swine feed additive could enable the U.S. to maintain pork production levels while raising 11 million fewer hogs. This would also reduce demand for cropland used to grow feed grains by more than 2 million acres.[28]

Similarly, for every million dairy cows managed with another widely used technology, the world saves 2.5 million tons of feed that would have required 540,000 acres of land to produce. This increase in efficiency saves enough electricity to power 15,000 households[29] and can substantially lower milk prices.

Technology has also played an important role in the poultry industry, which has seen a four- to six-fold increase in the slaughter weight of broiler chickens since 1957. Researchers attribute this increase to careful genetic selection and improvements in nutrition.[30]

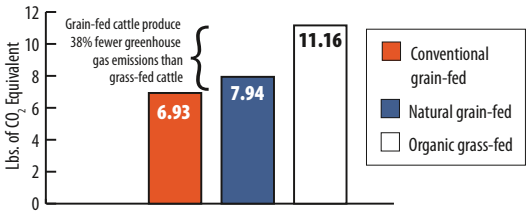
"HIGH FOOD PRICES ARE NOT ONLY CAUSING A HUMANITARIAN CRISIS, BUT ALSO PUTTING AT RISK THE DEVELOPMENT POTENTIAL OF MILLIONS OF PEOPLE."

– Josette Sheeran
World Food Programme

TECHNOLOGY CAN HELP SIGNIFICANTLY REDUCE ANIMAL WASTE PRODUCTION THAT CAN THREATEN VITAL WATER RESOURCES IN DEVELOPING NATIONS WHERE MODERN POLLUTION-CONTROL STANDARDS AND TECHNOLOGIES ARE NOT IN USE.

Figure 7

Total Greenhouse Gas Emissions per Lb. of Beef (excludes NOx)



Today's conventional production methods help reduce total greenhouse gas emissions compared to organic methods.[26]

2. Technology can help keep food affordable while ensuring maximum consumer choice—especially in developing nations.

Organic foods are a fine option for people who can afford to pay a premium for them. According to USDA researchers, these premiums can average 100 percent or more for vegetables,[31] 200 percent for chicken and nearly 300 percent for eggs.[32] On a global scale, however, most consumers can't afford to pay such premiums and instead demand less expensive food choices.

It bears noting that not all organic production methods are less efficient and provide foods that invariably cost more. According to a U.N. FAO report, in some countries, well-designed organic systems can provide better yields and profits than traditional systems. In Madagascar, for example, farmers have increased rice yields fourfold by using improved organic management practices. In Bolivia, India and Kenya, farmers have shown that yields can be double or triple those obtained using traditional practices.[2]

Nonetheless, the report also recognizes the need for more research to solve technical problems faced by organic growers, and suggests that organic agriculture could become a realistic alternative to traditional agriculture over the next 30 years, but only on a local level.[2]

Still, given the magnitude of the food crisis the world faces in the coming decades, efforts to maximize choice and achieve high production efficiencies (and lower costs) for all foods—including organic products—deserve the support of all constituencies in the global food chain.

3. Technology can help minimize the global environmental impact of increased food production.

Using modern production methods and technologies not only helps produce more high-value protein from less land, but can also have a net positive impact on the environment. For instance, what today's beef producers call "conventional" (i.e., modern) production techniques can actually reduce greenhouse gas emissions per pound of beef by 38 percent compared with an "all-natural" production method[26] (Figure 7).

Moreover, technology can help significantly reduce animal waste production that can threaten vital water resources in developing nations where modern pollution-control standards and technologies are not in use. Case in point: use of an FDA-approved feed additive for swine can reduce manure production in pigs by 8 percent.[33] Feeding this additive to every hog harvested in the U.S. in 2002 would have reduced annual production of swine manure by more than 3.4 billion gallons[28]—or enough to fill about 5,600 Olympic-size swimming pools.

Conclusions

1. The global food industry needs technology.

Without advancements in agricultural technology, humanity would likely not have progressed through the 20th century without major famines or devastating food wars. Will we be able to say the same thing at the end of this century, given that a food crisis is already here?

I believe the answer is *yes*, because I concur with the U.N. that 70 percent of this food must come from the use of new and existing technologies and methods. And these technologies and methods must have no negative impact on the environment, animal welfare or food safety.

2. Consumers deserve the widest possible variety of safe and affordable food choices.

In general, consumers trust food producers to keep the food supply safe, and they're more concerned about food contamination than about technology used on the farm. Instead, one of the most pressing human concerns about food is affordability.

For this reason, consumers from all classes and geographies—from those who can afford organic foods to those who struggle to maintain a diet that sustains them—must be allowed to choose from an abundance of safe, nutritious and, most importantly, inexpensive food options.

3. The food production system can mitigate the food economics challenge and achieve an "ultimate win."

Facing a global food crisis, the world is at risk through the midpoint of this century. We already see the signs: our population consumed more grain than we produced during seven of the last eight years.[34]

The good news: an "ultimate win" is still possible. What will it look like? Five key achievements will mark its success:

1. **Improving the affordability of food** by using new and existing technologies and optimal productivity practices.
2. **Increasing the food supply** by instituting a vastly improved degree of cooperation across the entire global food chain.
3. **Ensuring food safety** with a combination of technology and high-quality standards and systems, coupled with a greater measure of worldwide collaboration.
4. **Increasing sustainability** through a highly productive and efficient system that simultaneously protects the environment by means of sensitive and efficient use of natural resources.
5. **Producing more biofuels** to reduce dependence on fossil fuels while creating no negative effect on global food supplies.

In summary, three key concepts—**collaboration, choice** and **technology**—emerge as the pathway to success. Not only will they provide the direction, they will be necessary requirements for an ***"ultimate win"*** in the food economics challenge.

Jeff Simmons is the President of Elanco Animal Health, the animal health division of Eli Lilly and Company. Jeff is a member of the Animal Health Institute's (AHI) Executive Committee and serves on the Board of Directors of both AHI and the International Federation for Animal Health (IFAH). He is also a member of the Harvard Business School's Private and Public, Scientific, Academic, and Consumer Food Policy Group (PAPSAC) committee and the 2009 Chairman of the FFA Foundation Board. Jeff received a bachelor's degree in Agricultural Economics and Marketing from Cornell University in 1989.

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5. A. Agricultural Productivity Strategies for the Future: Addressing U.S. and Global Challenges

Gale Buchanan

CAST® Issue Paper
Number 45
January 2010

Agricultural Productivity Strategies for the Future: Addressing U.S. and Global Challenges

West view of the U.S. Capitol Building in Washington, D.C. (Photo courtesy of the Architect of the Capitol.)

Dedication

This Issue Paper is dedicated to Dr. Norman E. Borlaug who wrote the paper's preface before his death September 12, 2009, and to his myriad accomplishments. Dr. Borlaug—credited by *The Economist* with saving hundreds of millions of lives, more than any other person who has ever lived—was recipient of the 1970 Nobel Peace Prize, the Presidential Medal of Freedom, and the Congressional Gold Medal. Often called the "Father of the Green Revolution" for his pioneering work developing high-yielding wheats for areas with limited cultivated land and increasing population, Dr. Borlaug was a supporter and promoter of CAST since its inception.

Preface

By Dr. Norman E. Borlaug

Agricultural policy has played a key role in my career and will always be near and dear to my heart. I was pleased to be a featured speaker at a CAST–Industry meeting in 1973, and I was honored when CAST distributed those remarks as its first publication (CAST Paper No. 1, *Agricultural Science and the Public*, 1973). As I said in 1973: "CAST has both a tremendous responsibility and opportunity to present unbiased, scientific data so that wise policy and legislation will be enacted. I have faith that the correct decisions will be made if the facts are made known to the general public and to national and state legislative leaders" (Borlaug 2009).

Although modes of communication have changed in the 37 years since CAST was organized, agricultural policy still plays the key role in determining outcomes. Unfortunately, agricultural science—like many other areas of human endeavor—is subject to changing

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fashions and fads, generated from both within the scientific community and imposed on it by external forces, especially the politically induced ones and activist organizations. Increasingly, I fear, too much of international and national research budgets is being directed toward "development bandwagons" that will not solve Third World food production problems, which scientists are ill-equipped to solve.

I have worked with dozens of governments in different parts of world trying to serve as the link between scientists and their own policymakers. You have to be able to communicate. Research information must be applied in order to meet human needs.

We made great strides in the first Green Revolution by bringing improved agricultural techniques, seeds, and technology to poor underdeveloped and developing countries. But in the next 50 years we are going to have to produce more food than we have in the last 10,000 years, and that is a daunting task. I therefore have called for a "Second Green Revolution" (Borlaug 2002).

Now, more than ever, it is important for the general public to know the facts underlying the many agricultural issues influencing daily life. It also is critical that accurate science be communicated and distributed to policymakers and legislators for their continuing debate and eventual decisions on agricultural issues that impact the nation and the world. CAST is uniquely qualified to provide this information now and into the future. I am pleased that CAST has prepared this update on agricultural science and the public.

Abstract

This Issue Paper—dedicated to Dr. Norman E. Borlaug for his countless contributions to agricultural science, commitment to feeding the world, and support of CAST—has been prepared as an update of *Agricultural Science and the Public*, CAST Paper No. 1 written by Dr. Borlaug in 1973. The current paper is a forthright appraisal of contemporary and future challenges facing U.S. and world agriculture.

The authors address several key issues: Correcting pathologies in the broader U.S. economy that will allow American agriculture to become less dependent on domestic markets and take greater advantage of global markets; meeting developed countries' increased demands on agriculture for fuel and ecosystem services; further increasing production per unit of land, water, and nutrient resources; dealing with global population growth; and serving the increased food demands in developing countries. The convergence of so many challenges at one time is unprecedented.

Increasing the productivity of resources available to agriculture is critical. Enhanced efficiency can be achieved only through research focused on sustainable agricultural productivity. Agriculture can provide the food we eat, the feed for our livestock and companion animals, fiber for our clothes and homes, "flowers" for the environment, and the fuel we need—if countries develop the needed information, knowledge, and technology. The public will have to actively support political action, particularly on such broad issues as global climate change, regulations on the welfare of animals in agriculture, natural resources, and investments in agricultural research and education.

The authors are most concerned about the apparent lack of commitment by the United States and other countries to make the research and education expenditures needed to address the problems affecting our survival on this planet. Complacency is unwarranted given the many warning signs of tighter future agricultural supply–demand balance, rising real food prices, and the increasing role of agricultural commodities in meeting energy needs.

The interrelations between U.S. and global agriculture are large, and the authors discuss four places in the world that are particularly relevant to agricultural productivity considerations for the twenty-first century: China, India, Brazil, and sub-Saharan Africa. Future agricultural policy for all nations must include a strong commitment to science if nations are to meet the coming challenges successfully. The paper concludes with an Appendix of promising scientific approaches that could improve agricultural productivity and help to bring about the "Next Green Revolution."

Introduction

American agriculture has long provided adequate quantities of low-cost, healthful food for domestic consumption and substantial quantities for export. Agriculture's ability to continue meeting those needs is challenged by emerging domestic constraints on land use, water availability, and the environment, driven by broad concerns of U.S. society. Recent increases in petroleum prices have encouraged policies that make the conversion of crops into fuel profitable for the ethanol industry. Globally, agriculture faces unprecedented challenges such as increases in the demand for livestock-based foods in Asia, climate change that threatens to decrease production capacity in many places around the world, and increasing demand due to continuing rapid population growth in some poor countries.

This report addresses U.S. agricultural science and technology policy, and also recognizes that actions of one nation cannot be viewed in isolation—given environmental spillovers and improved transportation and communication. The report does not explicitly address important issues of food safety and nutrient balance, international trade barriers, farm price and income supports, the obesity epidemic, water management, rural development, and the like, but instead stresses the more basic need for knowledge to make sound decisions regarding such issues.

The interrelations between U.S. and global agriculture are large; however, given several existing comprehensive analyses of global agriculture and related matters,[1] the authors do not address international policy, with two exceptions. To the extent that actions in other countries have major impact on global food availability, the paper briefly reviews those impacts, and where U.S. policy actions have a dominant impact on the capacity of poor developing nations to meet their own food needs, the paper addresses those actions as well.

Correcting pathologies in the broader U.S. economy can reinforce the ability of agriculture to increase its productivity and exports. Dominant challenges include the need to end the three-decade-long pattern of living beyond our means: importing more than we export, borrowing more than we lend, spending more than we earn, and consuming more than we produce. Correcting this imbalance will require the value of the dollar to fall in relation to other currencies, interest rates to rise, and consumers to save more of what they earn. If we can make those changes, American agriculture will become less dependent on domestic markets and take greater advantage of global markets where food demand will nearly double by mid-century. The limited scope for global land and water resources to meet those demands at current food prices generates an opportunity for the United States. If U.S. agriculture can achieve substantial productivity gains while maintaining the quality of land, water, and biological resources, then it will profitably contribute to meeting the food and agricultural needs of global consumers in the twenty-first century. Improved productivity gains without sharply rising food prices, however, will require increased, sustained support for agricultural research in the United States, as well as assistance to developing countries abroad (Bertini and Glickman 2009).

In addition to traditional expectations, agriculture today also is being called on to contribute to the energy needs of the planet and to help mitigate global climate change. The demand for bioproducts and biofuels is virtually unlimited at expected future energy prices, but resources for production will constrain supply. In addition to supplying feedstocks for biofuels, some agricultural cropland resources will be shifted to trees, which sequester more carbon more sustainably and hence earn more carbon credits than cropland.

Meanwhile, there are huge unfulfilled demands for output of agriculture among the approximately 1 billion people in some developing countries who rarely get enough to eat for a productive life (FAO 2006). And billions of people in growing economies such as China and India will demand more meat, milk, and eggs in their diets as their incomes grow and they increase their expectation for a better life.

Given the finite nature of natural resources and the constraints on their further exploitation, if the United States is to meet a substantial fraction of the global agricultural output needs without a sharp increase in food prices it will have to further increase production per unit of land, water, and nutrient resources. Those increases can be achieved only through enhanced efficiency supported by research focused on sustainable agricultural productivity.

Future Demands Facing Agriculture

American consumers demand food that is safe, convenient, nutritious, and affordable, and U.S. agriculture continues to meet those demands. But the widening scope and depth of future demands on the industry from nontraditional sources is especially daunting. Ever-accelerating globalization characterized by improvements in transportation and communication, falling trade barriers, and ever-growing demand for exports to pay for oil and other imports means that global demand and U.S. demand are virtually indistinguishable to U.S. agriculture. Given the direct relationship between the output of ethanol and the input of corn, when domestic oil and gasoline prices rise sharply, the demand for ethanol and corn in the United States also rises sharply (Eidman 2006). But the opposite holds as well, as illustrated by the ethanol plants that shut down in 2009 after oil prices fell. Hence, when oil prices are high, the competition between bioenergy and food increases. The end result is that the potential demand for farm output is nearly unlimited.

Meanwhile, crop and livestock pests and diseases continue to emerge in varied forms to challenge agricultural productivity, not because past eradication efforts have failed but because pests continue to evolve to thwart earlier controls. Climate change and unstable eco-

[1] The United Nation's Millennium Ecosystem Assessment (2005) examines the consequences of ecosystem change for human well-being. The United Nation's Intergovernmental Panel on Climate Change (2009) was created to provide the world with a clear scientific view on the current state of climate change and its potential environmental and socio-economic consequences. The World Bank-initiated International Assessment of Agricultural Knowledge, Science, and Technology for Development (2007) focuses on how the world can reduce hunger and poverty, improve rural livelihoods, and facilitate equitable, environmentally, socially, and economically sustainable development through the generation of, access to, and use of agricultural knowledge, science, and technology. The International Water Management Institute's Comprehensive Assessment (2007) places water management in agriculture in a social, ecological, and political context and assesses the dominant drivers of change.

nomic conditions arising from nature and human activities also continue to confound the food system's best efforts to serve consumers. In short, the task of serving the myriad demands for agricultural output at home and abroad has never been greater.

The principal drivers of global demand for farm output are growing world population, higher expectations for standard of living, increases in disposable income, and greater energy needs. Global population will continue to grow for at least another 30 to 40 years. Rising income will add to food demand, especially in developing countries where a sizable share of income is spent on food. In addition to biofuels, bioproducts for pharmaceuticals and biodegradable plastics also are potentially huge emerging sources of farm output demand.

The overall global growth rate in per capita food and fiber demand from income has been quite stable at 0.27 % per year during the past 60 years.[2] This stability comes from the slowing increase in per capita food demand from wealthy countries offset by growing food demand in developing countries where food use is more responsive to income.

Table 1 shows past and projected annual growth rates in farm output demand from 1961 to 2050 from population only and from all sources, based on a study by Tweeten and Thompson (2009). (The initial year, 1961, was chosen because several data series began with that year.)

Population projections in Table 1 are from the United Nations (UN 2008). Many demographers view the assumptions underlying the "low" and "medium" projections as most likely, and they use the medium variant for projecting population (Tweeten and Thompson 2009). That variant calls for global population to grow at 0.82% per year in 2025 and at 0.36% per year in 2050. World population growth rates have been slowing for some years and several experts believe that global population will have already begun to fall by mid-century, as shown by the negative growth rate of –0.17% per year under the low population growth variant in Table 1.[3]

Table 1. Rate of increase and global total demand for farm output due to population only and from all sources in selected years from 1961 to 2050 (Tweeten and Thompson 2009)

	Year					
	Actual				Projected	
Item	1961	1975	2000	Variant	2025	2050
	%/year					
Population only	1.89	1.85	1.31	low	0.48	–0.17
				medium	0.82	0.36
				high	1.13	0.88
Total agricultural demand	—	—	—	low	0.83	0.18
				medium	1.17	0.71
				high	1.48	1.23
Agricultural output, accumulated demand	Year 2000 = 100					
Population only	50	67	100	low	124	127
				medium	131	150
				high	138	176
Total agricultural demand	—	—	—	low	135	152
				medium	143	179
				high	151	209

After year 2000, projected world demand growth for farm output per capita is calculated as the average compound rate of growth in population plus 0.25% annually due to income growth and 0.10% annually due to sources other than food and fiber. (See next section for elaboration on bioenergy demand underlying the especially elusive 0.10 number.)[4] Based on the medium population variant and including nonfood demands, overall demand for farm products is projected to be 143% of year 2000 output in 2025 and 179% of 2000 output in 2050 (Table 1). The demand projected from the high population variant seems unlikely, but the more plausible demand under the medium UN population projection requires a near doubling of agricultural output from 2000 to 2050. Because of their high income elasticities of demand and rapid population growth, developing countries will increase demand for farm output much faster than the world average.

Bioenergy and Bioproducts Bring a New Paradigm for Agriculture

As petroleum becomes a more limited and expensive resource, and with recognition that agriculture can contribute to the energy challenge, any consideration of agricultural policy must take into account bioenergy and bioproducts. Until energy became such a relevant issue, agriculture was thought of in terms of food for humans, feed for livestock and companion animals, fiber for clothes and homes, and "flowers" for

[2] In technical terms, stability occurred as slow increases in demand from wealthy countries with falling income elasticities of food demand and rising incomes were offset by more robust increases in demand from developing countries with relatively high income elasticities of food demand (Tweeten 2007, p. 183).

[3] Recent evidence of rising fertility rates in the most affluent developed countries raises the unsettling prospect for food demand that the demographic transition does not culminate in zero or negative population growth but rather in positive population growth (Best 2009).

[4] The food demand projection is consistent with those of other analysts (Runge et al. 2003; World Bank 2008). The future agricultural demands for ethanol, projected to grow 0.1% per year in Table 1, depend on technology such as for cellulosic ethanol, the price of oil, and federal subsidies. In 2009, the U.S. Department of Energy projected the price of oil to be $121 per barrel for ethanol in 2025 and $130 per barrel in 2030, numbers well above the break-even estimate of $80 per barrel for ethanol to be competitive (USDOE 2009). Although demand for crop-based ethanol is virtually limitless, the quantity supplied will in fact be severely constrained by farming resources and technology. The reader may wish to examine alternative ethanol demand growth scenarios to that in Table 1.

our enrichment and the landscape. The new paradigm adds fuel (energy and various bioproducts) and carbon sequestration to that portfolio.

As this process evolves there will be competition for resources. Use of land, nutrients, and water will require hard choices and result in conflict, as evidenced in the United States in 2008 with the sometimes heated "food vs. fuel" debate. Indeed, one of the most critical issues facing all nations is achieving a greater degree of sustainable energy security.

In view that petroleum is a highly fungible good (one that is substitutable in kind), energy should be viewed from a global perspective. The United States, as well as many other countries worldwide, is establishing goals and plans that will address this concern, including the use of approaches that capture the potential of wind, hydro, geothermal, solar, nuclear, river and ocean currents, and ocean waves, as well as bioenergy. The sun's energy can be captured directly by photovoltaic cells, photothermal plates, and through green plant photosynthesis. Each of these approaches has merit and, in time, will contribute to solving the energy challenge; but harvesting the sun's energy through green plant photosynthesis—one of the most promising approaches—if widely implemented, will greatly impact the future needs and expectations of agriculture.

Although demands on land, water, and plant nutrient resources will provide mankind with awesome challenges, the sun provides a limitless source of clean energy for the next 3 to 5 billion years. The challenge is how best to harvest the sun's energy in a readily useable form. In desert environments around the world, photovoltaic cells and photothermal plates would be the approaches of choice, whereas in other regions green plant photosynthesis—that is, agriculture—would be most appropriate. Current exploitation of photosynthesis includes burning wood and other biomass for its heat and converting crops such as corn and sugarcane to ethanol. Researchers in the United States and around the world are working vigorously to develop more efficient means of converting wood and other biomass such as straw, stover, or grass into liquid transportation fuels like ethanol.[5]

Biomass energy also can be used to generate electricity, but its lower density means it is more expensive to transport, limiting its feasibility. Probably the greatest advantage of capitalizing on the sun's energy is that all nations have access to this energy source so that with feasible technology and adequate capital, energy from the sun could be converted everywhere into the electricity and liquid fuels all countries require. Whereas only certain nations are blessed with such energy resources as fossil, wind, geothermal, nuclear, and hydro energy, every nation on earth has and can use the sun's energy. Although the sun's energy is not the total solution to the energy challenge, it can be a major contributor.

Emerging Constraints on Future Agricultural Productivity in the United States

A wide variety of issues pose challenges for future agricultural productivity; those issues include soil erosion, water use, bioengineered plants, animal welfare and livestock production practices, endangered species protection, fertilizer use, and global warming. Agriculture faces increasing competition for land and water from urban populations and industry in and around U.S. cities and competition for the environmental services that space and water provide to society as a whole.

Agricultural production entails environmental externalities (unintended consequences) that are attracting increased attention from society. This attention is leading to government interventions in markets in the form of local, state, national, and even international policies that influence the management of soil, water, air resources and, increasingly, animal husbandry and land. In recent decades, as more large-scale farms emerged and the nature of farming externalities changed, the public has demanded policies to address issues such as crop genetic engineering and animal agriculture. Policies related to climate change loom on the horizon.

Soil, Water, and Crop Issues

Soil Erosion

The most serious environmental problem of agriculture dating back at least to the 1930s was soil erosion. In the post-World War II era, land set-asides and conservation measures were used to address erosion and decrease the surplus production encouraged by crop price supports. More recently, the attendant problems of water pollution from sediments, synthetic chemicals, and pesticides have become of great concern. By 1983, government programs had diverted 31.6 million hectares (78 million acres) of cropland, many of them highly productive, to soil-conserving uses (APAC 2001). Under pressure of growing demand, the land in the Conservation Reserve fell to approximately 12.1 million hectares (30 million acres) and government programs such as Sodbuster and Swampbuster have been added.[6]

The wide adoption of reduced tillage on row crops also has reduced soil erosion. High-yield technology has obviated the need to crop fragile and highly erodible lands. Once the moldboard plow was used to prepare most corn land, but by 1991 only 15% of corn acreage was tilled by a moldboard plow. Reduced tillage keeps carbon out of the atmosphere and sequesters it as organic matter, useful for retaining moisture and nutrients in the soil.

Excess production capacity (apparent in land diverted from crop production by government programs) is now minimal for responding to growing demands for agricultural output. But emerging technologies can prompt reconsideration of policies. For example, the Conservation Reserve might be reduced if cellulosic ethanol becomes economically feasible. Feedstocks of perennial grasses and trees can be produced on erodible land with minimal soil erosion or other damage to the environment.

[5] Harvesting of crop residues as feedstock for cellulosic ethanol can conflict with environmental goals if cropland erosion increases and water quality declines.

[6] These are programs administered by the U.S. Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS).

Water Quality and Quantity

Historically, irrigation was the largest user of water. In the United States in 2005, however, cooling for thermoelectric power generation was the largest use of water, accounting for approximately half the 410,000 million gallons per day withdrawn, 92% of that used on a "once-through" basis (USGS 2009). Irrigation was the second largest use, accounting for 39% of the total, and public water supply, industrial uses, aquaculture, and livestock uses comprised the balance. Water not withdrawn from rivers and streams provides important environmental services including the required protection of endangered aquatic species.[7]

Farming can have a serious impact on water quality. An Environmental Protection Agency (EPA) survey in the 1990s found that 2% of rural water wells contained nitrate levels in excess of EPA safety standards and 0.6% of wells exceeded the pesticide safety level (Tweeten 1996). Modern precision farming with global positioning systems, yield monitors, weather-dependent fertilizer application rates, and other computer-assisted tools helps farmers avoid overuse of chemicals by tailoring applications to crop needs.

Bioengineered Crops

Plants bioengineered to resist pests can decrease the need for synthetic pesticides. The first bioengineered crops presented a challenge to the U.S. regulatory system because they had aspects that fell under the purview of the USDA, the Food and Drug Administration (FDA), and the EPA (US Regulatory Agencies 2005). Those challenges have been worked out and such crops are deployed widely in the United States with evident benefits to the environment. For example, modern "three-stack" corn hybrids contain bioengineered genes that confer rootworm and earworm control as well as glyphosate tolerance that facilitates weed control. The result is better water quality due to less applied synthetic pesticides.

Bioengineered crops decrease soil erosion by facilitating no-till practices and improving water quality as less mechanical cultivation is needed to control weeds. Research on plants bioengineered to cope better with heat, salinity, and moisture stress offers substantive new benefits not only for the United States, but especially for tropical and subtropical areas.

Significant voices still oppose the use of genetically engineered crops in the United States. In Europe those voices have been strong enough to effectively limit the use of bioengineered crops. Europe followed a different public policy approach with regulations focused on processes used rather than on the resulting products. Many African and Asian countries fear genetically engineered crops and have not established regulations governing their use, effectively banning them. Bioengineered crops need to be monitored for safety, but excessive caution can seriously undermine U.S. and global efforts to serve future demands on agriculture.

Animal Welfare Issues

Growth of large farms has brought to the fore issues concerning livestock production practices. The development of agricultural operations where animals are raised or kept in confinement or on a small land area with feed delivered rather than the animals grazing has led to the development of EPA regulations on concentrated animal feeding operations (CAFOs) (US Regulatory Agencies 2005). These regulations can significantly increase capital requirements and costs in dairy, hog, and other livestock production systems.

State and local regulations stemming from animal welfare concerns have a similar effect of raising production costs. If costs increase too much, livestock production will shift to jurisdictions without such regulations. Thus, federal regulations may drive production overseas and state regulations may drive production into other states with lower animal welfare standards (see Textbox 1).

When markets alone do not provide desirable levels of environmental protection or animal welfare, a public role may be appropriate. The usual avenue for public policy is through state or national legislators. Alternative agriculture advocates (political consumers) increasingly turn to the *plebiscite democracy* of the referendum rather than the traditional *representative democracy* of legislatures to achieve their objectives. Unless voters are informed by science and education, unintended consequences may result from plebiscite democracy. For example, requirements for costly facilities and equipment mandated for U.S. poultry and livestock producers can drive production elsewhere. Another example is organic food that, by rejecting genetically modified varieties and synthetic herbicides, fertilizers, and pesticides, can cost substantially more than conventionally produced foods (Knutson et al. 1990). Such examples are not used here to condemn political consumerism, but to caution that science and education need to attend the decision process to avoid counterproductive outcomes.

Labeling of products for practices used to produce them, such as organic, fair trade, non-genetically modified organism (non-GMO), or non-bovine somatotropin (non-BST), is a productivity-enhancing and hence resource-saving alternative to costly statewide or national government mandates. With products labeled as to how they are produced, consumers can vote with dollars in the marketplace for the practices they are willing to pay for. To the extent that such labeled production practices sometimes require more resources and hence are higher cost, they constitute further

Textbox 1. Animal welfare issues in California

California voters passed Proposition 2 mandating that as of January 1, 2015, it shall be a misdemeanor for any person to confine a pregnant pig, calf raised for veal, or egg-laying hen in a manner not allowing the animal to turn around freely, stand up, lie down, and fully extend its limbs. A laying hen has a wingspan of 3 feet, hence would require 9 square feet per bird, more than 10 times the current average cage space per laying hen. Compared with current practices, egg producers likely would see cost increases of 20% or more for larger cages, 26% for raising hens in barns, and 45% for free-range poultry production (Sumner et al. 2008).

[7] In some places these are substantial issues. For example, the quantity of water pumped into the California aqueduct was the subject of a lawsuit (see Textbox 2).

demands on agriculture.

Endangered Species Act

In many countries, particularly in the United States, there is great concern about the increasing loss of plant and animal species. Preserving natural resources and maintaining diversity of the planet's flora and fauna is important. Protection of species, however, comes at considerable cost (see Textbox 2). Preserving diversity poses one of Earth's most serious dilemmas. The planet's resource base is critically needed for production of food, feed, fiber, and energy, while land resources also are required for the multitudes of plant and animal species. Again, this issue can be addressed by more definitive research on how best to preserve plant and animal species with minimal impact on the land and water resource base.

Fertilizer Resources

Among principal commercial fertilizer resources, nitrogen is plentiful in the air but currently is made available to agriculture through petroleum feedstock. Although fertilizers are effective in driving crop yield improvements, they also frequently have a negative impact on the environment. Because most plants are able to use only a portion of the nitrogen fertilizer applied by growers, much of the remaining nitrogen fertilizer is lost through volatilization or leaches into the soil and water and pollutes lakes, rivers, aquifers, and oceans.

A significant portion of the unabsorbed nitrogen fertilizer volatilizes in the form of nitrous oxide. In fact, agriculture is the second largest industrial contributor to global greenhouse gases (GHGs)—ahead of the transportation sector and behind only electrical and heat generation.

One of the most visible examples of the harmful environmental effects of nitrogen fertilizers is the creation of "dead zones" in the world's oceans. Dead zones result from the death and decomposition of massive algae blooms that are fed by excessive nutrient runoff. When algae populations get too large, they die and their natural decomposition depletes the water of oxygen. This creates a condition called "hypoxia" and results in suffocation and death of fish.

A 2004 United Nations Environment Program report identified dead zones as one of the most significant global environmental threats facing the world. According to the report there are more than 146 dead zones around the world that range in size from between one square kilometer to more than 70,000 square kilometers.

Textbox 2. An Endangered Species Act example

In 2009, the amount of water being pumped into the California aqueduct has be dramatically reduced because a small fish, the Sacramento River smelt—an endangered species—cannot be screened out from the pumps. In some cases only 15% of the normal supply of water is being provided. Farmers currently are cutting down almond orchards or are leaving the land fallow because there is not enough water to grow a crop. It is an example of unintended consequences or an incomplete cost/benefit analysis, where some of the most productive farmland in the United States can no longer be used at a time when the state is in a dire economic condition.

Potassium reserves are abundant. Phosphorus derived from phosphate rock is a limiting mineral resource in crop production. The United States extracted 31 million metric tons (mmt) of phosphate rock in 2008 from a reserve base[8] of 3,400 mmt, or a 110-year supply at the 2008 rate of production (United Nations 2008). This supply is not a comfortable margin for an element so basic to crop production, and the United States eventually will become a net importer of phosphate. World phosphate production totaled 167 mmt in 2008 from a reserve base totaling 47,000 mmt, or a 281-year supply at the 2008 production rate. Nearly half the world's phosphate rock reserves are in Morocco and the Western Sahara.

Overuse of phosphorus creates a less sustainable agriculture and causes environmental damage as water is contaminated. Production and consumption of phosphate rock will increase in the future, but known reserves will expand as phosphate rock prices rise with increasing rock scarcity. The ocean floor holds unrecorded large reserves, but mining such reserves is expensive. There is no substitute for phosphorus in plant growth, but some plants require more phosphorus than others and plant breeding can decrease nutrient use per unit of crop production.

[8] The reserve base includes resources that are currently economic, marginally economic, and some that are currently subeconomic.

Global Warming

Global warming influences the demand for natural resources. Although overall agricultural output and cropland area may not be affected materially in the United States, the location of crop production and land in crops will change (Rosenzweig and Hillel 2005). With adaptation to global warming, cropland area and production are expected to increase especially in the Lake States and also in the Northeast, Cornbelt, Mountain, and Pacific regions and to decrease especially in the Southeast, but also in the Delta and Southern Plains regions. Overall rainfall may increase and be more variable with warming. Water shortages are evident already but will intensify, notably in the Colorado and Rio Grande river basins and the Ogallala aquifer of the Great Plains.

Major Issues Facing Future Agricultural Productivity Outside the United States

Worldwide, issues that will pose challenges for future agricultural productivity include natural resource costs, food demand vs. food supply, and climate change.

Natural Resource Costs

The world will not run out of natural resources but their cost rises as marginal reserves are used. For example, millions of hectares of land are available for cropping in Brazil and Africa, but only under a rising supply price to compensate for needed investment in roads and other infrastructure. The lowest-cost sources of irrigation water already have been developed, and regions such as North Africa and the Middle East will experience severe water shortages as agriculture competes with urban uses for water and land. As with other

natural resources, the thrust needs to be on achieving greater productivity from existing resources rather than from expansion of resource utilization.

Food Demand vs. Food Supply

Both increases in land area farmed and increases in productivity have contributed to keeping food production ahead of population growth. Yield per hectare (or yield per acre) is the most familiar and widely available measure of productivity. Tweeten and Thompson (2009) reported that global cereal yields increased at approximately 3% annually in 1961, 2% annually in 1975, and 1.4% annually in 2000; yields of vegetable oil crops increased at about 4% annually in 1961, 2.6% annually in 1975, and 1.58% annually in 2000. The weighted total of all livestock and crop yields grew at 2.4% per year in 1961, 1.7% per year in 1975, and 1.13% per year in 2000.[9] Other analysts find similar patterns, as shown for "land productivity" (excluding China) in Table 2. Global agricultural labor productivity (excluding China) grew at 1.23% per year from 1961 to 1989 and at 0.42% per year from 1990 to 2005. The story in China clearly is different, with labor productivity growing faster in the second period, perhaps because China has followed unique policies for the past half-century.

Judgments about the future global food situation come down to comparing the rates of growth in food demand and food supply. During the twentieth century, the rate of growth in supply exceeded that of demand; as a result, food prices in the United States and the world generally fell during that period as illustrated in Figure 1. The sharp upturn since 2005 is evident, but food prices turned down again in 2008. The reversal of the secular downtrend of real prices between 2005 and 2008 led to strong concerns about the prospects for meeting future needs. China, Brazil, and India suffered from insufficient agricultural growth in the not-too-distant past, but in the most recent two decades turned around their performance. Sub-Saharan Africa, the epicenter of famines in the 1980s and 1990s, continues to be a cause for concern.

[9] Rates are expressed for a single year because Tweeten and Thompson measured them along linear trend lines.

Table 2. Growth in agricultural land and labor productivity worldwide, 1961–2005 (Alston, Beddow, and Pardey 2008)

	Land Productivity		Labor Productivity	
Group	1961–1989	1990–2005	1961–1989	1990–2005
Developing countries	2.60	3.00	1.60	2.56
Excluding China	2.47	2.29	1.49	1.49
Developed countries	1.71	0.27	3.81	2.89
World	2.04	1.84	1.12	1.37
Excluding China	1.93	1.20	1.23	0.42
Excluding China and USSR	1.93	1.58	1.14	0.73
Top 20 producers	2.08	2.18	1.14	1.78
Excluding China	1.98	1.38	1.32	0.63
Other producers	1.83	0.88	1.08	0.07

Climate Change

Developing country agriculture is likely to be impacted more negatively by global warming than temperate zone agriculture. Night temperatures and longer dry periods are expected to increase in areas close to the equator, and these changes are expected to be relatively more intense than in temperate regions and hence stress crops relatively more in tropical than in temperate regions.

Country/Regional Examples

Four countries (or regions) are particularly relevant with regard to agricultural policy for the twenty-first century. China and India represent exceedingly large population centers of the future world. Brazil has the greatest still-untapped potential of agricultural productivity. Sub-Saharan Africa represents the region on the planet with the greatest challenge with regard to sustenance for its people.

China

Rapid income growth in China was well established by the mid-1990s and

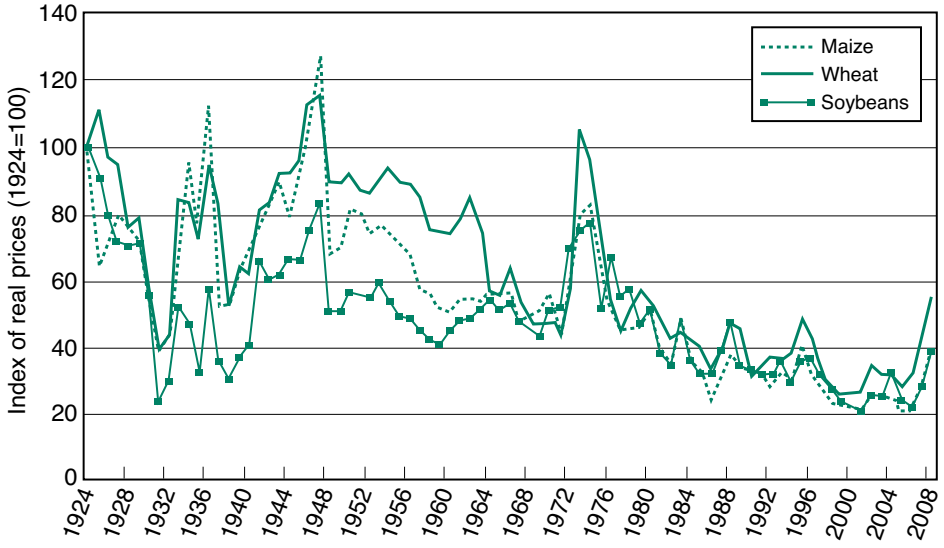

Figure 1. Real U.S. prices of maize, soybeans, and wheat, 1924–2008 (Alston, Beddow, and Pardey 2008).

led some people to question whether the world had the ability to meet the expected growing Chinese demand for food, especially meat, fruit, and vegetables. Some projections held that net import demand might reach 400 mmt of feed grains by 2030 (Fan and Agcaoili-Sombilla 2002), and many people worried about the impact such demand would place on the global ecosystem (Brown 1995). In 1975, China's per capita consumption of calories, fats, and protein were all well below the world average, but by the late 1990s they exceeded the world average and continue to increase.

Confounding those earlier expectations, during the past decade (despite accelerating income growth) China has not greatly increased its demands on the world food market. Its imports of rice and wheat have been modest, and it continues to export corn, aquatic, and horticultural products. Consumption of chicken rather than pork has increased dramatically (Gale and Henneberry 2009).

Some of the muted increase in demand is attributed to price changes and resulting consumer adjustments. For example, in 1991 the retail price of eggs was 12 times the price of flour, whereas by 1995 egg prices were only about 3 times the price of flour. These and other changes in the relative prices of pork, eggs, and chicken have shaped demand and greatly decreased the need for corn, but have increased the imports of soybeans. China increased its annual total corn consumption from 125 mmt to 160 mmt from 2000 to 2009 and met that increase from internal production, decreasing its exports from approximately 10 mmt to less than 1 mmt and with less than 0.2 mmt of imports (USFAS 2009). China's imports of soybeans were 28 mmt in 2005–06 and grew to 38 mmt in 2009–10, with soybean production of 16 mmt in 2005–06 and essentially the same amount in 2009–10.

India

The story of production, productivity, and food security in India is somewhat similar to China's but less buoyant. India's general economic growth accelerated somewhat later than China's and to less lofty levels; but India's food production growth rates began to accelerate earlier than China's, beginning in the mid-1960s, and have continued through the beginning years of the twenty-first century, driven by increasing crop yields and fertilizer efficiency (Evenson, Pray, and Rosegrant 1999).

Concerns in India now focus on the government's crop price supports, subsidies to fertilizer, and subsidies to electricity used to pump irrigation water, the latter especially leading to overexploitation of groundwater (Shah and Verma 2009). Careful analysis indicates that the marked historic discrimination against agriculture created by trade and other policies has evolved to approximate neutrality between their agricultural and non-agricultural traded sectors (Gulati and Pursell 2008). On a simple yield basis, India, with average grain yields of approximately 3 metric tons per hectare (mt/ha), would seem to have much greater potential to increase production than China, with national grain yields already exceeding 6 mt/ha.

Brazil

During the past 40 years Brazil's agriculture has grown rapidly. Driven by incentives that encouraged exploitation of savanna and tropical forest, from 1970 to 1990 Brazil's production of soybeans, corn, rice, edible beans, and wheat rose to 54 mmt, double the level of 1970. In the 1990s, Brazil instituted new macro-economic policies that ended decades of hyperinflation, thereby improving market incentives. From 1990 to 2005 production of major crops again doubled. Brazil has become the world's second largest exporter of soybeans and the largest exporter of orange juice, sugar, beef, poultry, coffee, and ethanol.

Brazil is using only one-third of its potential arable land, suggesting that continued growth of agriculture is possible (Valdes 2006). To realize that possibility, Brazil will need to ensure a favorable macro-economic environment and adequate investment, and to deal with continued opposition to clearing the Amazon and exploiting its savanna. But the physical capacity exists to increase production and exports considerably.

Sub-Saharan Africa

Sub-Saharan Africa is composed of more than 45 countries including 15 with fewer than 5 million people. Many of these countries are landlocked; many have fragile governments, limited transportation, and inadequate communication. The countries of sub-Saharan Africa have experienced decades of slow economic growth. With more than 120 million "ultra poor" people, rapid population growth, civil violence, a rampant HIV/AIDS epidemic, and recurrent food crises, Africa's challenges are deep and persistent.

Between the 1960s—when most African countries achieved independence—and the 1980s, population growth outpaced food production, reducing per capita food availability. Africa is the most rural of global regions with 65% of its workforce in agriculture, so regardless of the assistance it may (or may not) get from the rest of the world, increasing the productivity of its agriculture will be absolutely necessary if Africa is to work its way out of its problems.

The growth rate of the agricultural gross domestic product (GDP) per person was close to zero in the 1970s and negative through the 1980s and 1990s. But with positive growth rates in the past 10 years, this trend has been reversed, suggesting that the stagnation in sub-Saharan agriculture may be over (World Bank 2008). To prosper, sub-Saharan Africa has significant challenges to overcome. Investment in human resources, irrigation, marketing systems, transportation, agricultural technology, and computer network infrastructure are critically necessary if the region is to continue to accelerate its agricultural output.

Strategies to Meet Future Needs for Agricultural Output

The basic framework of strategies to meet future needs for agricultural output is straightforward.

Harness Market Power

No country can meet the demands for agricultural output without harnessing

the power of markets in directing what, how, when, and where to produce. Even a country with a sound, market-based food system has disadvantaged persons who lack access to food, housing, and other items essential for a productive and healthy life. But markets perform poorly without a supportive institutional structure. Key elements of that structure are government provision for equity and for public goods and services.

Support Research

The public sector makes provision for public goods and services because the private sector acting alone underinvests; firms are unable to capture enough of the (perhaps considerable) social benefits to cover costs. Examples are infrastructure such as roads, as well as education and basic research. Sound economic policy is to subsidize activities such as research and education that have positive externalities and to tax activity such as smoking that has negative externalities. A strong case can be made to publically support research on alternative energy technology such as cellulosic ethanol and other agricultural technologies outlined in the Appendix.

Basic research that has no immediate application but a potentially large future value tends to be underfunded by the private sector. Public agricultural research has a proven record of high payoffs in the past and much promise for the future. The high rates of return, frequently 40% or more on investment, indicate that agricultural research has been underfunded in the past by the public sector (Alston et al. 2000; Gardner and Lesser 2003; Huffman and Evenson 2006.) The private sector has stepped up research in recent years but will not fund research with a large public but small private payoff.

Assist Less-Developed Countries

The foregoing remarks apply to rich and poor countries alike, but given the dire food insecurity in developing countries in sub-Saharan Africa, it is useful to review opportunities for the United States to help less-developed countries (LDCs) meet their need for food and other agricultural output (Tweeten 2007).

- The United States will continue to provide humanitarian food and medical support to deal with crises of hunger and disease in LDCs. But the priority is for poor countries to follow sound economic policies, thus raising living standards so that no country perennially needs to depend on donor charity.
- LDCs need continuing help to build institutional and intellectual capacity so they can avoid or treat economic, social, and environmental problems. In many instances this will mean bringing students from LDCs to study in U.S. universities. But increasingly, education of such students will take place in LDC institutions assisted by modern electronic communication with advanced institutions of education and research.
- Some environmental solutions must come multilaterally through international agreements—given the "free rider" problem[10] and the global consequences of air, water, and land degradation.
- One of the highest payoff policies is open international trade and investment markets. Freer trade in most cases pays off whether done unilaterally, bilaterally, or regionally, but is best done multilaterally. Nine recent and past studies reviewed by Huff, Krivonos, and van der Mensbrugghe (2007) predict that global international trade liberalization would add $12 billion to $155 billion (1997 U.S. dollars) annually to world income. Interestingly, the largest gains to developing countries come from liberalizing their own markets. Multilateral negotiations need to work toward farm commodity price and income support programs that, if used at all, give access by other countries to local markets and avoid dumping commodities abroad at subsidized prices.
- Sub-Saharan Africa and many other poor regions desperately need improved technologies to raise agricultural productivity. Although agricultural and environmental technology has been found to have a high payoff, poor countries (aside from notable exceptions such as Brazil, China, and India) do not have the economic means or political will to sustain the necessary research. Africa spends less than 0.5 % of its agricultural GDP on agricultural research, in part because countries do not recognize the high payoff from investing more and in part because they cannot afford more. Wealthy nations spend 2 to 4% of their agricultural GDP on agricultural research, a growing part of that by the private sector.

The United States and other developed countries do a great service by performing basic research, often with wide possible application. Considerable adaptive research development and dissemination are required to apply results of basic research to the disparate agricultures and environments of LDCs. Small developing countries especially need assistance in adapting basic research to local environments.

Falcon and Naylor (2005) document the alarming shift of international support away from agricultural research and development (R&D). Globally, the real value of R&D aid to agriculture in the late 1990s was down one-third from its level a decade earlier. The U.S. Agency for International Development cut its agricultural staff by more than two-thirds from its peak in 1990. The budget of the Consultative Group on International Agricultural Research (CGIAR) system—the institutional father of the green revolution estimated to have saved 1 billion lives—stagnated at approximately $350 million in nominal terms from 1992 to 2001, implying that annual funding fell in real terms. The CGIAR's comparative advantage, which is its productivity-enhancing agricultural research, accounted for just one-sixth of its budget, and expenditures fell 6.5 % annually in real terms from 1992 to 2001.

Africa is a continent characterized by so-called "orphan crops." Countries that grow these crops have limited resources and consequently do not adequately fund R&D; these countries are largely bypassed by the green revolu-

[10] A free rider takes no action, expecting to benefit when other countries take needed action to protect the global environment.

tion. Agricultural R&D expenditures in these countries from all sources total only $1.5 billion annually. Given the high returns to public agricultural R&D, these trends imply missed opportunities that warrant reexamination of donor assistance priorities.

The "Next Green Revolution"

Future agricultural policy for this nation and, indeed, for all nations must include a strong commitment to science if the nations are to meet the coming challenges successfully. It is not sufficient to just understand the dynamics of the existing conditions and the factors that impact success; it is equally critical that agricultural policy identify satisfactory means of changing the dynamics based on information and knowledge. It is the responsibility of science to develop such information, knowledge, and technology through research to allow decision makers to make the changes that reflect the new realities of existing conditions. Dr. Borlaug clearly understood that science was a key part of agricultural policy to alleviate hunger in some regions of the world. That is why in his last writings he called for a "Second Green Revolution."

Norman Borlaug's work illustrates Thomas Edison's maxim: "Success is 10 percent inspiration and 90 percent perspiration." Beginning in Mexico in 1943, Dr. Borlaug—employing the latest developments in science and technology—used hard work, innovative techniques, and a great deal of perseverance to breed highly productive cultivars of wheat. The new cultivars led to increased productivity, personal income, and food availability for hundreds of millions of people in Mexico and South Asia from the mid-1960s to the 1990s.

Increases in population and rising expectations have nearly expended this enhanced productivity, and today the world awaits a renewed green revolution. Innovative, yet classical plant breeding played a central role in the first green revolution and will continue to be needed, but biotechnology that generates GMOs will have an increasingly important role in the second and future green revolutions. The following list suggests additional areas of ongoing scientific research that—if successful—will improve agricultural productivity worldwide. (More complete descriptions of these topics are provided in the Appendix.)

- Enabling C_3 plants to utilize the C_4 photosynthetic pathway
- Introducing nitrogen fixation in nonlegumes
- Incorporating the process of apomixis into crop plants
- Enhancing water and nutrition efficiency of crop species
- Developing processes for more efficient conversion of cellulose, hemicellulose, and lignocellulose to fuel
- Improving pest resistance in plants
- Improving energy efficiency of plants
- Developing commodities with increased health benefits
- Seeking new innovations

What is the Commitment to Agricultural Research to Bring about Another Green Revolution?

Evidence of the highly positive contribution of agricultural research to agricultural productivity growth is clear (Evenson and Gollins 2003). Hundreds of country-specific studies reported in professional agricultural economics literature (Alston et al. 2000) reveal a strong association between agricultural productivity improvements in a given year and spending on agricultural research and extension during the previous 30 years and more (Alston, Beddow, and Pardey 2008).

In an era of intense budget scrutiny, at issue is how to pay for research and development to improve the productivity of agricultural resources. This report offers no definitive answers, but opportunities for U.S. government budget savings are apparent (see Textbox 3 for examples). Just as Borlaug labored for 20 years before his wheat varieties were ready for widespread adoption, today's support must be sustained for decades, to obtain high payoffs (Griliches 1964).

Since the green revolution of the mid-1960s, significant assistance has been directed at developing-country agriculture, growing from $4.7 billion a year in 1973 (in 2002 dollars) to more than $12 billion a year in 1983–87. Approximately 3% of that amount went to support agricultural research, both in national programs and through the centers of the CGIAR. Beginning at essentially zero in 1970, development assistance for agricultural research by developing-country governments reached $456 million in 1983–87 (Herdt 2009).

From the mid-1980s until about 2000, however, development assistance to agriculture was drastically and steadily cut from $12 billion to $4.8 billion, back to approximately the level of the 1970s. Aid for agricultural research fell along with aid for general agricultural development. Funding for the CGIAR centers grew from their creation in 1960 to approximately $40 million in 1970 and further to approximately $300 million in 1988 and then grew slowly thereafter. United States aid to agriculture followed the same general pattern over time, making up between 9 and 14% of the Organization for Economic Co-operation and Development's total. The sharp fall in aid to agriculture after 1992 is difficult to explain in terms of

Textbox 3. Opportunities for U.S. government budget savings

Examples are the government programs to address instability, arguably the principal economic problem of commercial farmers. To address this very real problem, billions of dollars are spent each year on an array of fragmented and often redundant farm programs, including direct payments, countercyclical payments targeting mostly price, the Average Crop Revenue Election (ACRE) program targeting price and yield, the Supplemental Revenue Assistance (SURE) and ad hoc disaster assistance programs, marketing loans, loan deficiency payments, and myriad government-subsidized crop insurance programs. Consolidating these overlapping efforts into a cost-effective safety net could serve farmers while freeing billions of dollars to fund agricultural research and development.

needs. Whereas there was evidence of vigorous agricultural growth in Asia by the 1980s, the opposite was true in Africa. Since about the year 2000, there has been a gradual increase in aid to agriculture and agricultural research.

Globally, in 2005, public agencies invested $23 billion in agricultural research annually, a 50% increase over the 1981 level. In the United States and other high-income nations, the development of deoxyribonucleic acid (DNA)-related tools and intellectual property rights has permitted a great increase in the precision with which the products of plant breeding can be identified (Herdt 2006), leading to a rapid increase in private investments in breeding crop varieties. In 2005, private companies invested $16 billion annually in agricultural research, essentially all (96%) in the high-income countries of the world. The CGIAR is, of course, focused on developing countries, and its investment reached approximately $400 million annually by 2004 (Beintema and Stads 2008), about 2.5% of what private companies invest in research in the more developed countries.

In 2009, influential voices advised the new administration to increase its development assistance for agricultural research and education for developing countries (Bertini and Glickman 2009). The Obama Administration did declare its intention to increase aid substantially to help millions of the world's poorest farmers grow enough food to feed themselves (Baker and Dugger 2009) and the leaders of industrialized countries, known as the G8, pledged increased aid to agriculture. The Bill and Melinda Gates Foundation is making substantial contributions to agricultural and nutritional research, particularly in Africa.

Even assuming these aid efforts are successful, the authors contend that the United States will need to make additional investments to raise the productivity of U.S. agriculture, given the almost unlimited demand for liquid biofuel that can be unleashed by policies designed to reduce oil imports and the possible effects of global climate change. During the period 1950 to1970, percentage growth rate of U.S. public agricultural research and development spending approached 4% per year. It was less than 2% during the next 2 decades and fell to approximately 1% during the period 1990 to 2007 (Alston, Beddow, and Pardey 2008).

Any country and industry would be remiss not to have a contingency plan for a future in which global greenhouse gas control has failed, for whatever reason. Policies "for all seasons" are a critical backstop for agriculture; they include research on genetically modified cultivars to resist heat and drought stress, infrastructure to facilitate farm input and output movement, and open trade so that food can move from regions of abundant supply to regions of diminishing supply due to global warming. Because cropland is less promising than land in trees for carbon sequestration and climate control (trees sequester 4 to 8 times more carbon than crops), a useful policy is to promote high crop yields to minimize crop area so that areas in forests can be retained and expanded.

Conclusions

Numerous factors are converging to make "the perfect storm" in global food and agriculture. While population growth rates are falling in most countries, global population is still increasing and national populations are expected to increase in many developing countries for the next several decades. Approximately 1 billion people in poor countries today do not receive enough dietary energy, and another billion do not get enough protein, fat, important minerals, or essential vitamins. In addition to those increasing demands for food from developing countries, developed countries are increasing their demands on agriculture for fuel and ecosystem services and to offset negative effects of technologies used in the current global industrial economy.

The United States has the land resources and the science capacity to equip American agriculture to meet a large portion of the coming challenges—if the nation takes the right policy steps. We must recognize that the era of living beyond our means is coming to an end, and the end of cheap, plentiful energy from petroleum is driving that demise. United States agriculture is being called on to supply much of that energy, but without substantial increases in research and development, those energy supplies will come at a huge cost. The potential may exist, but today's technology is not able to convert potential into usable energy at a reasonable cost.

Agricultural supply of conventional commodities is of concern as well. The global annual average increments in crop and livestock yields for all major commodities have stagnated or declined in recent decades (Tweeten and Thompson 2009). At current commodity prices, the opportunities to meet food demands without additional cropland and irrigation are constrained. Global warming threatens to decrease agricultural production, especially in tropical and subtropical regions where most poor people live.

The dire predictions of political economist Thomas Malthus have failed to materialize, but complacency is unwarranted given the many warning signs of tighter future agricultural supply–demand balance, rising real food prices, and the increasing role of agricultural commodities in meeting energy needs. The convergence of so many challenges at one time is unprecedented. Increasing the productivity of resources available to agriculture is critical. The typical lead time for investments in science and technology to raise agricultural productivity is 10 to 20 years; hence, delays in investment constitute a cost in foregone output a nation can ill afford.

Responding to needs is not solely the province of the President, Congress, industry leaders, and state governments. The public will have to actively support political action, particularly on such broad issues as global climate change, regulations on the welfare of animals in agriculture, natural resources, and investments in agricultural research and education.

The greatest concern felt by the authors of this paper is the apparent lack of commitment by the United States and other countries to make the research and education expenditures needed to address the problems affecting our survival on this planet. Agriculture can provide the food we eat, the feed for our livestock and companion animals, fiber for our clothes and homes, "flowers" for the environment, and the fuel

we need—if we develop the needed information, knowledge, and technology through research and education. It will take a strong and constant public commitment to adequate funding. Indeed, we have no other alternative if we are to gain success.

Appendix

The following examples suggest areas of ongoing scientific research that—if successful—will improve agricultural productivity worldwide and could help to bring about the "Next Green Revolution."

Example 1. Enabling C_3 Plants to Utilize the C_4 Photosynthetic Pathway

There are two basic forms of photosynthesis. In one form, the first compound resulting from photosynthesis has three carbons (3 phosphoglycerate), hence C_3 photosynthesis. In the other form of photosynthesis, the first compound is a four-carbon compound (oxaloacetate), hence C_4 photosynthesis (Hatch and Slack 1966). C_4 plants such as corn, sorghum, sugarcane, and bermudagrass are much more efficient at fixing carbon (producing more biomass such as grain, straw, or root mass) than C_3 plants are. The unique structure of C_4 plants enables them to divide the reactions of photosynthesis between two types of cells. This mechanism greatly decreases photorespiration, a process whereby "fixed carbon" is released to the atmosphere. Given that some of the most important crop plants such as wheat, soybeans, and rice are C_3, the capacity to convert C_3 plants into C_4 plants holds great promise for increasing productivity.

Example 2. Introducing Nitrogen Fixation in Nonlegumes

Nitrogen fertilizers enable farmers to achieve the high yields that drive modern agriculture. The use of nitrogen fertilizer will continue to increase substantially as global population and food requirements grow. One of the most critical plant nutrients, nitrogen, alone comprises more than 78% of the atmosphere. Despite its abundance, nitrogen is not cheap when converted into a form useful to plants. Nitrogen fertilizer constitutes a major cost of producing crops such as corn and sorghum. Some major crops such as soybeans and alfalfa have the capacity to "fix" atmospheric nitrogen in a form that supports growth of the plant or, on decay, returns it to the soil profile for future crops. The symbiotic relationship of nitrogen-fixing bacteria in legumes that evolved through long periods of time is a complex process; however, finding a way to imbue nonlegumes to fix their own nitrogen would greatly stimulate productivity. Recent research in phytoplasmas could be a successful means of introducing nitrogen fixation in non-legumes by using the nitrogen-fixing mechanism of certain microbes that possess this capacity.

In addition to developing crops that can biologically fix nitrogen, research should focus on increasing the efficiency with which crops are able to mine nitrogen from the soil. Plants with this high extraction efficiency require less nitrogen and also decrease potential contamination of groundwater from nitrogen fertilization.

Example 3. Incorporating the Process of Apomixis into Crop Plants

The requirement of annual hybrid seed production can be circumvented by the process of apomixis, which is production of seed without fertilization by the male gamete in pollen grains, resulting in progenies identical to the seed-bearing hybrid plant. Hybrid vigor has enabled some crops to achieve an exceedingly high level of productivity as evidenced by hybrid varieties of corn. Unfortunately, the development of hybrids such as corn is expensive because of the requirements for planting different inbred lines to produce the hybrid seed every year. Without this annual reproduction of first-generation hybrid seed, productivity in subsequent generations would continually decline due to inbreeding depression. This practice would enable hybrid crop plants to maintain hybrid vigor at no additional cost (i.e., the annual hybrid seed production field is unnecessary if the hybrid plant is apomictic.)

Example 4. Enhancing Water and Nutrition Efficiency of Crop Species

Given the potential for global climate change, improving efficiency of production assets and improving plant and animal tolerance to adverse growing conditions and stress become important considerations. Several approaches are possible. For example, breeding plants with greater drought, heat, or submergence tolerance is a long-sought goal.[11] Water is an increasingly important factor in agricultural productivity in many regions of the world. There are estimates that 40% of corn crop losses are due to a lack of water (Boyer 1982; Boyer and Westgate 2004). Water will become a more serious factor affecting productivity with further progression of global climate change. Considerable research is under way that holds promise of conferring remarkable levels of drought tolerance to corn (Castiglioni et al. 2008; Nelson et al. 2007).

Soil salinity is one of the major abiotic stresses impacting agricultural productivity in many parts of the world. The problem is exacerbated by irrigating with water that has high salt concentrations. Two main approaches to improving crop salt tolerance are (1) developing more salt-tolerant cultivars through natural genetic variation either through direct selection in stressful environments or through mapping quantitative trait loci and (2) subsequent marker-assisted selection. Another approach is through the generation of transgenic plants to introduce novel genes or to alter expression levels of existing genes (Yamaguchi and Blumwald 2005).[12]

Recent developments suggest the possibility of sustainable bioenergy production through pyrolysis of biomass with the use of the biochar co-product as a soil amendment, which may increase nutrient and water use efficiency and enhance productivity especially for

[11] An excellent example of overcoming stress is the recent identification of a tolerant-specific allele named Sub1A-1 and an intolerance-specific allele named Sub1A-2. Over-expression of Sub1A-1 in a submergence-intolerant species conferred enhanced tolerance to flooding in the rice genus *Oryza* (Xu et al. 2006). Introduction of the genetic material Sub1A-1 into current cultivars of rice gave these new varieties tolerance to submergence for up to two weeks.

[12] Salt tolerance in plants can be enhanced by increasing solute concentrations in the vacuoles of plant cells thereby increasing the vacuolar osmotic potential. This would result in a decrease of the cellular water potential such that it would favor water movement from the soil into the plants (He et al. 2005).

degraded and problematic soils (Laird et al. 2009).

Example 5. Developing Processes for More Efficient Conversion of Cellulose, Hemicellulose, and Lignocellulose to Fuel

It is becoming more commonly accepted that a portion of agricultural output will be used to produce readily usable forms of energy such as transportation fuels and bioproducts. Conversion of sugar to ethanol using yeast fermentation is one means of converting an agricultural product to a usable energy form. This conversion is done in Brazil using sugarcane and in the United States using corn (after hydrolyzing starch to sugar). A major research effort is under way to develop effective and efficient means of converting cellulosic biomass directly to transportation fuels and various bioproducts. This approach would permit the use of nonfood biomass and many types of waste that presently are not being used for productive purposes.

Example 6. Improving Pest Resistance in Plants

Considerable progress has been made in developing plants with resistance to certain insects and diseases. The *Bacillus thuringiensis* (Bt) gene is an excellent example, but only the beginning. This type of plant improvement alone will not bring about another green revolution, but certainly could contribute. Scientists must continue to seek new and novel ways of giving plants desirable traits, such as the use of phytoplasmas. Although infection of a plant by phytoplasmas often causes a disease, phytoplasmas have great potential for introducing genetic material into plants that can express a desired outcome, such as pest resistance. The classical means of incorporating new genes into plant cells is by using the bacterium *Agrobacterium tumefaciens*. Of course, in either case, the undesirable aspects caused by these organisms must be disarmed.

Another novel approach involves the development of a different mode of action by using a process called ribonucleic acid (RNA) interference (RNAi) by such organisms as Bt. This would be valuable for managing insect resistance. For example, ingestion of double-stranded RNAs supplied in an artificial diet triggers RNA interference in several coleopteran species, leading to larval stunting or mortality (Baum et al. 2007). Additional research in these approaches is warranted.

Example 7. Improving Energy Efficiency of Plants

Plants are quite inefficient in capturing energy from the sun. Calculations show that less than 3% of sunlight absorbed by the leaf is converted to chemical energy; frequently, it is less than 1%. This number is in contrast with photo voltaic cells (solar panels) that routinely capture 10 to 15% of light. With new technology in solar panels, efficiency may become even greater, up to 20%. Most crops capture light in the range of 400 to 700 nanometers (nm). On the other hand, throughout nature there are organisms that capture light from 400 to 900 nm. The light harvesting mechanism (grana) of crops could be improved through genetic engineering. Genes could be transferred to improve energy efficiency either by enhancing the light-harvesting capabilities or by expanding the wavelength of light being captured.

Example 8. Developing Commodities with Increased Health Benefits

Another means of enhancing agricultural productivity is by developing "better" commodities. This may include food commodities that have unique properties such as increased health benefits. Recent advances in several areas of basic sciences provide an optimistic basis for developing foods with unique and desirable properties such as a specific amino acid profile or particular antioxidants, vitamins, or minerals. Once such desirable traits are identified, they can be incorporated into an array of foods to meet dietary and ethnic requirements. Vegetables, fruits, and nuts especially contain many of the highly desirable nutrients and properties that contribute to a healthy diet.

Example 9. Seeking New Innovations that Offer Possibilities

In addition to the foregoing ideas that represent areas of ongoing research that could contribute to the next green revolution, the authors are quick to offer the possibility of other innovative ideas. For example, the emerging discipline of phonemics[13] could provide the basis of quantum increases in plant efficiency. Another promising technology is bioengineered algae that convert the carbon dioxide waste from coal-fired plants into biofuel. One of the greatest opportunities for powering the next green revolution is "farming the world's oceans." When considering the simple fact that there is a lot of ongoing photosynthesis in the oceans and recognizing the tremendous expanse of the oceans, it is not surprising that developing farming practices for ocean crops would provide a quantum increase in agricultural output. Although there are many approaches that could be considered, developing floating perennial crops that produce seeds or biomass holds great promise.

And researchers should not overlook the micro innovations that could bring about environmental adjustments that taken individually have only a modest impact, but combined can have a tremendous impact. These innovations include such things as improved tillage systems, better irrigation efficiency, new crop species, and more effective use of manures.

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[13] While genomics is the study of a genome of a given species and proteomics is the study of a species' entire complement of proteins, phenomics is that branch of science that integrates all available information into a holistic picture of the species. It is the systemic study of phenotypes on a genome-wide basis, usually implying a high-throughput approach of capturing phenotypes and associating those phenotypes with either genomic or proteomic differences.

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APPENDIX D

Power Point Presentations

Integration of competing concepts surrounding the ethical use of food animals

Wes Jamison
Palm Beach Atlantic University

Integration of Competing Concepts Surrounding the Ethical Use of Animals

Wes Jamison, PhD
Palm Beach Atlantic University
University of Florida

Outline

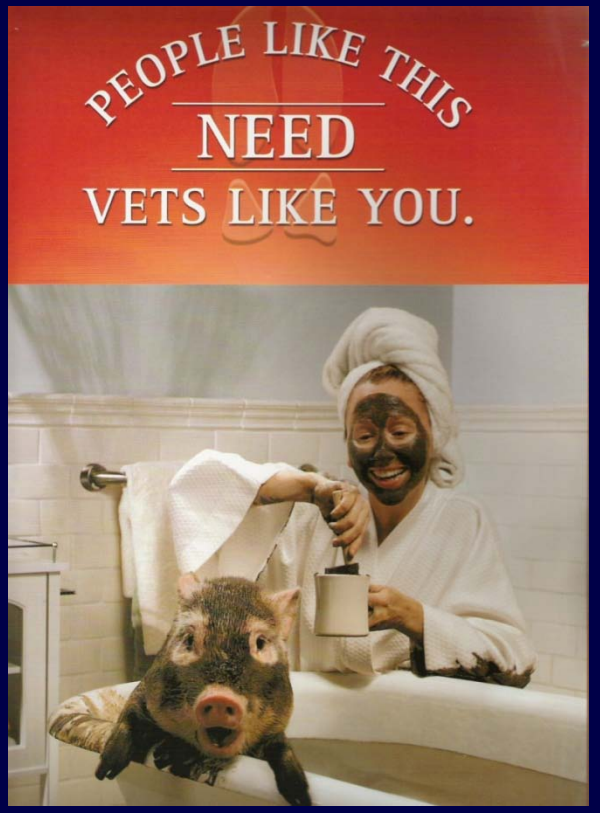
- Disintegration
- Current Status
- What Integration Requires
- Potential ‘Futures’

Disintegration of Consensus
(in no particular order)

- Growth of Urbanization
- Legitimacy of Philosophical Pluralism
- A Collapsing Cohesive World-View
- Collapse of Optimistic Scientific Humanism
- Disintegration of ‘Two Standards’ Approach

Growth of Urbanization

- Obvious changing contact w/ animal farming
- Shifting mediating structures & institutions that organize and interpret reality
  - Urban epistemology
  - *Lost Country Life* & the cult of the pet
    - Animal use mediated through non-consumptive, pet-centric cognition



Legitimacy of Pluralism

No one, single privileged perspective

Reflected in 1st Amendment

Worldview Collapse

- Pre-Industrial Revolution: relatively unified cosmological/epistemological/ethical view of animal roles and the human-animal relationship
  - Cohesive anthropocentric consumptive instrumentalism
- Rising aff[illegible]hical develop[illegible]
- Currently [illegible]

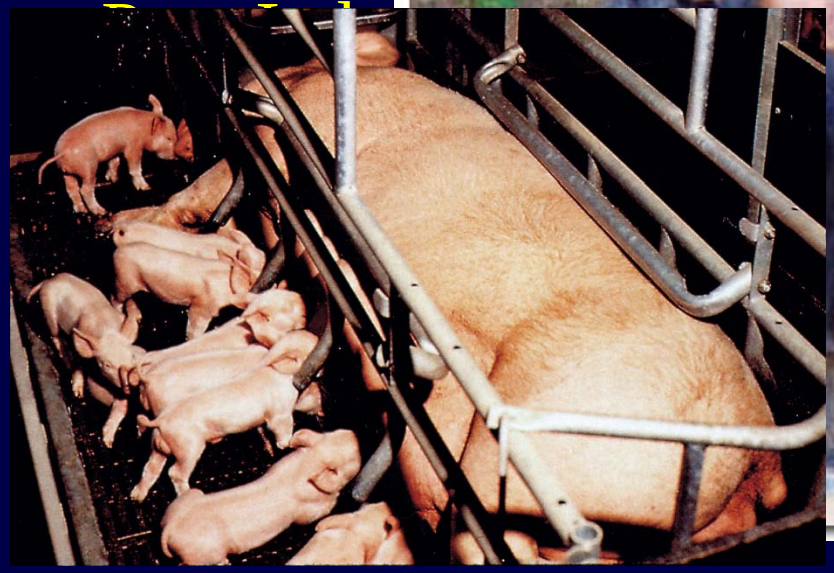
Worldview Collapse

Delegitimization of Optimistic Scientific Humanism

- Early View: Faith in science & technology

Disintegration of ‘Two Standards’ Approach

- Pre-Industrial Revolution
  - Cohesive anthropocentric consumptive instrumentalism
- Post-Industrial Revolution
  - Anthrop…ism + anthrop…



Where Are We?


Why love one but eat the other?
Choose Vegetarian.
MERCY FOR ANIMALS
LAMAR

Competing Worldviews: old narrative

Anthropocentric instrumentalism

Old ‘welfare’

We can use animals as long as unnecessary pain and suffering are minimized

New ‘welfare’?

Where are we?

- For a significant majority of Americans, the role of animals in their lives changed
  - From instrument used as tool and commodities to instrument used for human aesthetic purposes
    - Companionship
    - Entertainment
    - Symbolic repositories of human virtue

Importantly, instrumentalism still extant but evolved

Where are we?

- The dominant, cohesive worldview regarding the role and utility of animals has faded
- No dominant, cohesive worldview has emerged
- What, exactly, is an animal, and what is its role in our lives?

Where are we?

- A narrative ‘vacuum’ created wherein philosophers & interest groups provide a new narrative
- “Inherent interests = inherent rights”
- “Can they suffer?”
- Animals are not “ours”

Current Narratives

- The Mirror: animals reflect people, e.g. how we treat them shows us ourselves
- The Model: animals are perfect family members, e.g. malleable, compliant, transportable
- The Misanthrope: nature = good …animals = natural …people = bad…people altering animals = bad
- The Muse: animals teach us how to be better humans

Recap

- Disintegration
- Current status

What does Practical Integration of Competing Concepts Require?

- Shared values
- Shared experiences
  - In their absence, intractible conflict is to be expected
  - No long-term policy solutions can be expected

What does Future Integration Look Like?

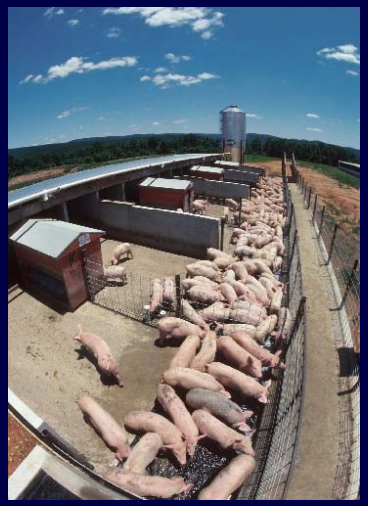
- Learn to speak Spanish
  - Coersive Isomorphism
- Food science + genetic engineering end run
  - Science is universal ‘acid’ & pragmatic
  - It is accepted because it ‘works’
  - Current disarray merely ‘noise’ as we shift agricultural epochs

What does Future Integration Look Like?

- Development of tiered, boutique agriculture with continuing agrarian culture wars
- Continued muddling through
  - Consumers and the lessons of BP
    - Addicted to oil + pristine environment = out-of-sight drilling → "make it go away!"
    - Consumers have a remarkable ability to rationalize
    - The policy system absorbs perturbations & disruptions
    - Necessity forces choices

Why Does Animal Agriculture Endure?

- Animals take nature we can't use and convert it to nature we can
  - Methods and locations will change
  - Social 'noise' generated by disintegration will not overcome anthropocentric instrumentalism



Summary

- Disintegration
- Current Status
- What Integration Requires
- Potential ‘Futures’

Impressions from the agricultural community regarding food-animal welfare and agricultural regulation

Gregory P. Martin
The Pennsylvania State University

Impressions from the agricultural community regarding food-animal welfare & agricultural regulation

Gregory P. Martin, Ph.D., PAS
The Pennsylvania State University Extension
Southeast Region

Setting the Table

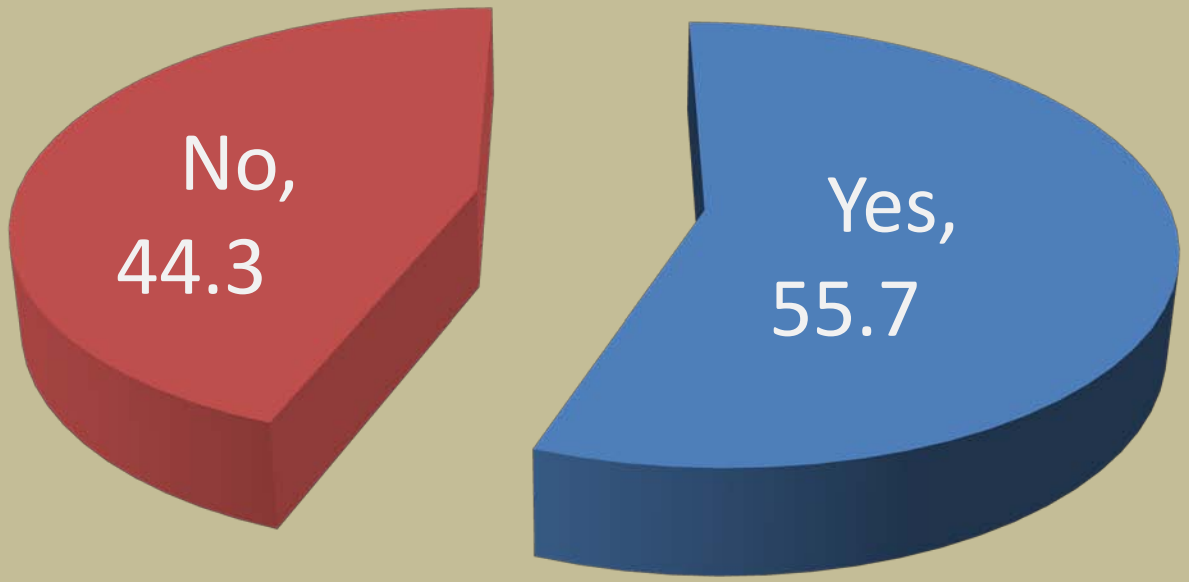
- 309 Million to feed
- 2 % working to feed us = 6.2 million
- Farming environment is changing
  - Fiscal, tax
  - Environmental
  - Production Practices
- What is the producer's perspective in all this?

Tools Used

- Questionnaire Built
- Canvassing via Survey Monkey
  - Data Downloaded 21MAY2010
- Looking primarily for farmers and farm groups associated with animal agriculture
- Only a sample, not a cross-section !
- 1,077 questionnaires completed

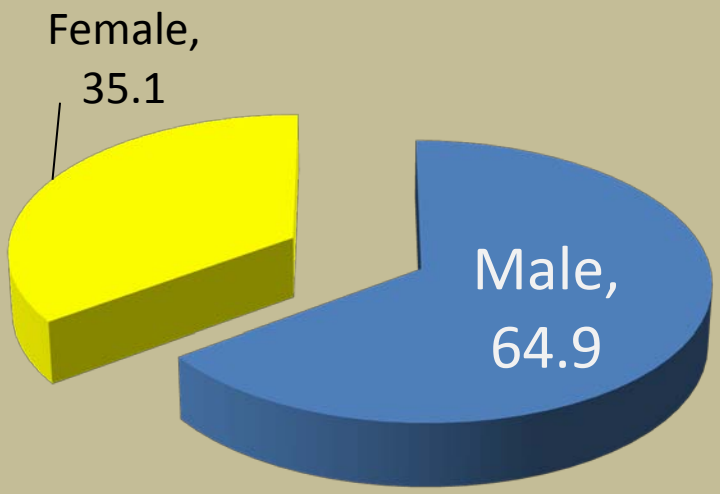
Demographics

50 Years or Older?

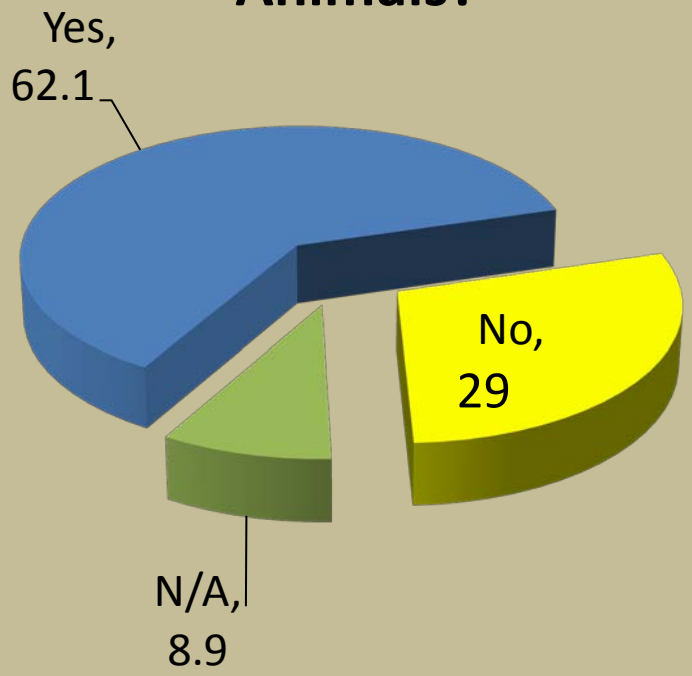


Demographics

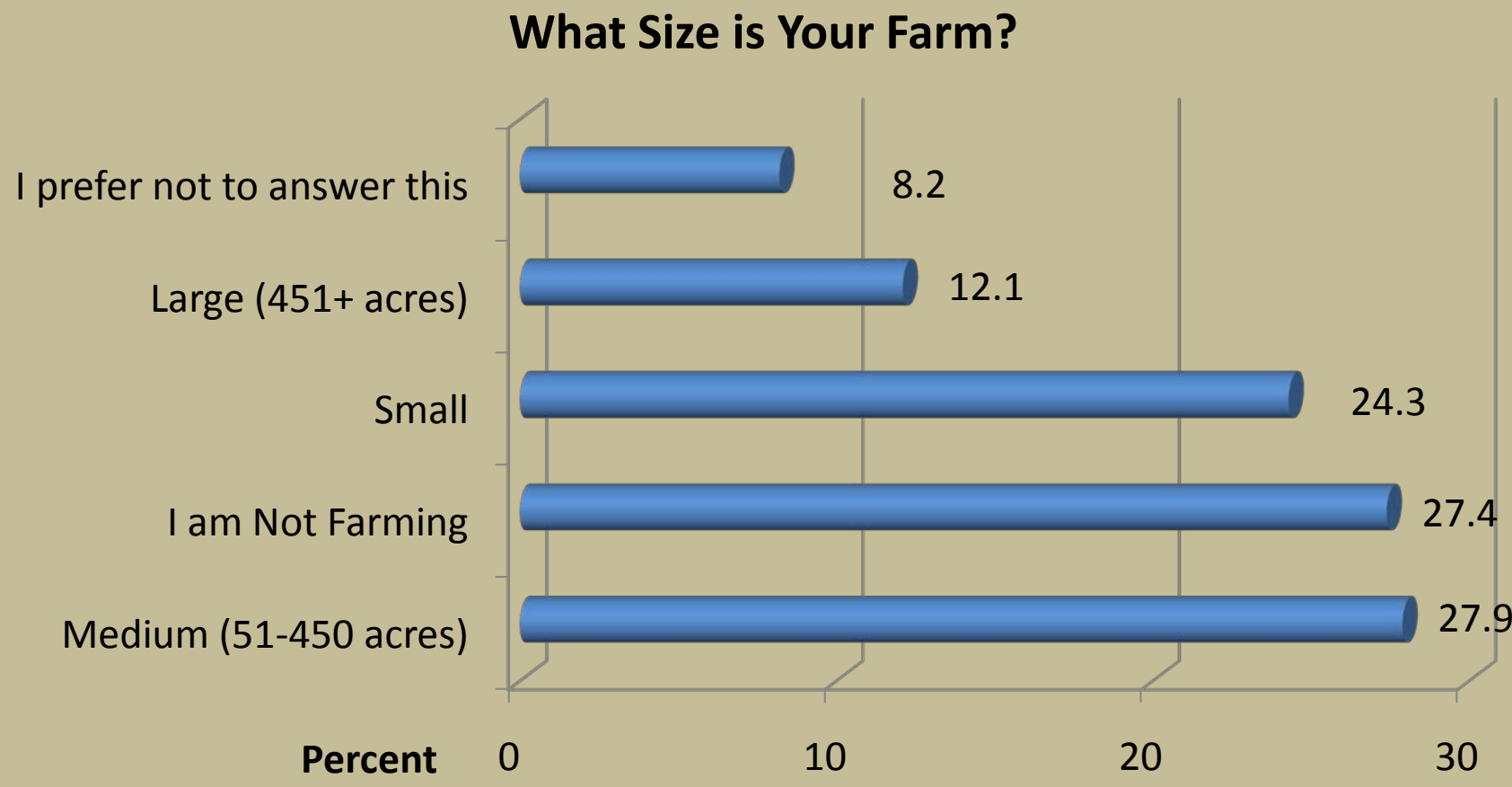
Are You:



Do You Raise Food Animals?

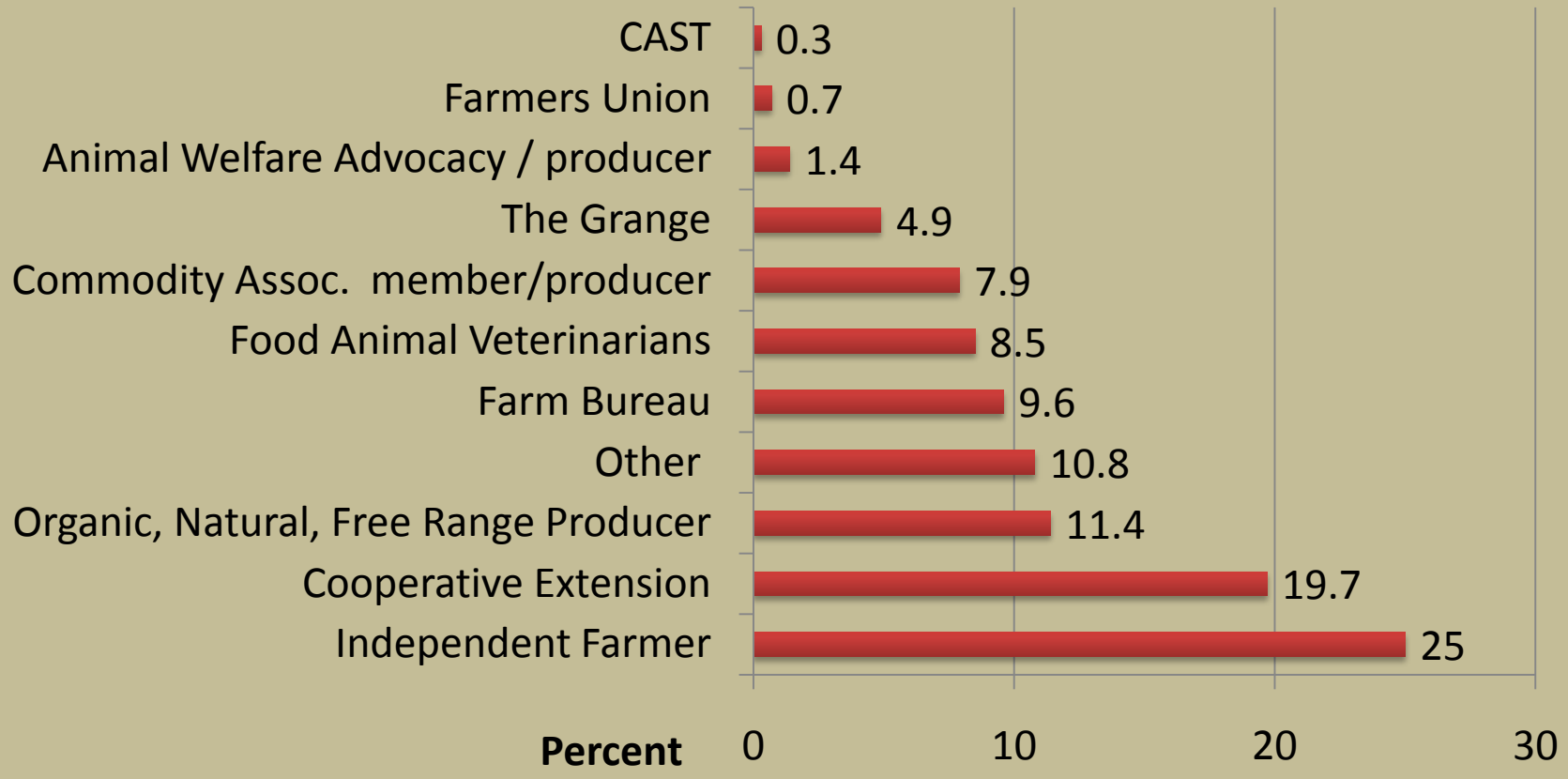


Demographics



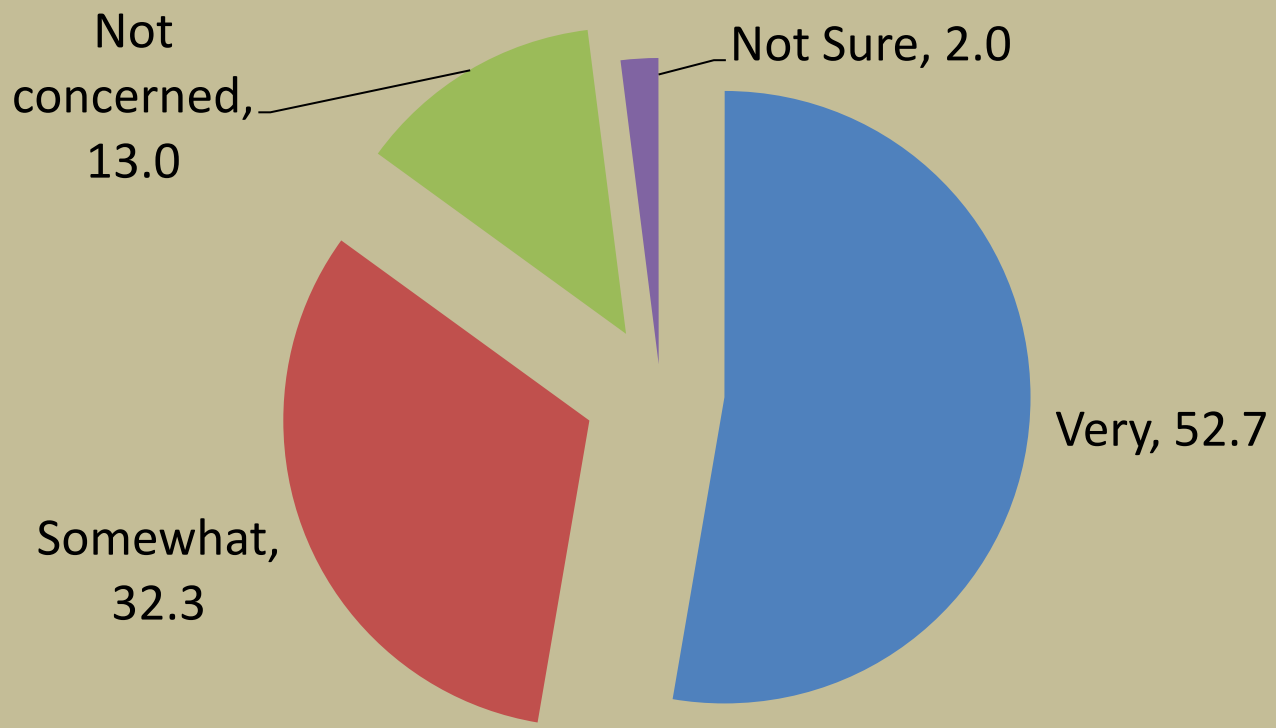
Demographics

Group Affiliation



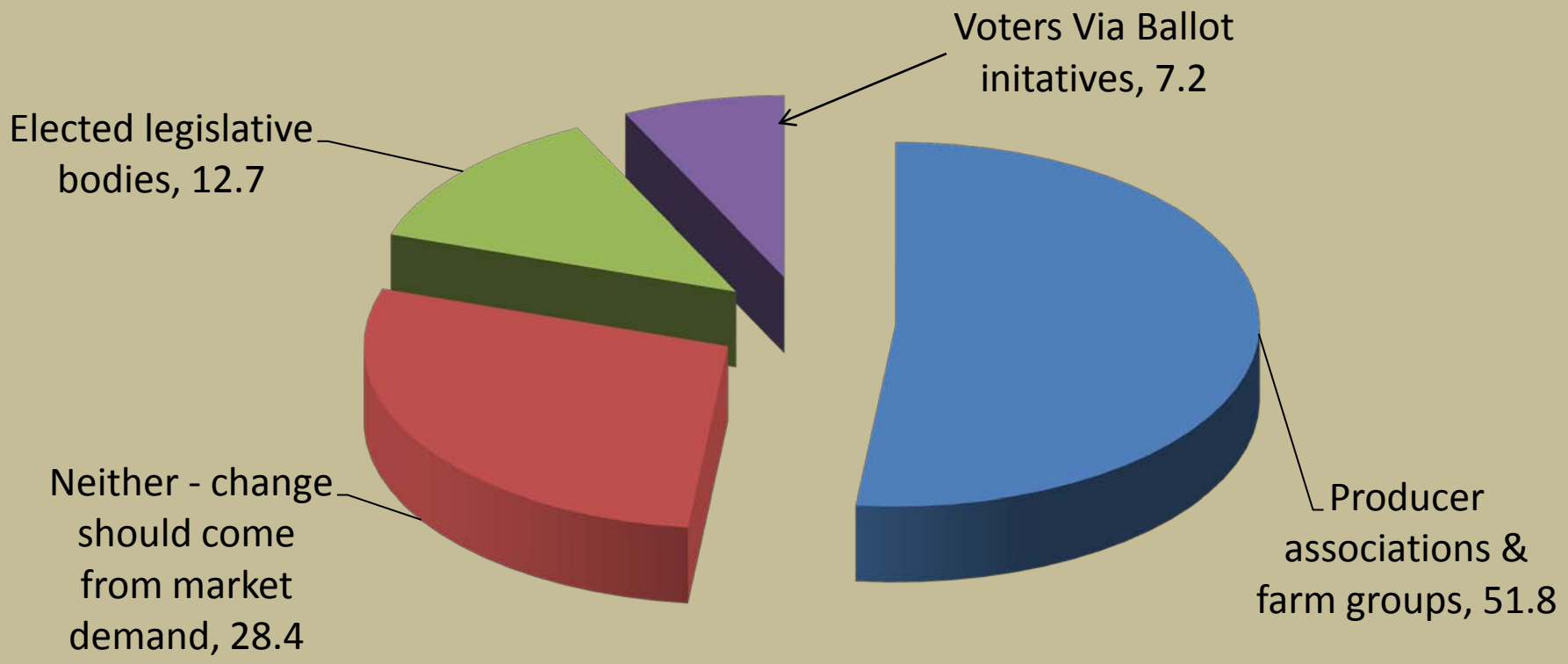
Impressions

How concerned are you about food animal welfare?



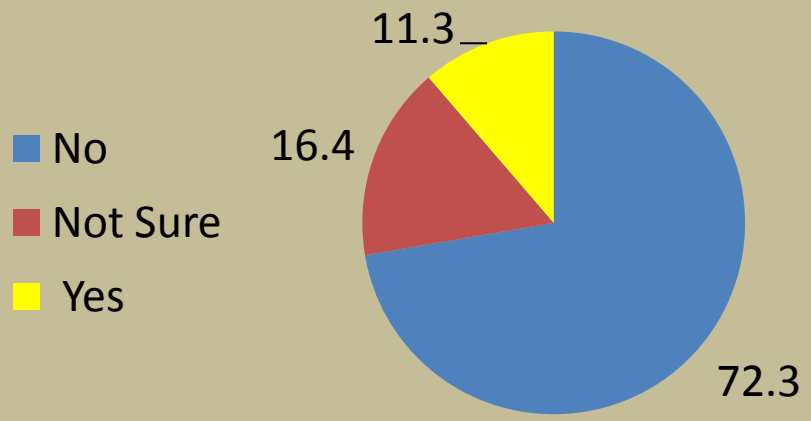
Impressions

Who Should Make Regulatory Decisions Related to Food Animal Ag?

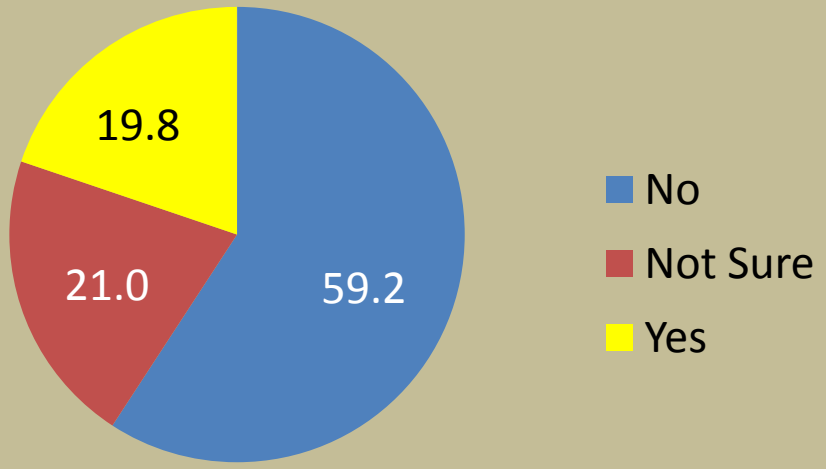


Impressions

Do consumer food expectations match proposed & mandated demands placed on food animal producers?

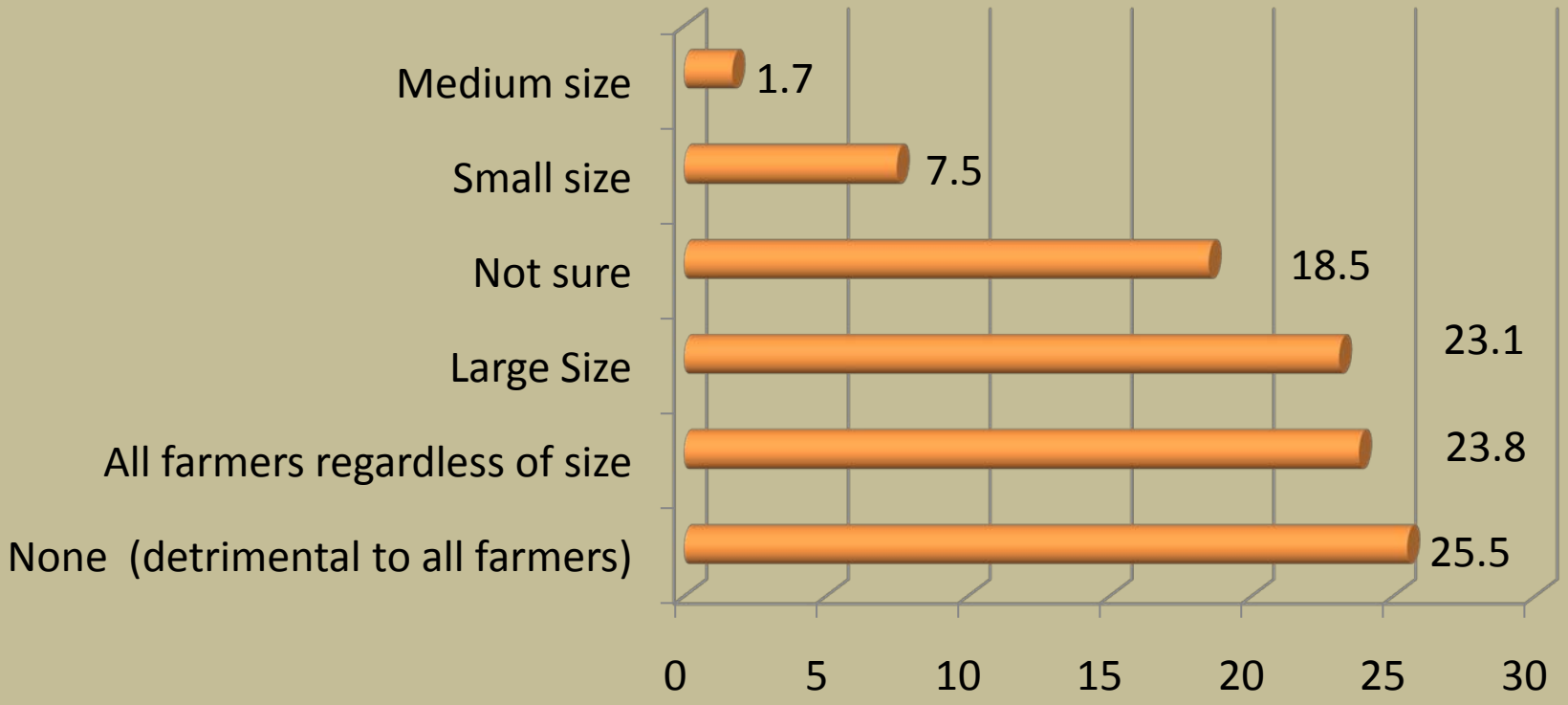


Do you think consumers are willing to pay for increased food costs due to certification or regulatory programs?



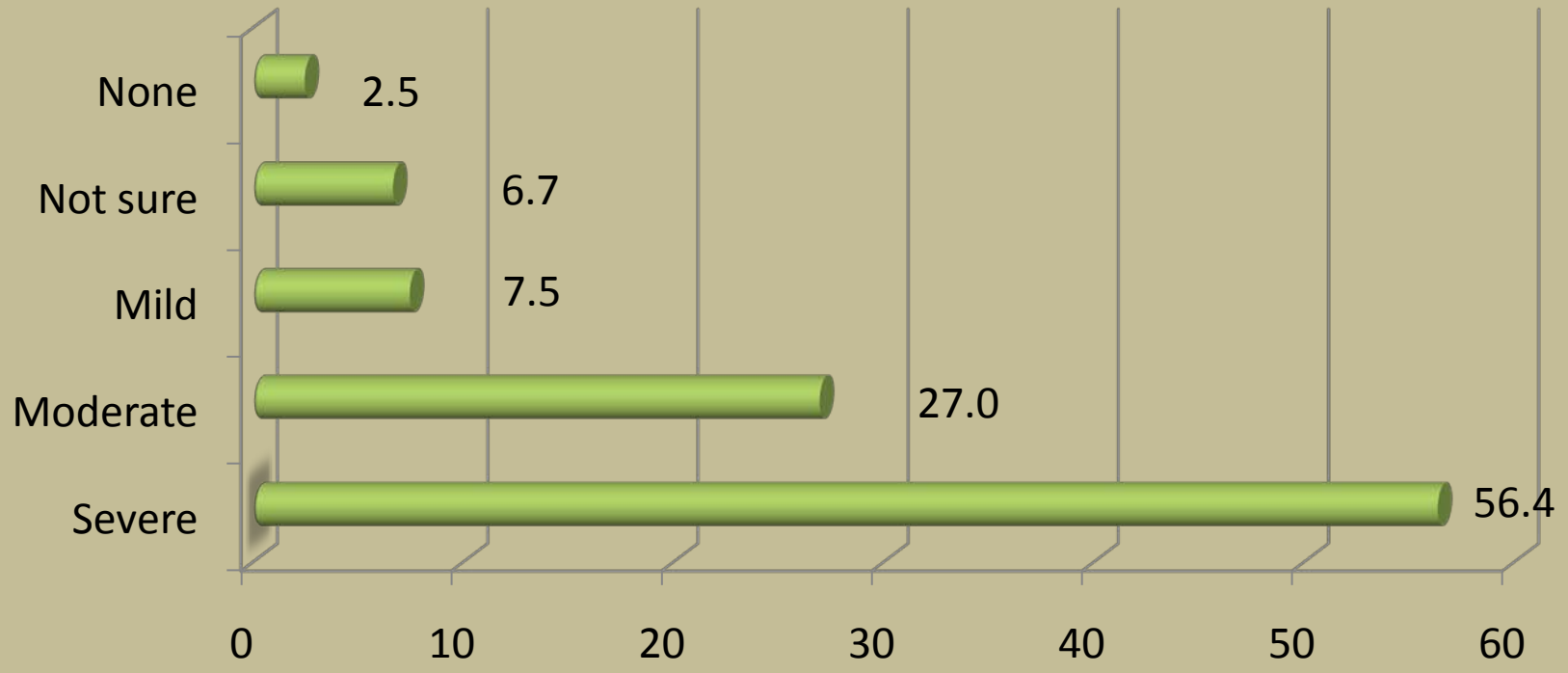
Impressions

What type of farmers do certification programs & regulations benefit most?



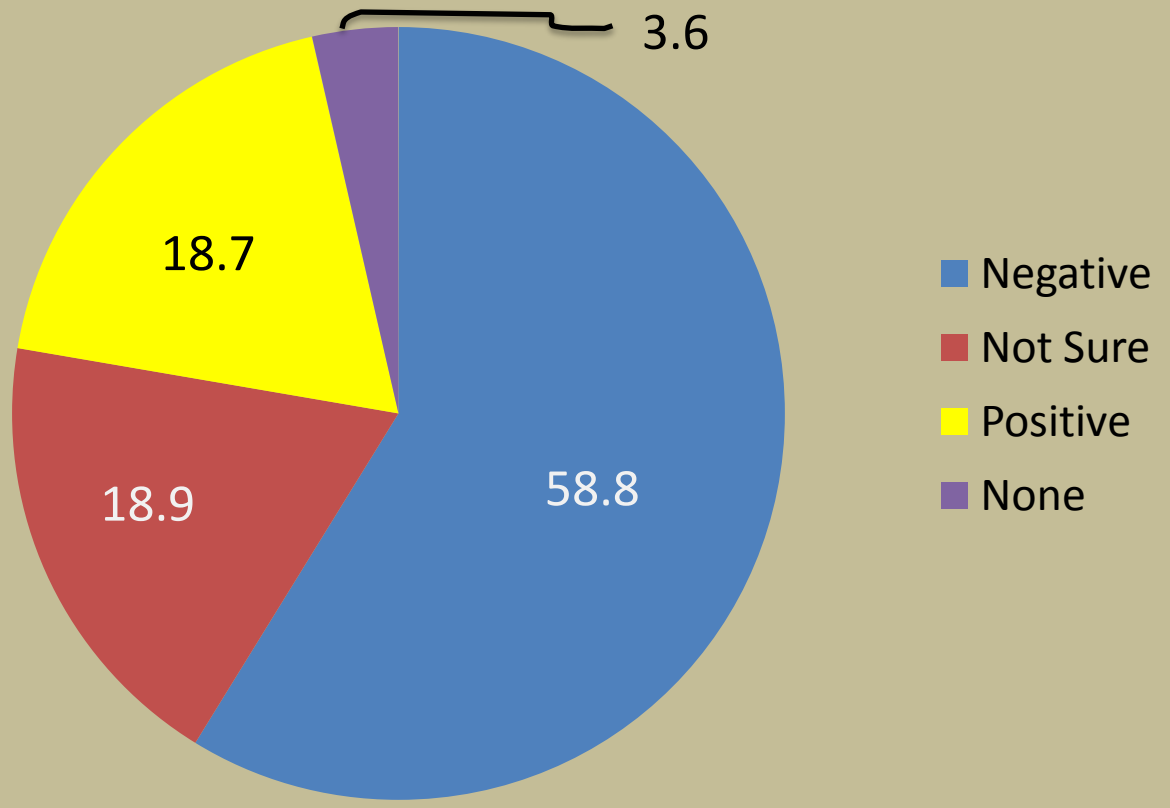
Impressions

How much impact do you think animal welfare initiatives, propositions & other legal mandates have on small communities & the rural infrastructure?

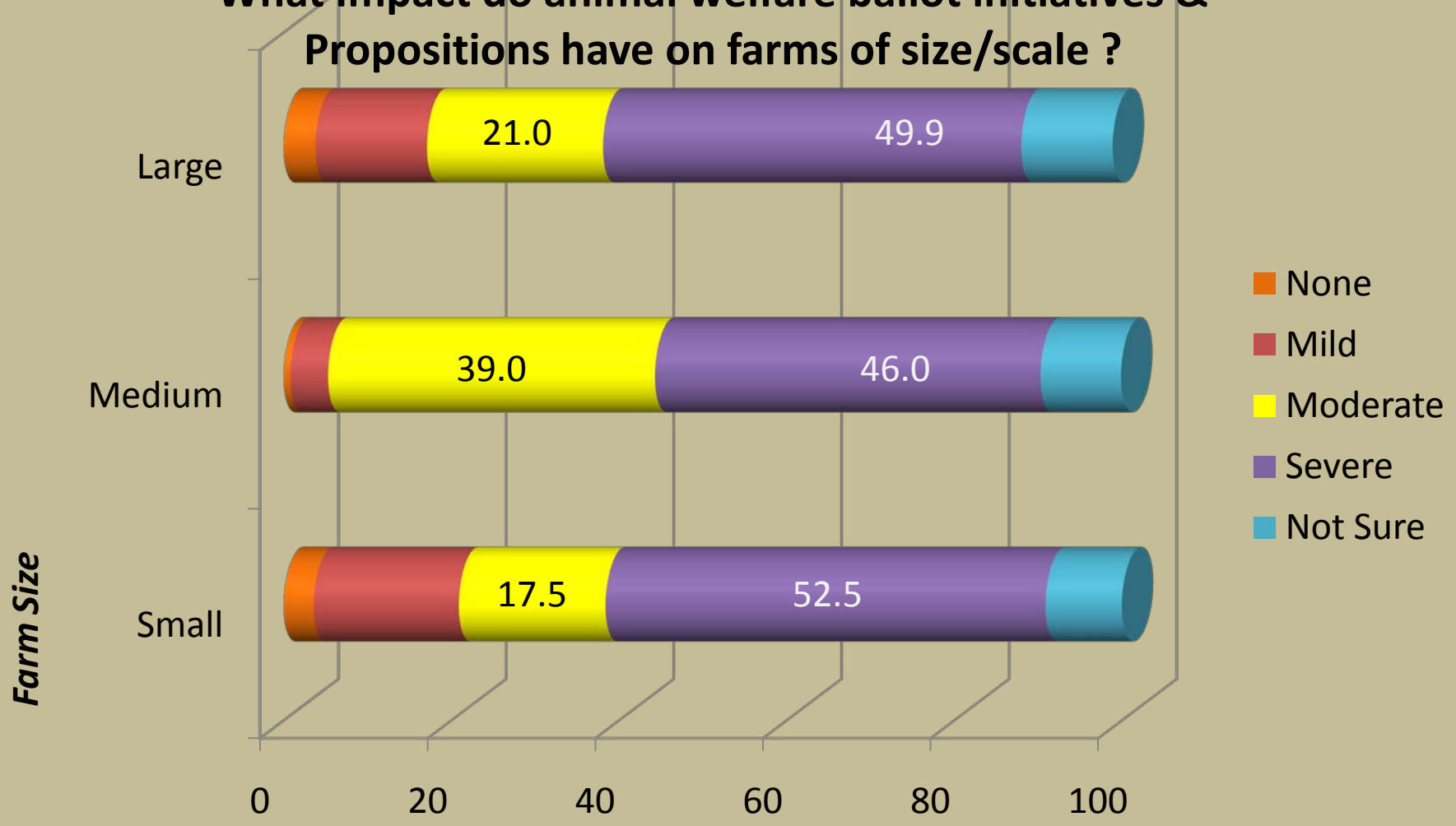


Impressions

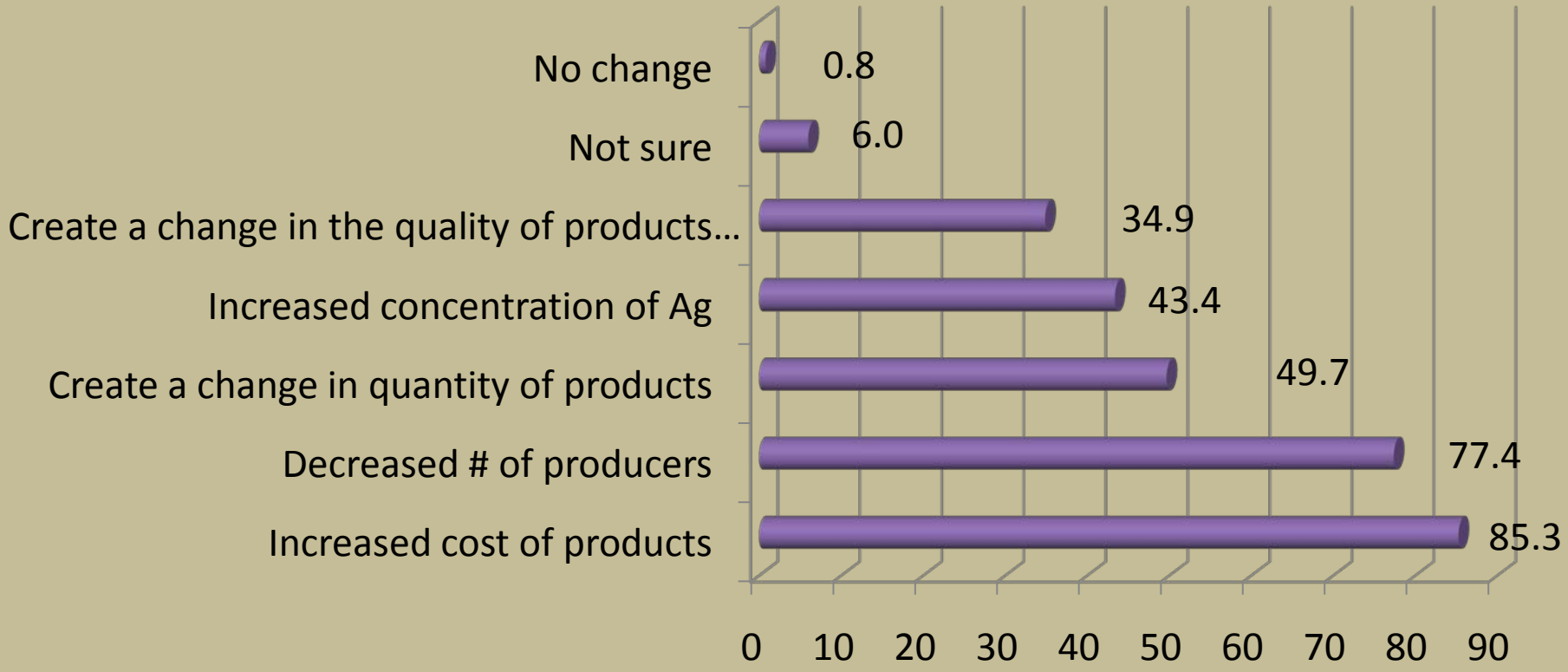
In general, what impact does consolidation of food animal industries have on rural communities?



What Impact do animal welfare ballot initiatives & Propositions have on farms of size/scale ?



What are the unintended consequences of current and proposed animal welfare ballot initiatives on the structure of agriculture? (select all)



Comments – 454 entered

- “Regretfully there are still some producers who do not understand the animal welfare issue and there are others (i.e. - consumers, politicians, and others) who think they know animal welfare but do not understand or work with animals. The animal industry must police its self if they want to have affective and rational requirements.”

- “I don't think that I have enough knowledge about the entire situation to make an intellegent[sic] response. I do know that I do not eat the cattle we raise because they seem like pets. When I eat a steak from the store, there is no sentiment. Slaughter of any animal makes me sad, but animals and grain have been a means of income in my family for many years. For an animal to give it's life to nurture mankind is a supreme sacrifice. I don't think the world is ready to become vegan at this date. Thank you.”

Thank You !

Gregory P. Martin, Ph.D., PAS
Pennsylvania State University

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http://drbirdnotes.blogspot.com/

Historical perspective of the integration of animal agriculture

Ron Plain
University of Missouri-Columbia

CAST Food-Animal Ag Symposium
June 8, 2010 Washington, D.C.

Historical Perspective of the Integration of Animal Agriculture

Ron Plain, Ph.D.
D. Howard Doane Professor
Dept. of Agricultural & Applied Economics
University of Missouri-Columbia
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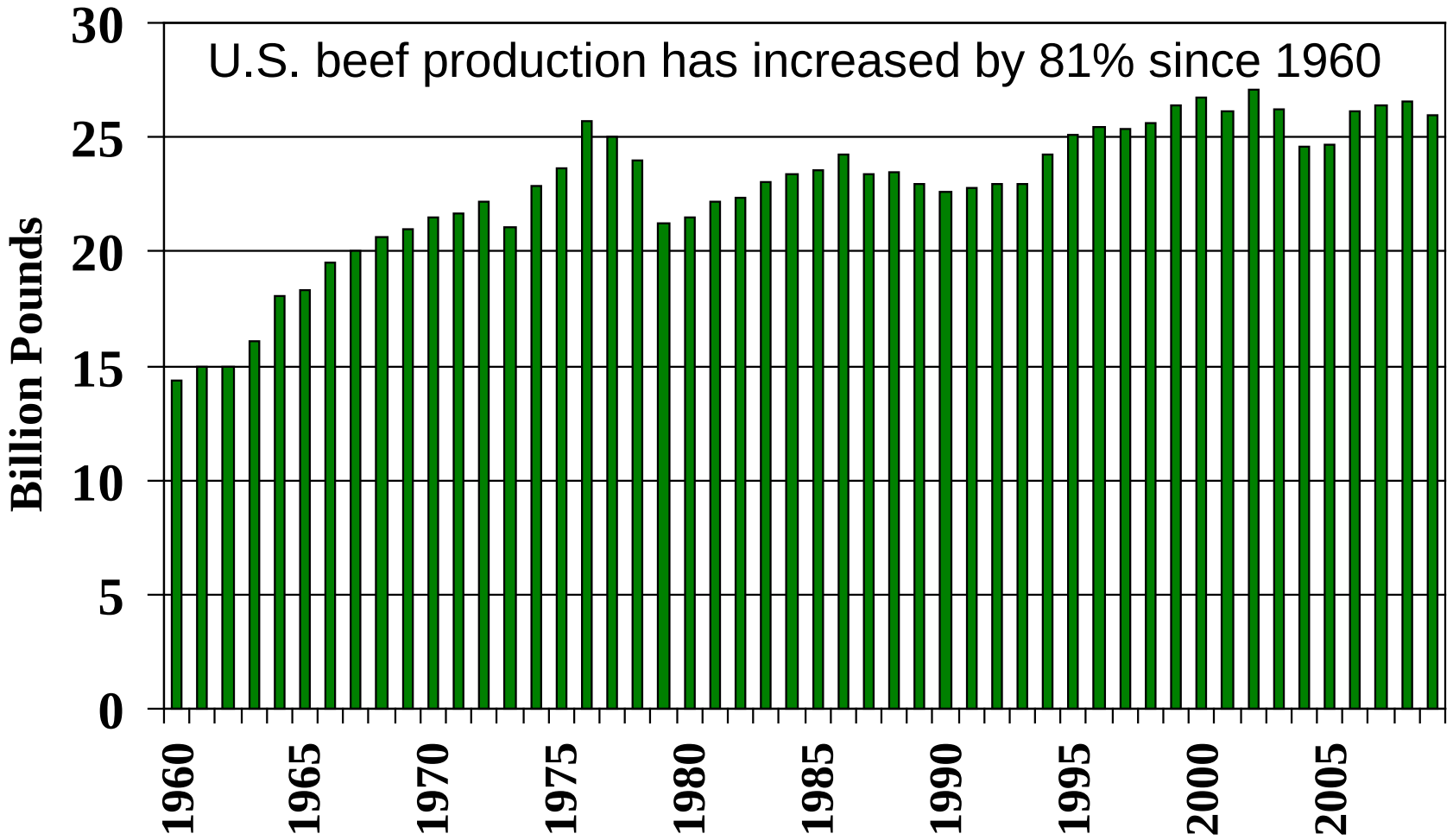
Long Running Trends in Animal Agriculture

1. Expanding production
2. Fewer & bigger operations
3. Specialized farms
4. Integration
5. Contracting
6. More efficient
7. Shrinking footprint

Long Running Trends in Animal Agriculture

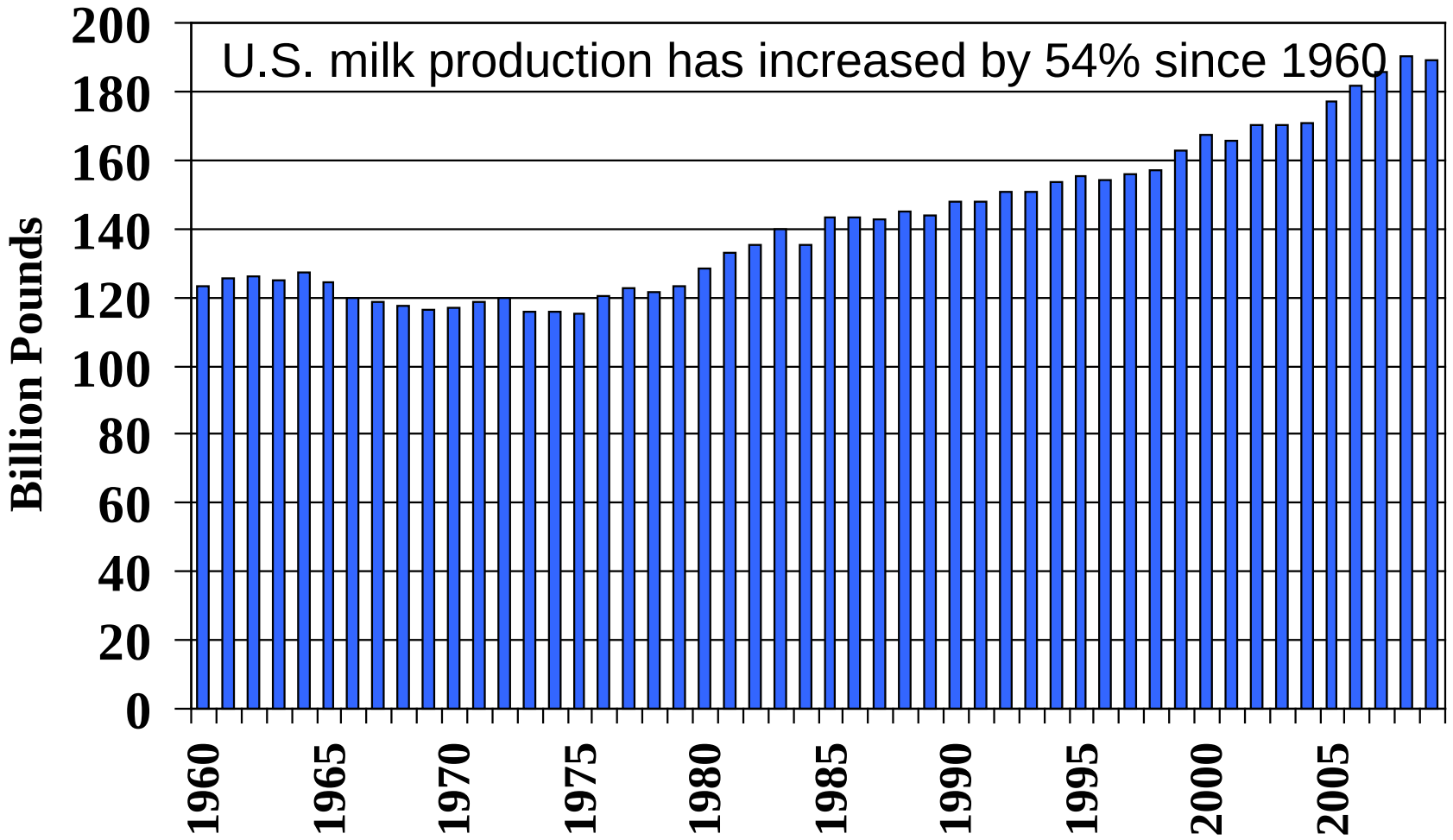
1. Expanding production

U.S. Beef Production, 1960-2009



Source: USDA-NASS

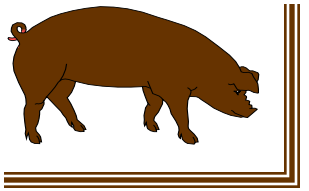
U.S. Milk Production, 1960-2009



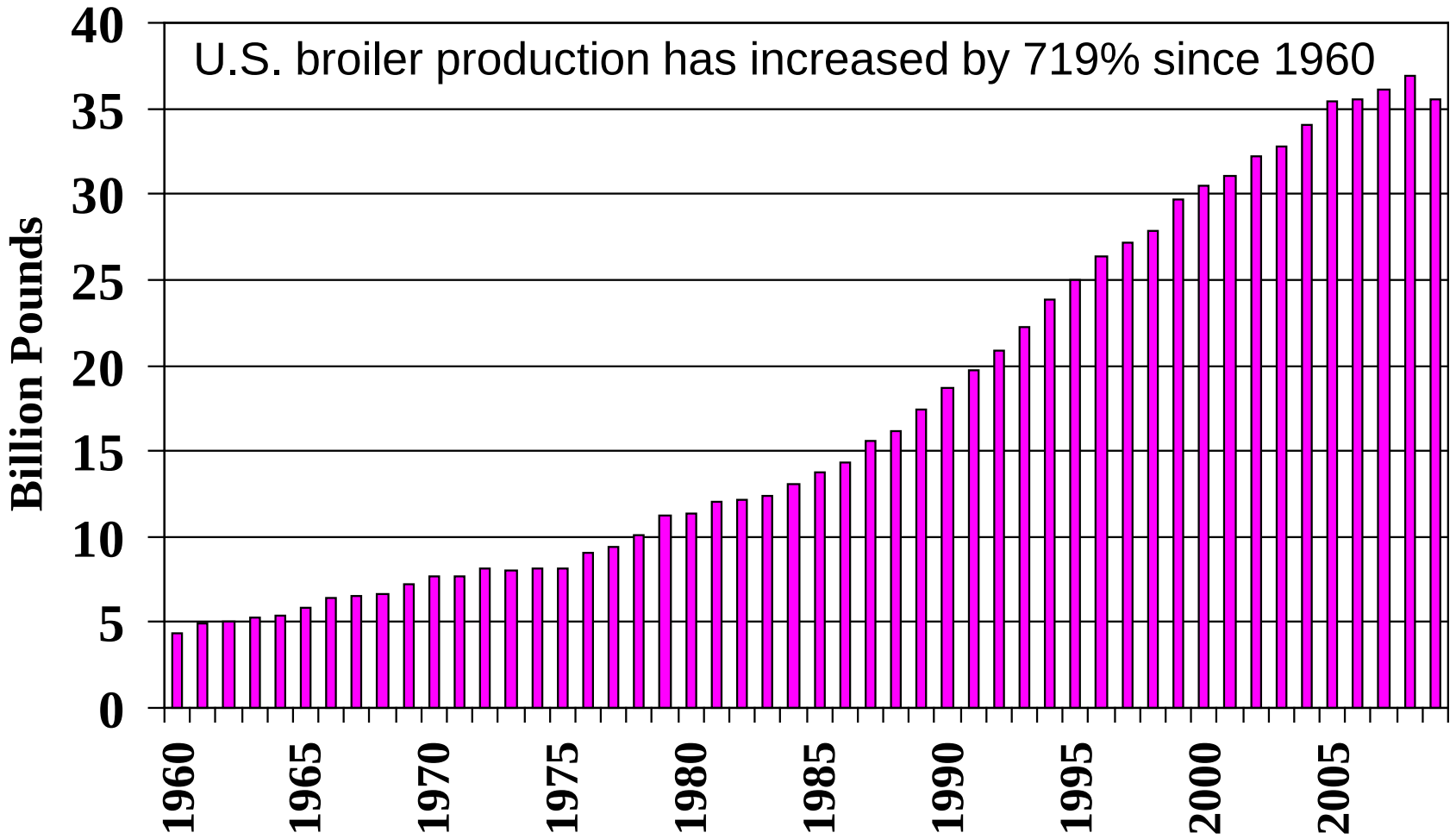
Source: USDA-NASS

U.S. pork production has increased by 112% since 1960

Source: USDA-NASS

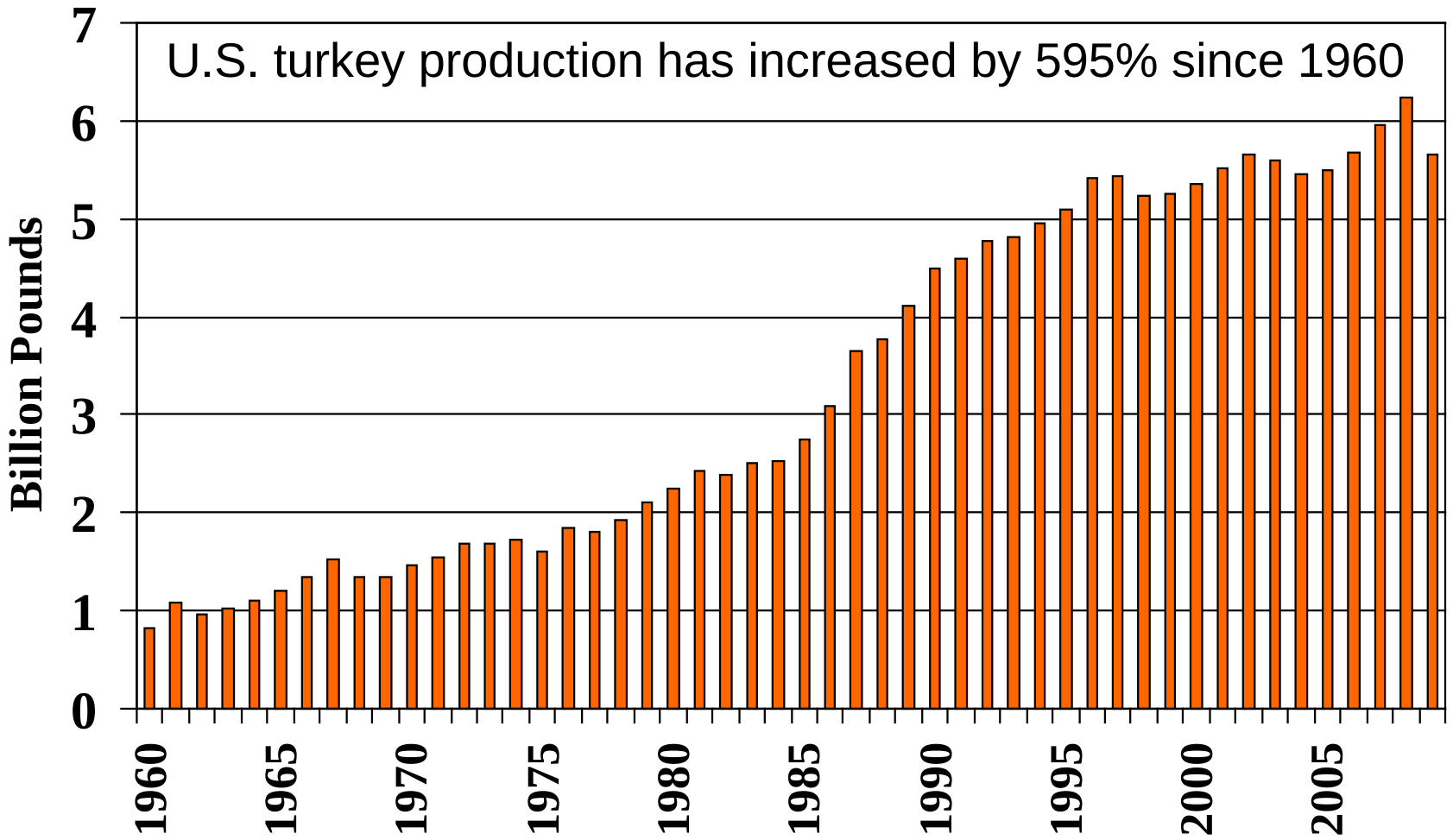


U.S. Broiler Production, 1960-2009



Source: USDA-NASS

U.S. Turkey Production, 1960-2009



Source: USDA-NASS

Long Running Trends in Animal Agriculture

Why is production expanding?

A. More Americans to feed

our population grows about 1% per year

Long Running Trends in Animal Agriculture

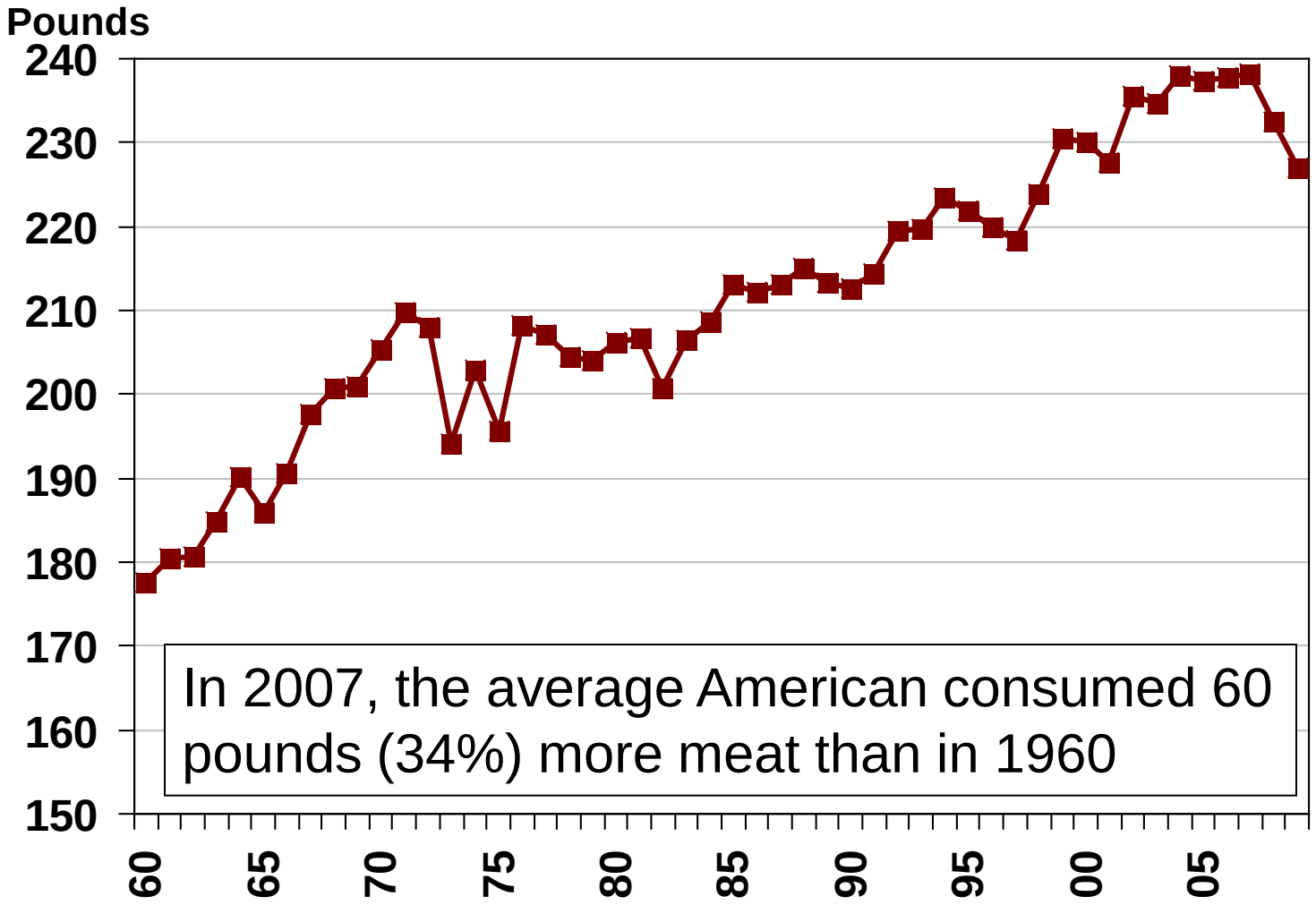
Why is production expanding?

A. More Americans

B. Increased per capita consumption

U.S. Per Capita Meat Consumption

Retail Weight, 1960-2009



Long Running Trends in Animal Agriculture

Why is production expanding?

A. More Americans

B. Increased per capita consumption

C. Increased exports

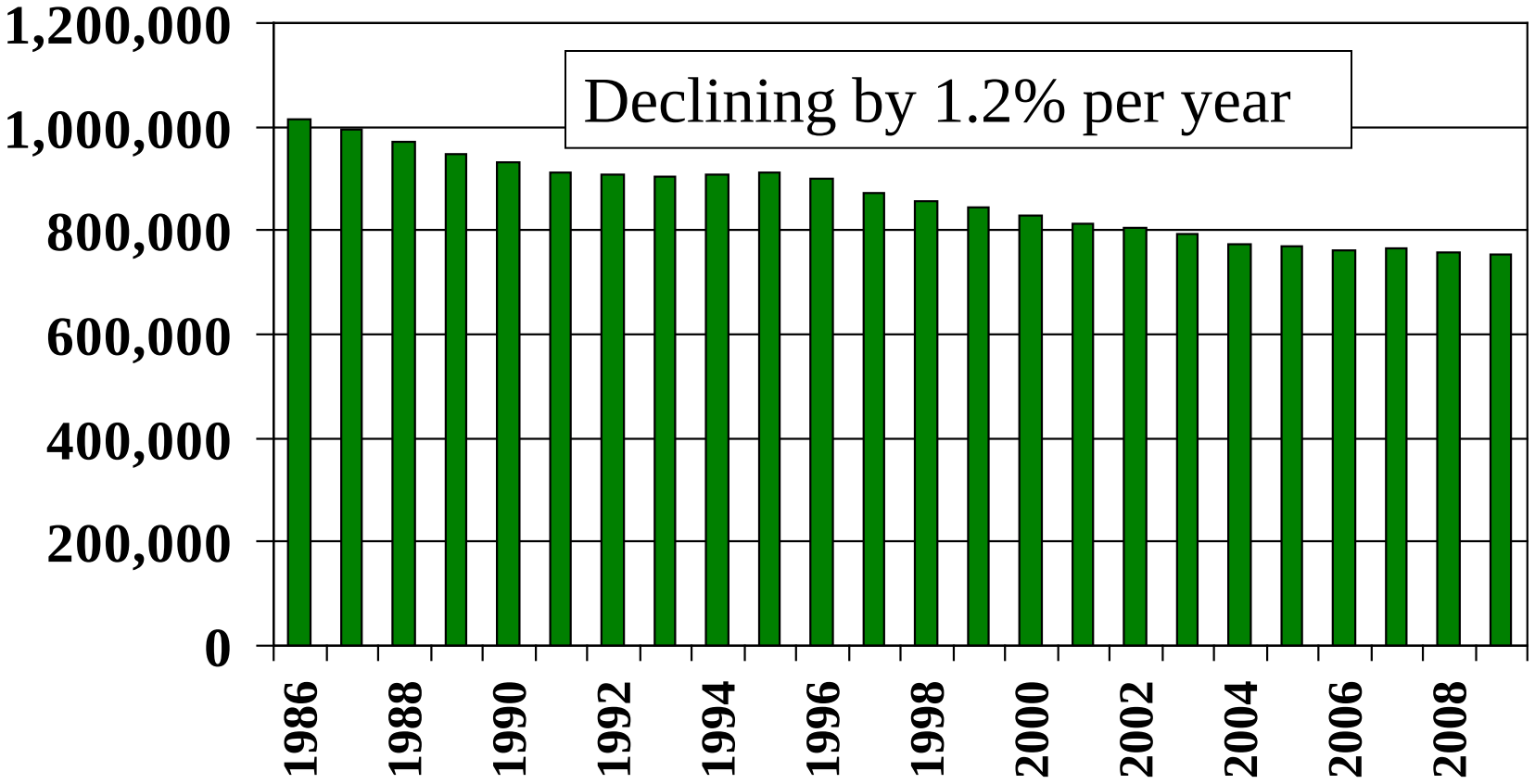
in 1960 the U.S. exported 161,306 tons of meat; last year we exported 6.7 million tons of meat

Long Running Trends in Animal Agriculture

1. Expanding Production

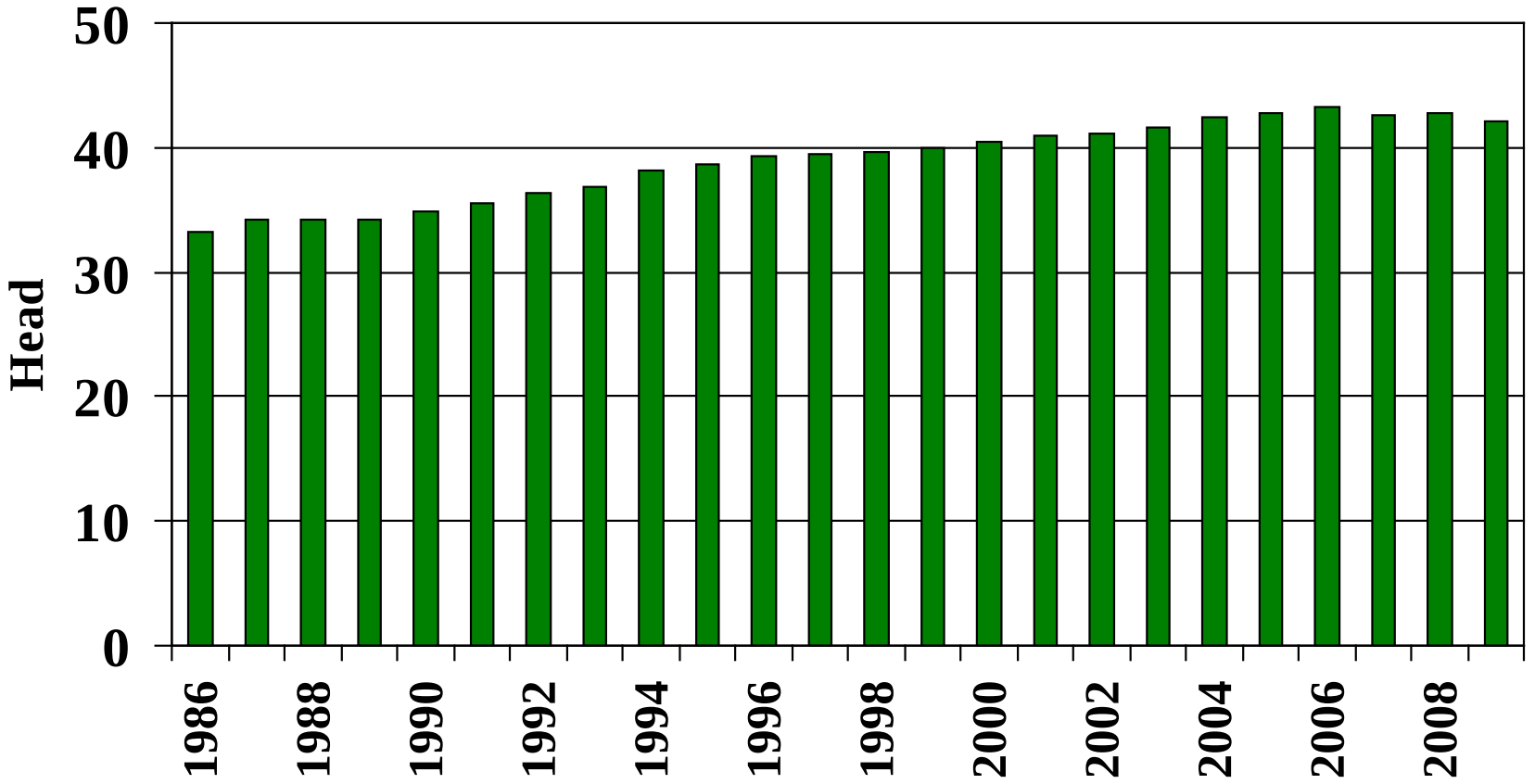
2. **Fewer & bigger operations**

U.S. Farms with Beef Cows



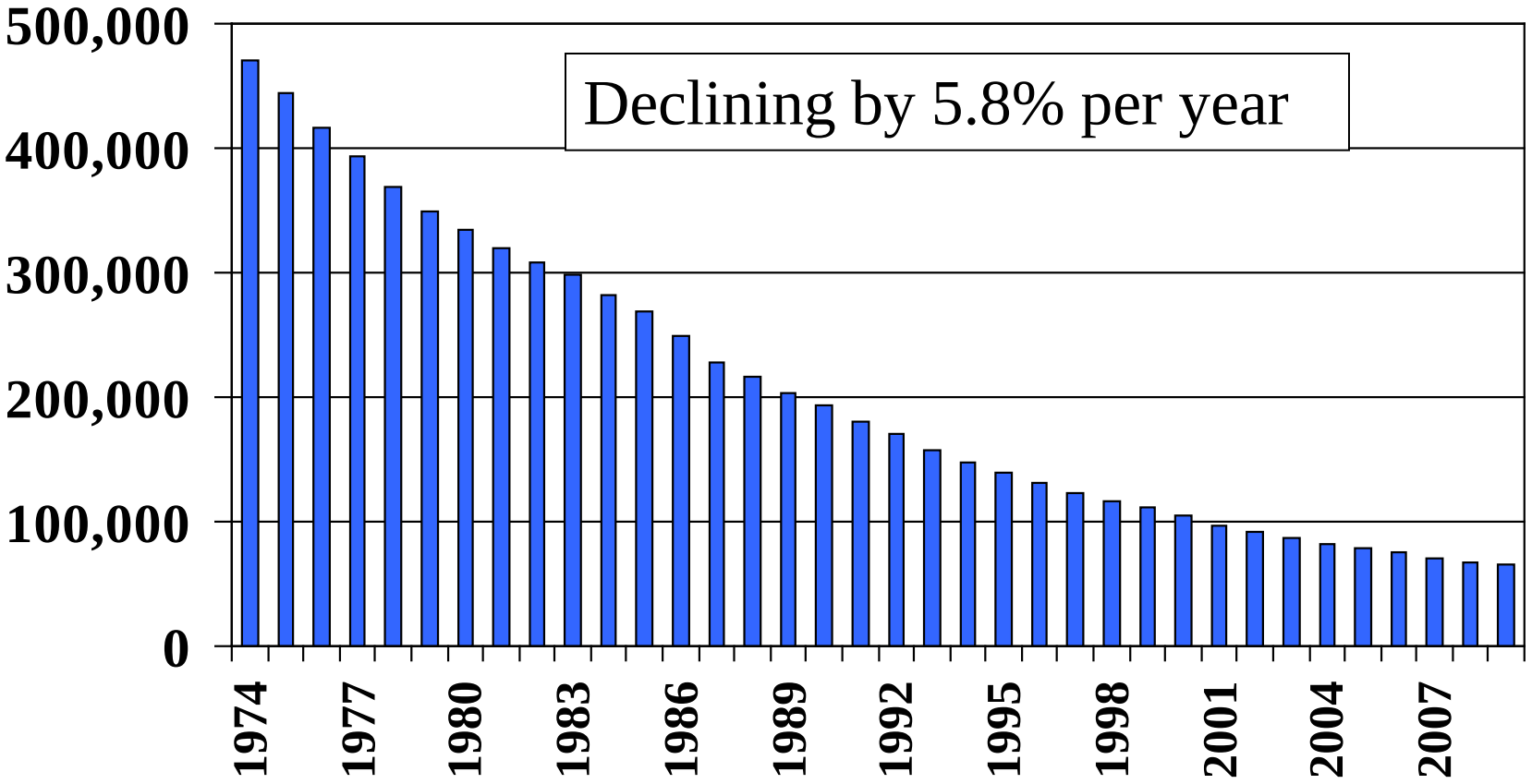
Source: USDA/NASS

Beef Cows Per U.S. Cow Farm



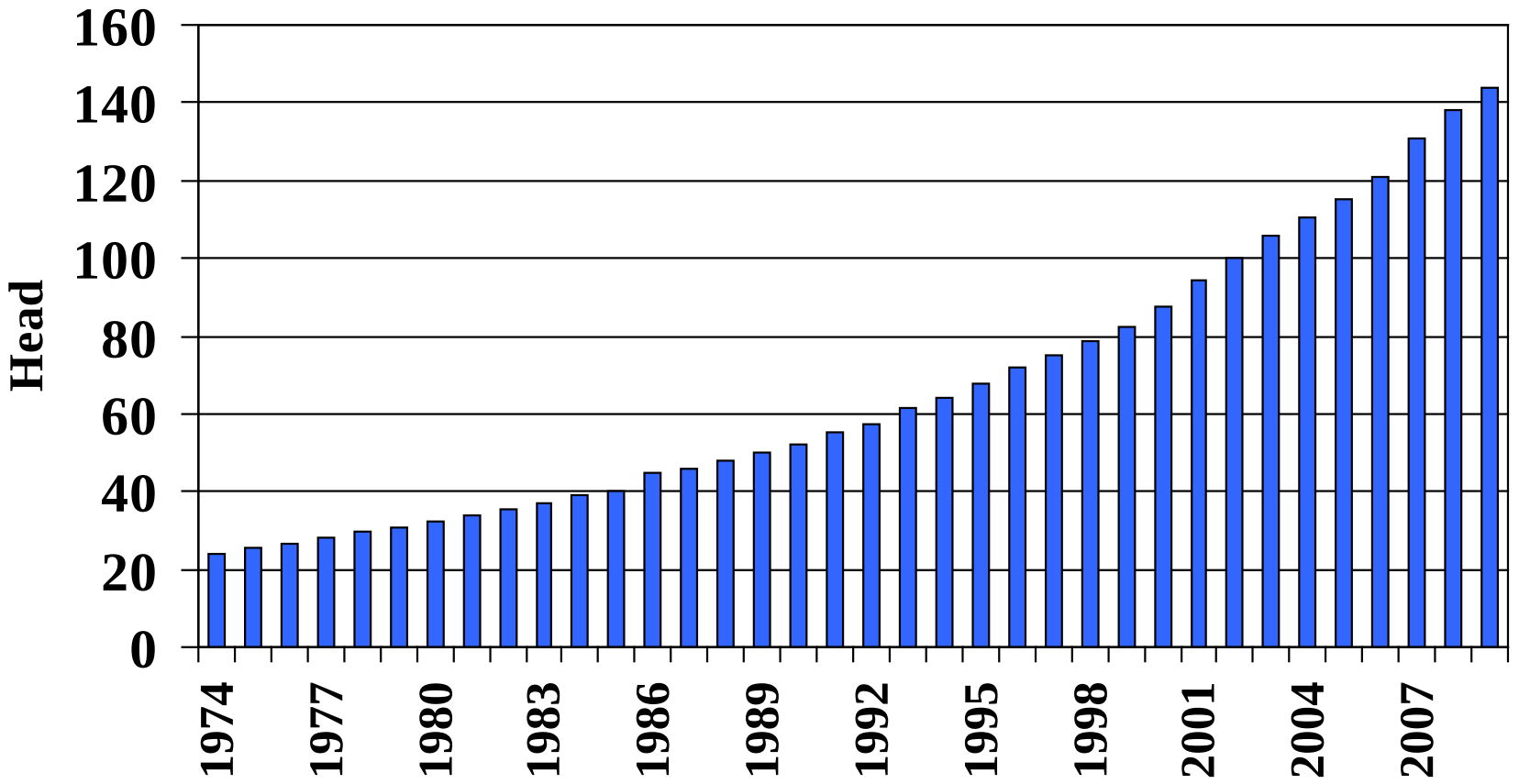
Source: USDA/NASS

U.S. Farms with Milk Cows



Source: USDA/NASS

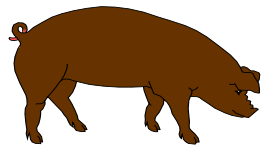
Milk Cows Per U.S. Dairy Farm



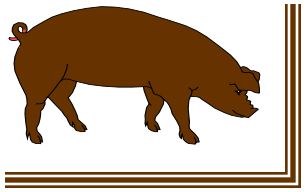
Source: USDA/NASS

Declining by 8.5% per year

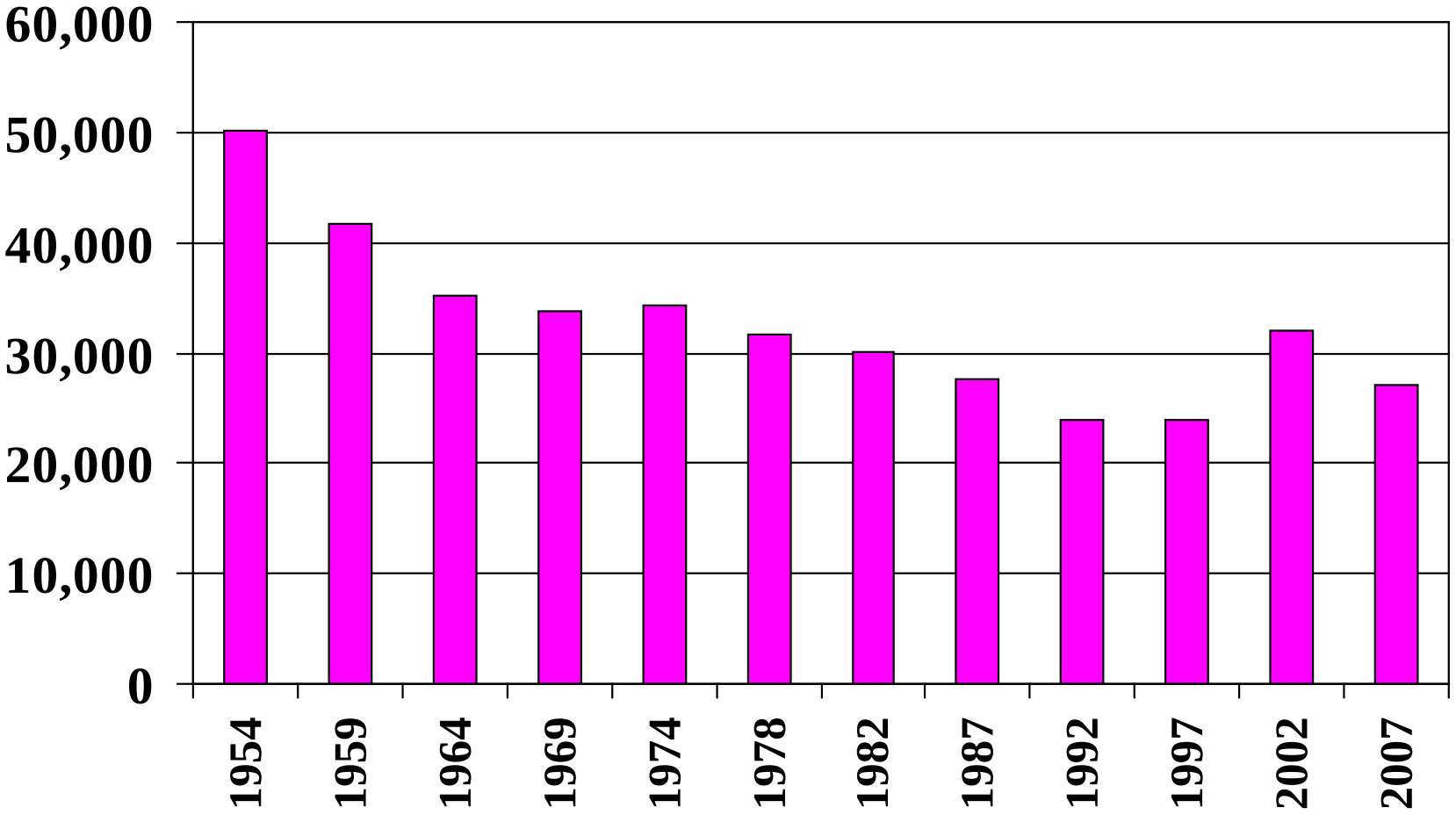
Source: USDA-NASS



Source: USDA-NASS

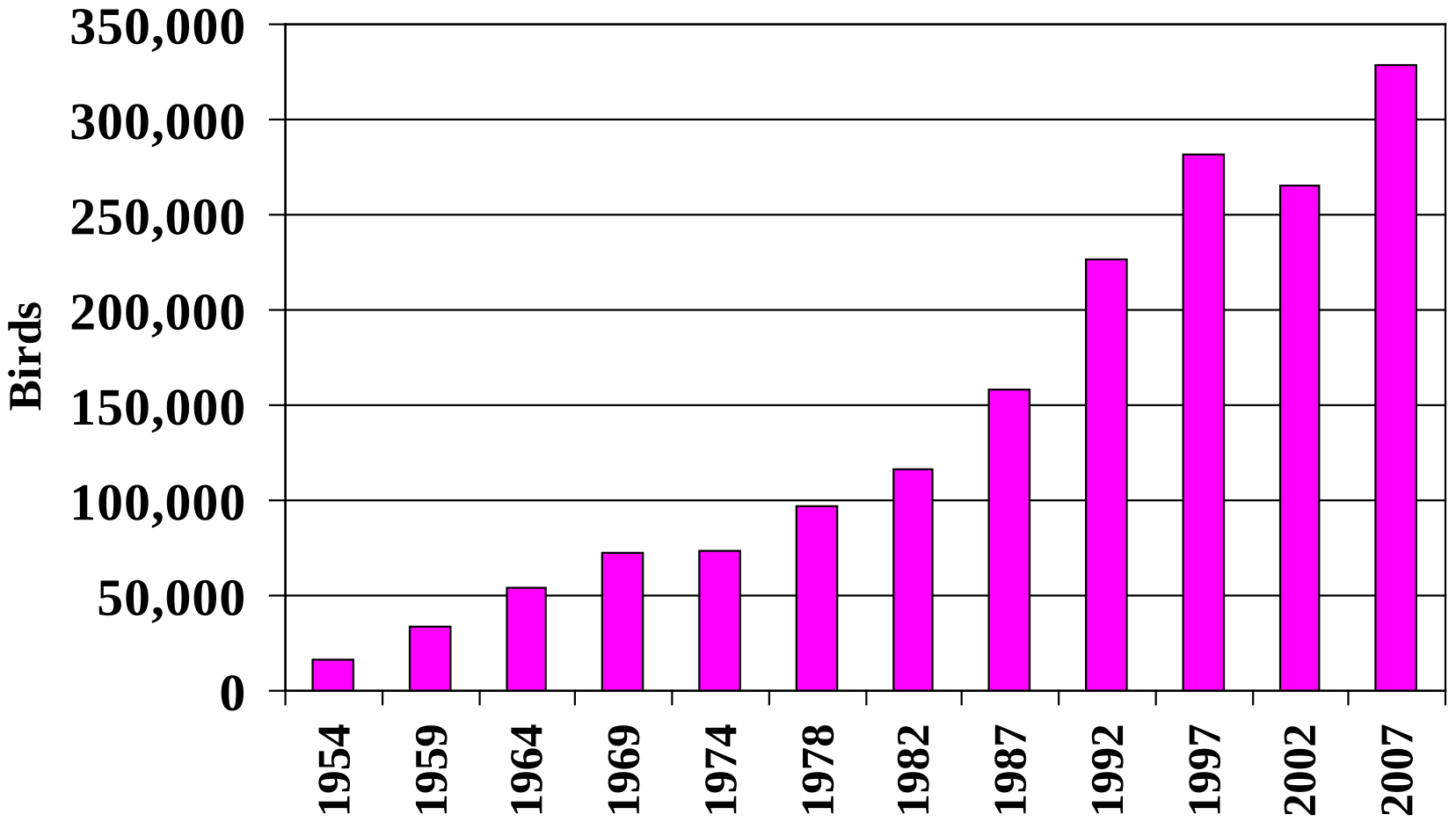


Farms Selling Broilers, 1954-2007



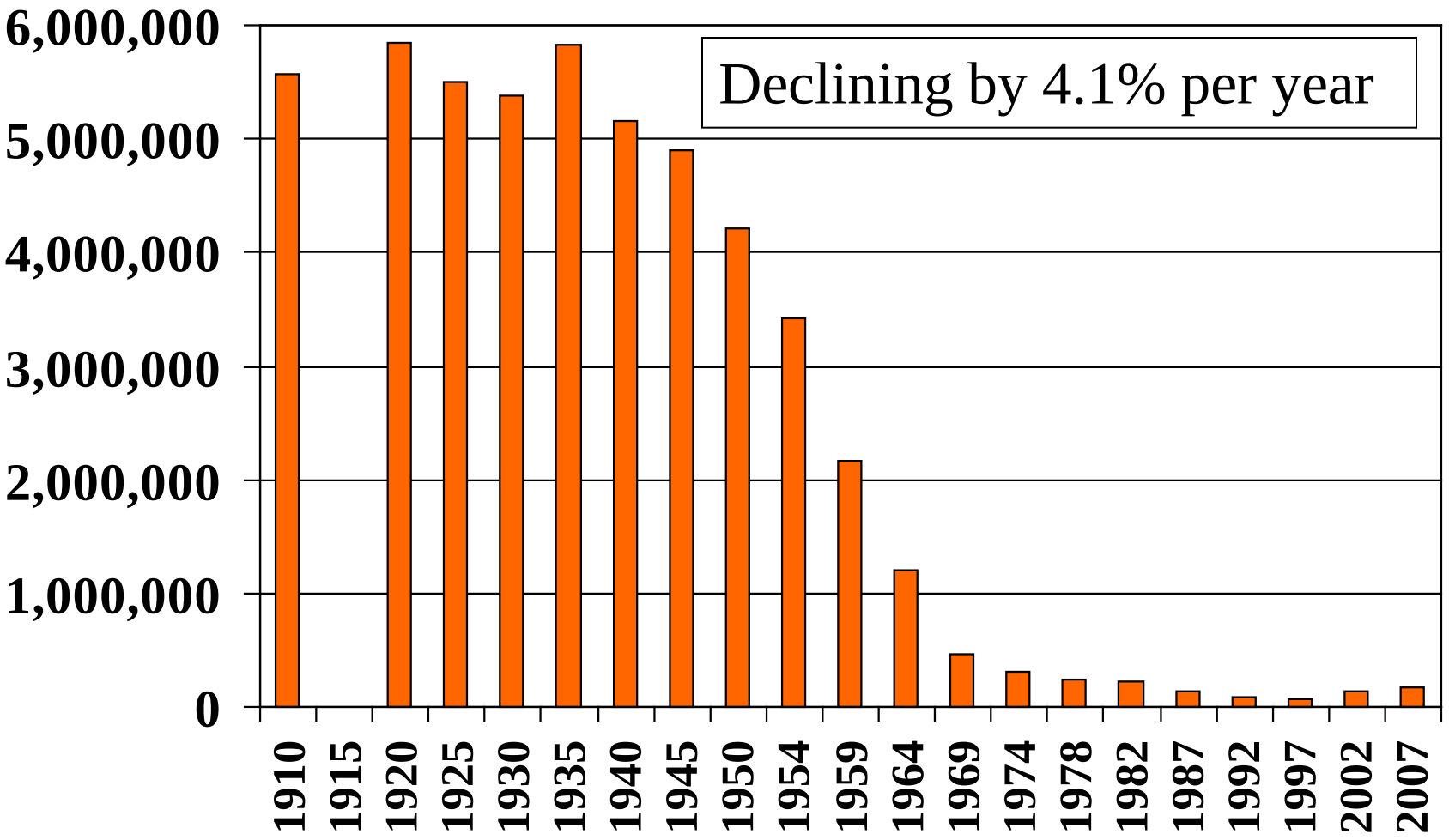
Source: US Census of Agriculture

Broilers Sold Per Farm



Source: US Census of Agriculture

Number of U.S. Farms Raising Chickens



Source: US Census of Agriculture

Long Running Trends in Animal Agriculture

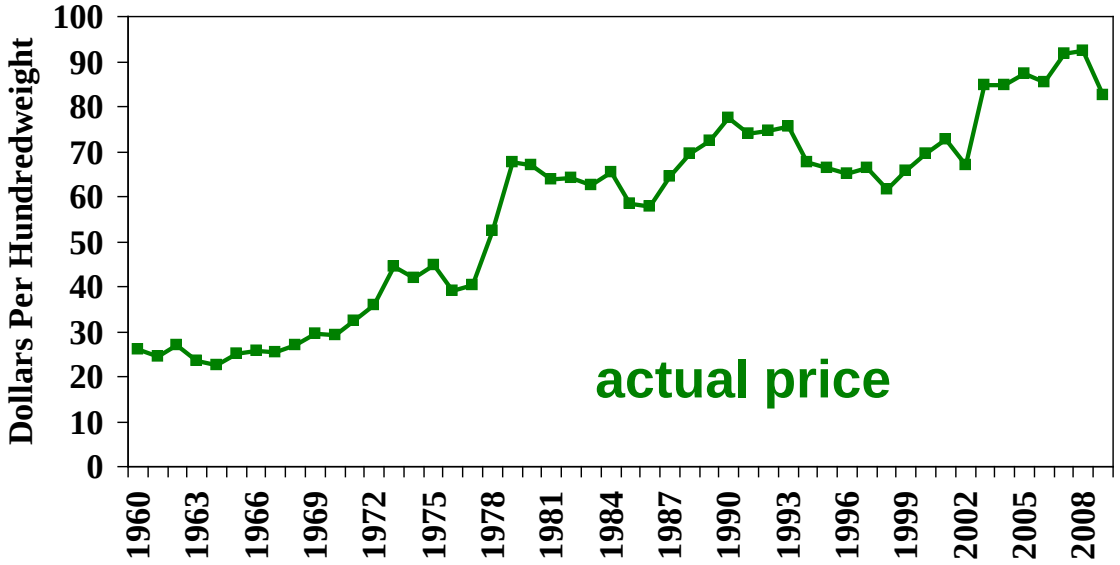
Why fewer and bigger operations?

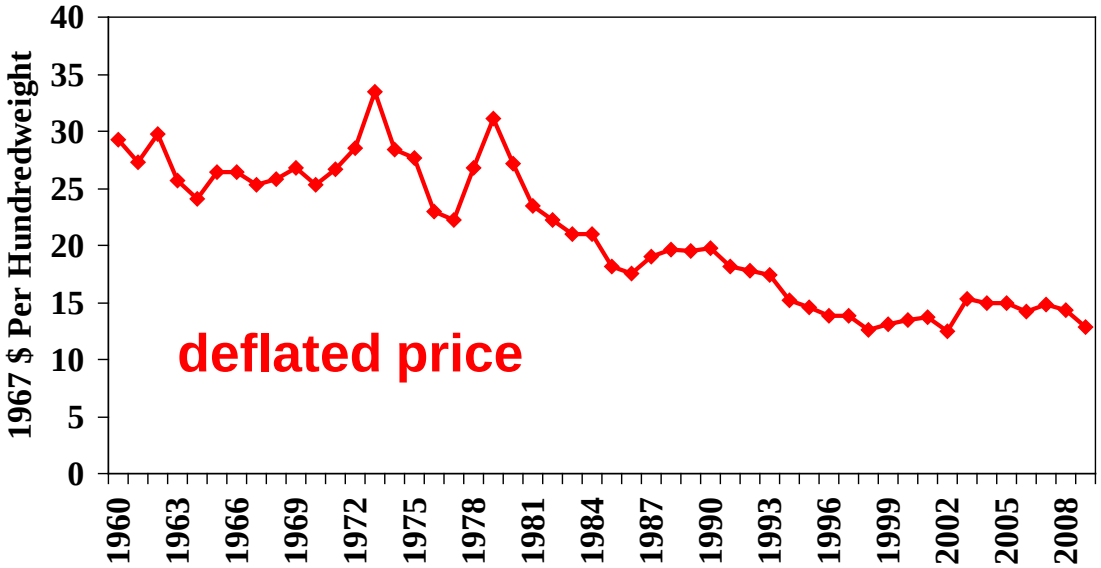
Long Running Trends in Animal Agriculture

Why fewer and bigger operations?

A. Deflating livestock prices

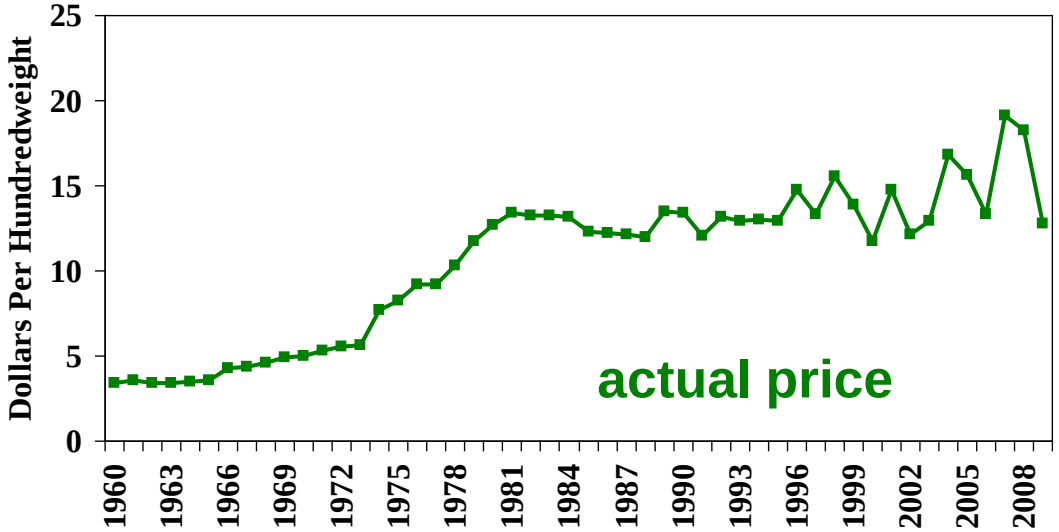
Slaughter Steer Prices, 1960-2009

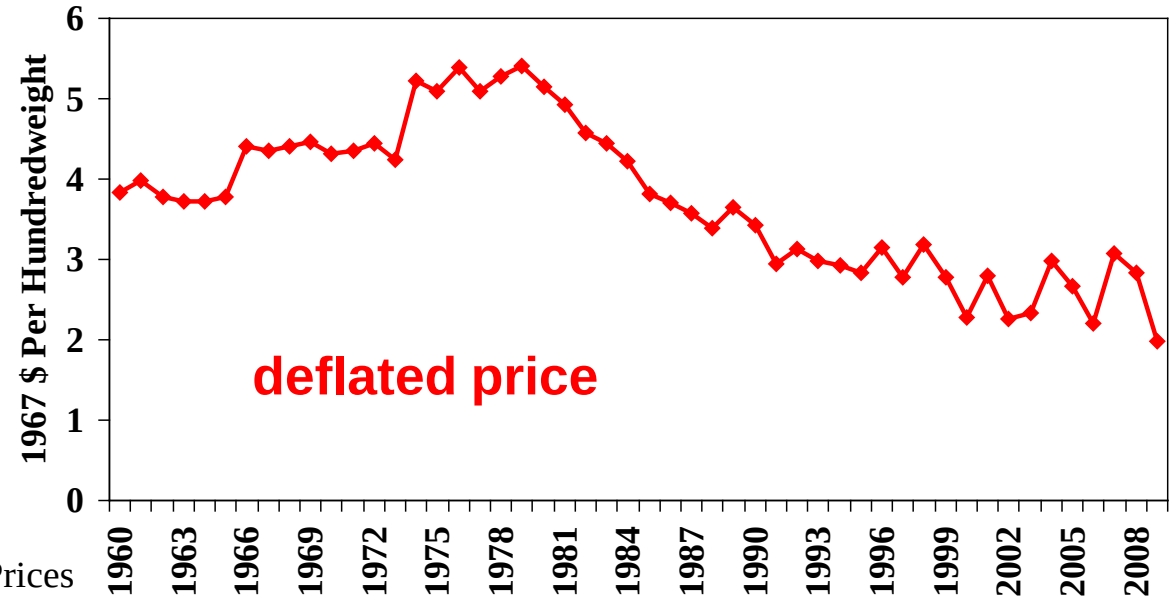




Source: USDA/AMS

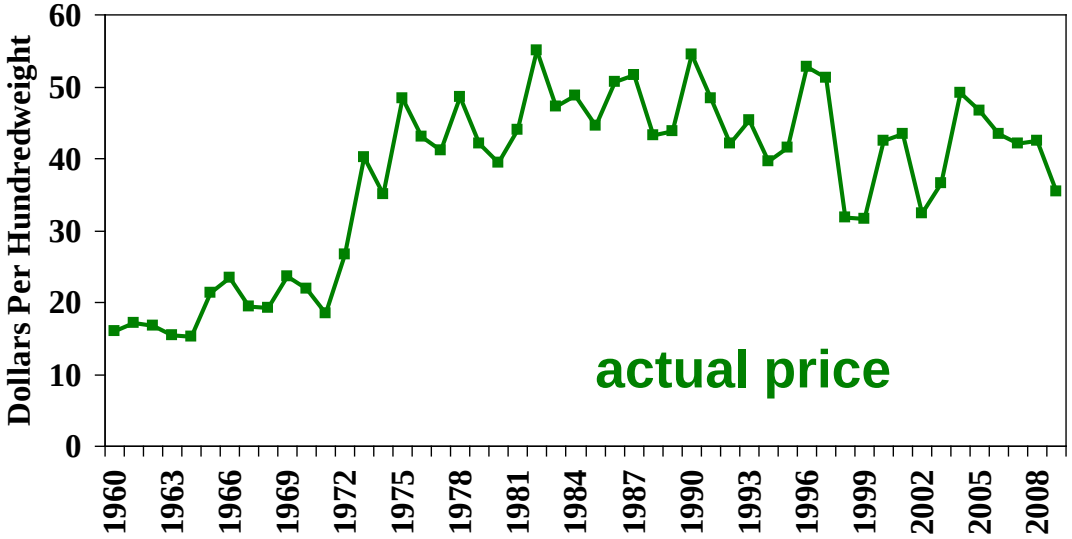
Milk Prices, 1960-2009

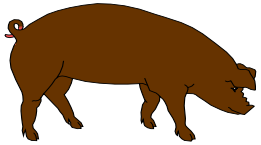


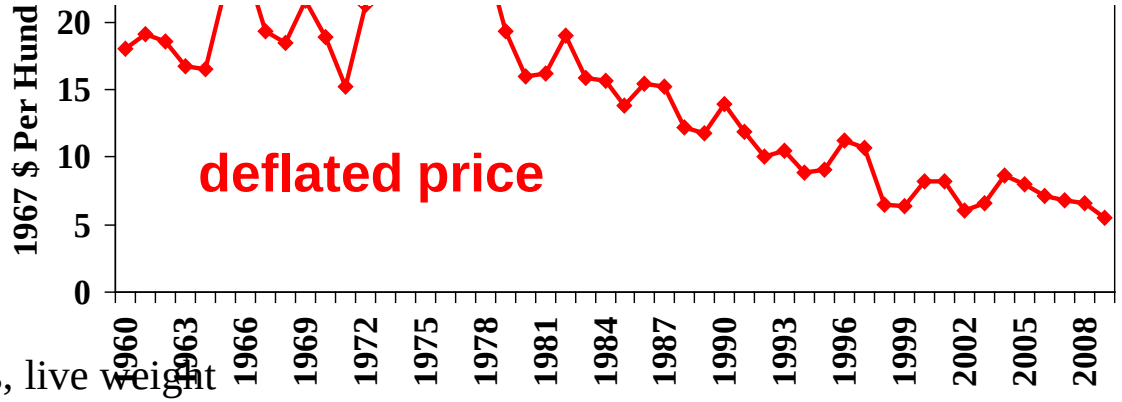


Source: Wisconsin, All Milk Prices

Slaughter Hog Prices, 1960-2009

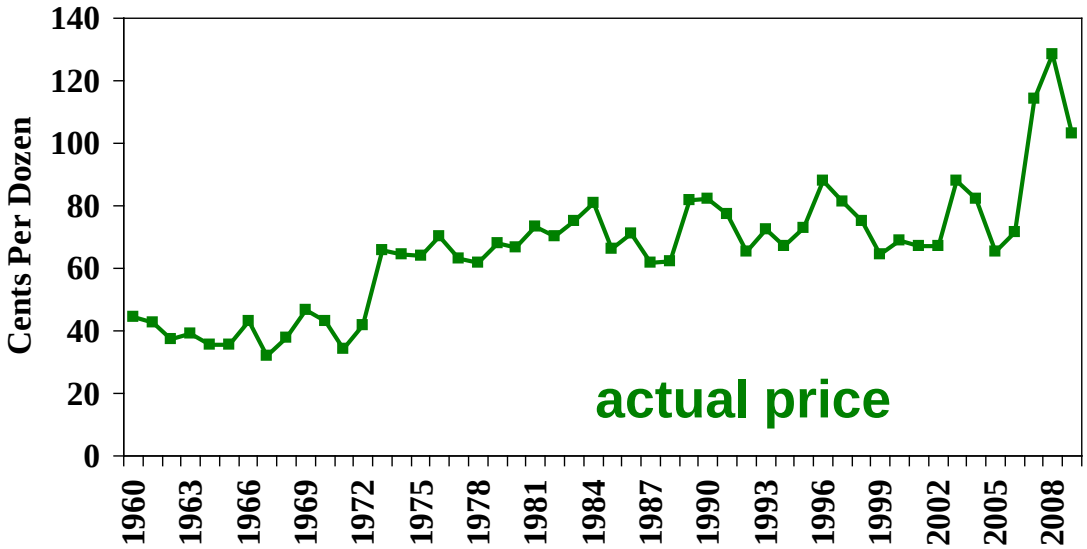


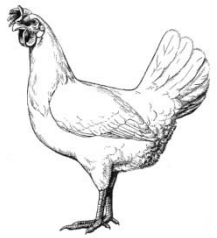


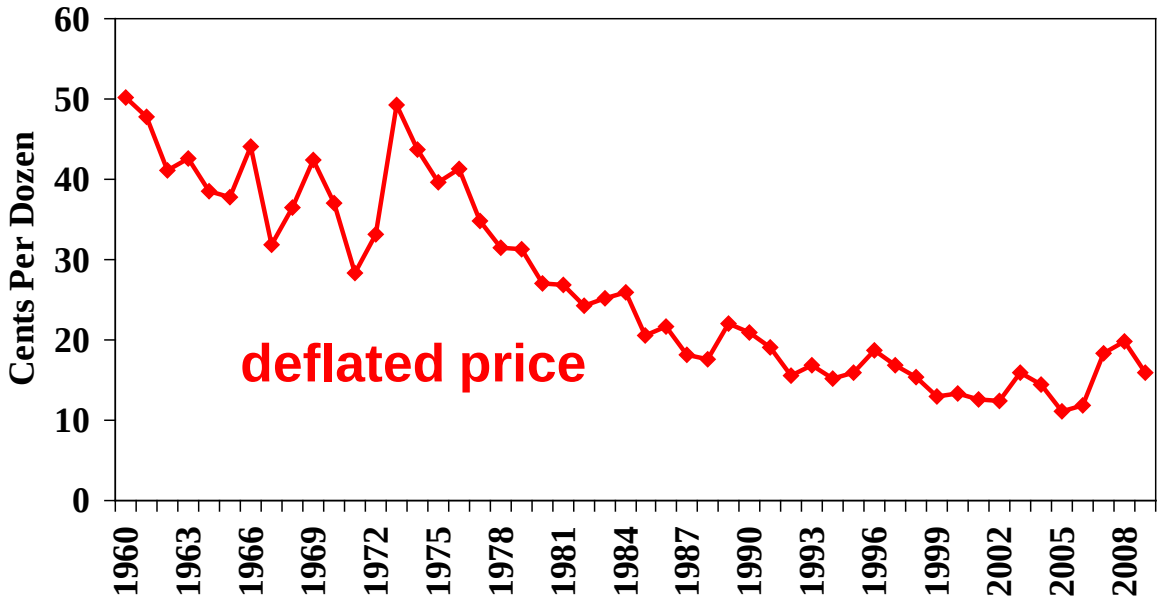


Source: Terminal Markets, live weight

Wholesale Egg Prices, 1960-2009

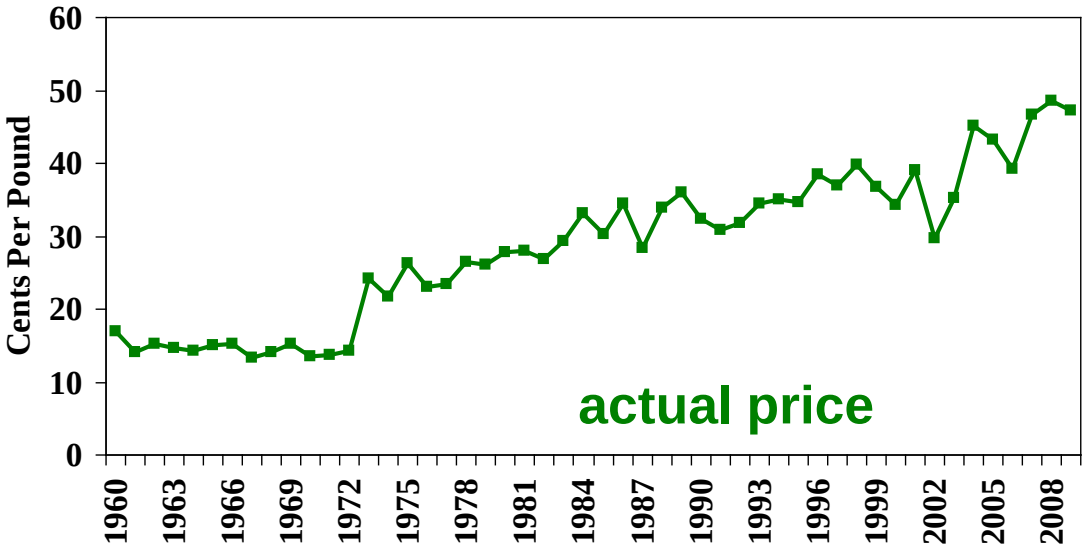


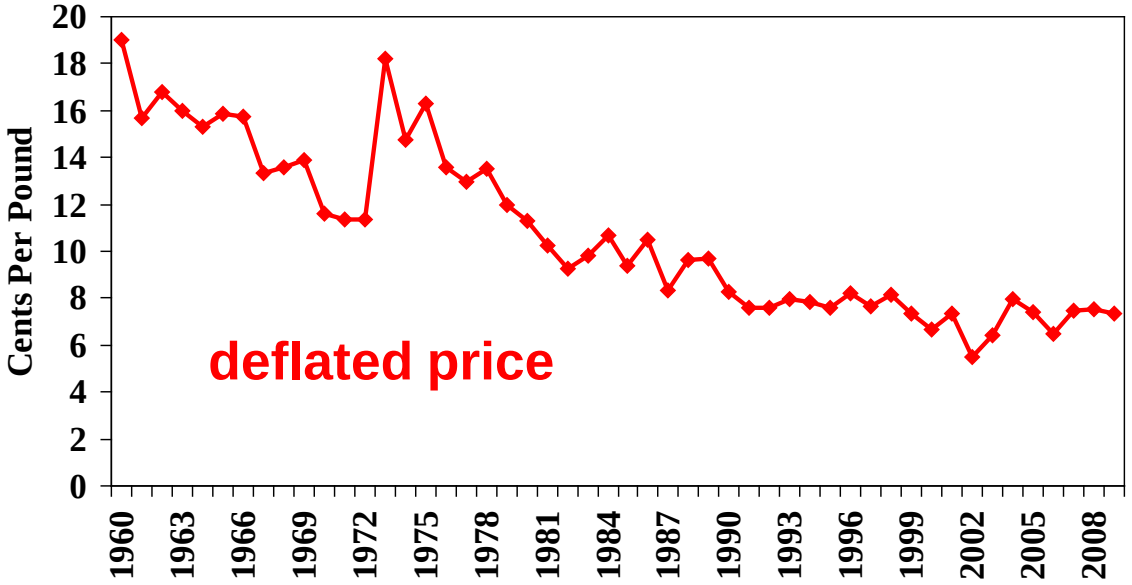




Source: USDA/AMS

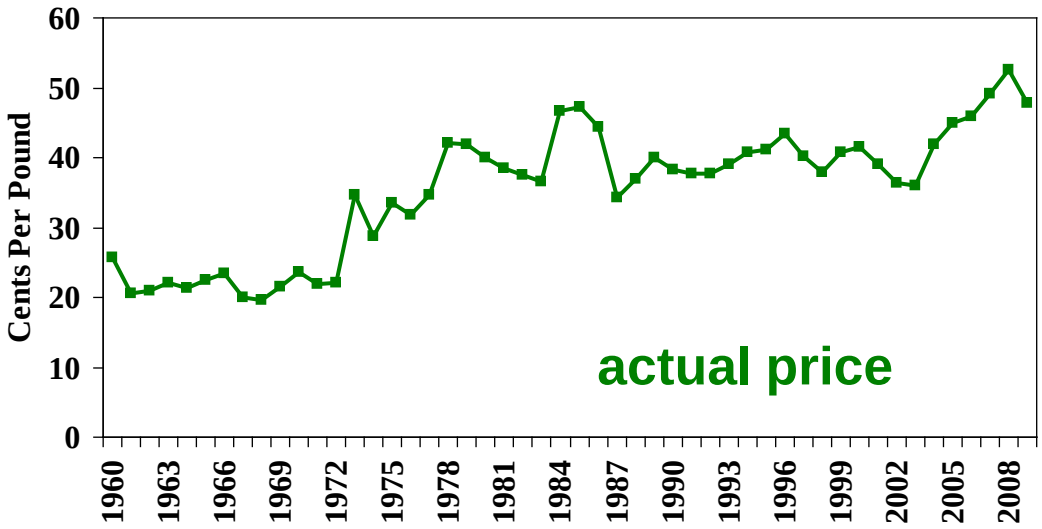
Chicken Prices, 1960-2009

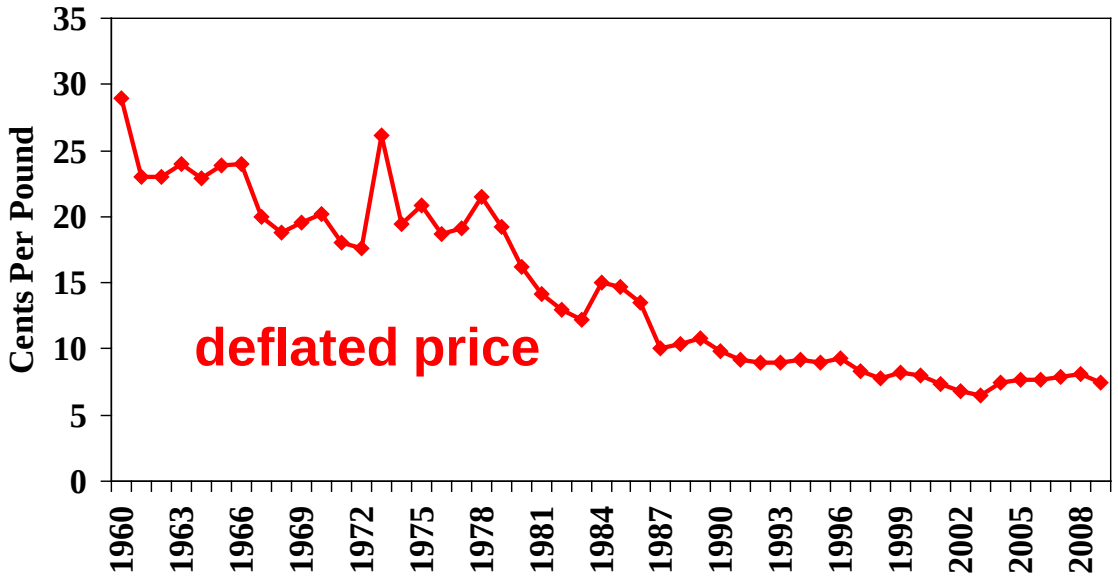




Source: USDA/AMS

Turkey Prices, 1960-2009





Source: USDA/AMS

From 1960 to 2009, the deflated average farm price of…..

- Cattle declined by 56%
- Milk declined by 48%
- Hogs declined by 69%
- Eggs declined by 68%
- Chickens declined by 61%
- Turkeys declined by 74%

Since livestock prices have failed to keep up with inflation, producers have two basic choices……. live on less money year after year, or raise more animals.

Long Running Trends in Animal Agriculture

Why fewer and bigger operations?

A. Deflating livestock prices

B. Economies of size

Economies of Size

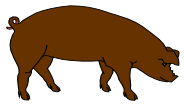
For most U.S. farms,
getting bigger means they can:

- Buy lower
- Sell higher
- Be more efficient

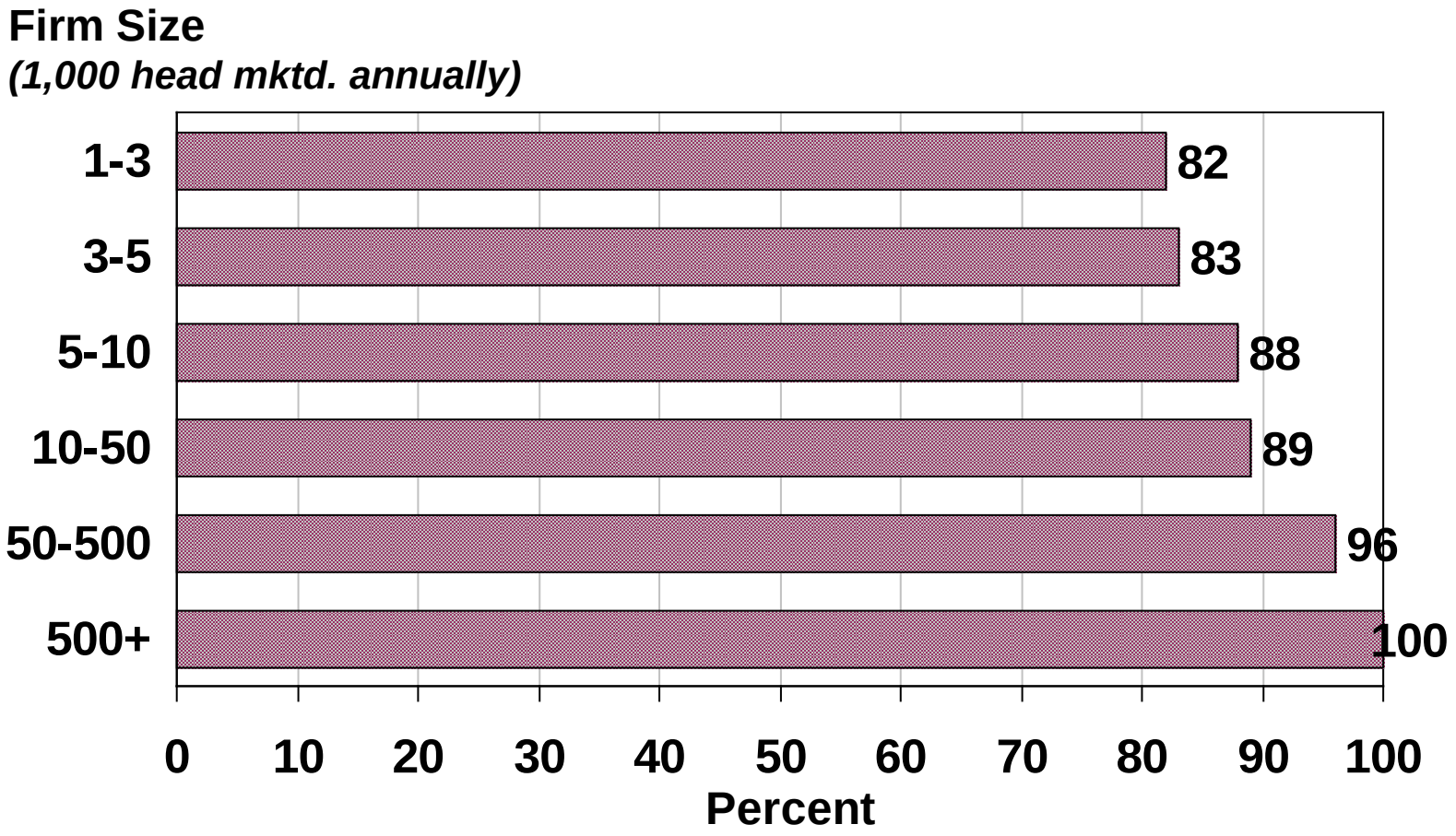
Pigs Per Litter By Herd Size - 2009

Herd Size	Pigs/Litter
1-99	7.38
100-499	8.13
500-999	8.50
1000-1999	9.15
2000-4999	9.55
5000 & up	9.70

Source: USDA Hogs & Pigs Reports



Percent of Firms That Made a Profit in 2006



Long Running Trends in Animal Agriculture

Why fewer and bigger operations?

A. Deflating livestock prices

B. Economies of size

C. Labor utilization

$10/hour jobs and $100/hour jobs - on a small farm the owner does both

Long Running Trends in Animal Agriculture

1. Expanding production
2. Fewer & bigger operations
3. **Specialized farms**

Portion of U.S. Farms with Livestock

	1950	**1964**	**1978**	**1992**	**2007**
Sheep	6.0%	7.4%	3.6%	4.2%	3.8%
Beef	75.5%	72.3%	38.5%	41.7%	34.7%
Hogs	56.0%	34.2%	18.0%	9.9%	3.4%
Dairy	67.8%	35.9%	12.6%	8.1%	3.2%
Chicken	78.3%	38.3%	9.7%	4.6%	6.6%

Source: U.S. Census of Agriculture

Portion of U.S. Farms Marketing Crops

	1964	**1974**	**1992**	**2002**	**2007**
Corn	43.8%	31.9%	26.2%	16.4%	15.8%
Wheat	23.4%	19.9%	15.2%	8.0%	7.3%
Soybeans	17.7%	22.8%	19.8%	14.9%	12.7%
Cotton	10.3%	1.7%	1.8%	1.2%	0.8%
Tobacco	10.5%	8.0%	6.5%	2.7%	0.7%
Orchards	7.1%	4.6%	6.0%	5.3%	5.3%
Vegetables	4.2%	3.4%	3.2%	2.6%	3.1%

Source: U.S. Census of Agriculture

Long Running Trends in Animal Agriculture

Why are farms specializing?

You can't learn to do 50 things as well as you can learn to do 10 things.

Long Running Trends in Animal Agriculture

1. Expanding production
2. Fewer & bigger operations
3. Specialized farms
4. **Integration**

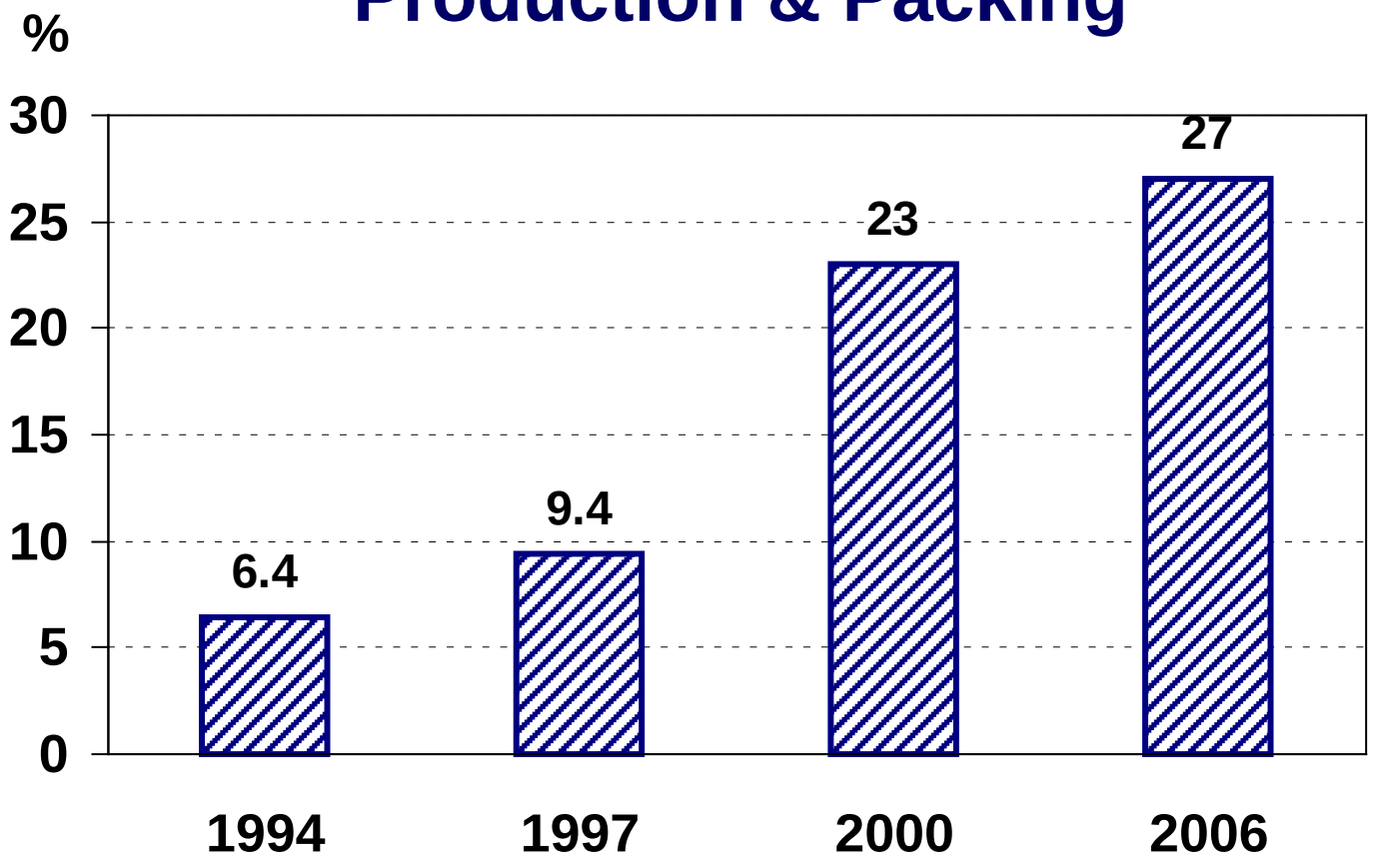
Livestock Integration

- Vertical integration – bringing together different stages of the production process under common ownership

  Livestock production used to be closely linked to crop production

  Now livestock production is often linked to packing

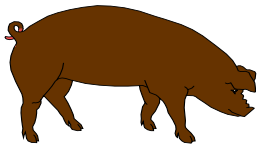
Vertical Integration in U.S. Hog Production & Packing



University of Missouri, Iowa State University, National Pork Board, Pork magazine, PIC, Land O'Lakes, Dekalb Choice Genetics, and Research Institute for Livestock Pricing.

Livestock Integration

- Advantages of being a producer/packer
  - Offsetting profitability
  - Coordination
    - Quantity
    - Traceability
- Disadvantages of being a producer/packer
  - Investment
  - Complexity
  - Lack of flexibility



Long Running Trends in Animal Agriculture

1. Expanding production
2. Fewer & bigger operations
3. Specialized farms
4. Integration
5. **Contracting**

Long Running Trends in Animal Agriculture

1. Expanding production
2. Fewer & bigger operations
3. Specialized farms
4. Integration
5. **Contracting**
    - **A. Production contracts**

What is a Production Contract?

- An arrangement where one person/firm owns an animal and another person/firm owns the production facility where the animal is raised

Production Contracts

- 90% of U.S. chickens are raised by farmers who own no chickens
- Three-fourths of U.S. turkeys are raised by farmers who own no turkeys
- 46% of U.S. hogs are raised by farmers who own no hogs

Because of production contracts, many self-employed farmers make a living raising livestock and poultry without having to own livestock or poultry.

Percent of U.S. Hogs Raised under Contract, 1997-2006

Firm Size (thousand head mktd.)	Farrowed				Finished			
	1997	2000	2003	2006	1997	2000	2003	2006
1 - 50	1%	2%	7%	1%	8%	3%	5%	7%
50 - 500	4%	7%	5%	4%	7%	10%	11%	14%
500+	11%	13%	17%	15%	16%	21%	25%	25%
Total	17%	22%	23%	20%	30%	34%	41%	46%

Long Running Trends in Animal Agriculture

Why production contracts?

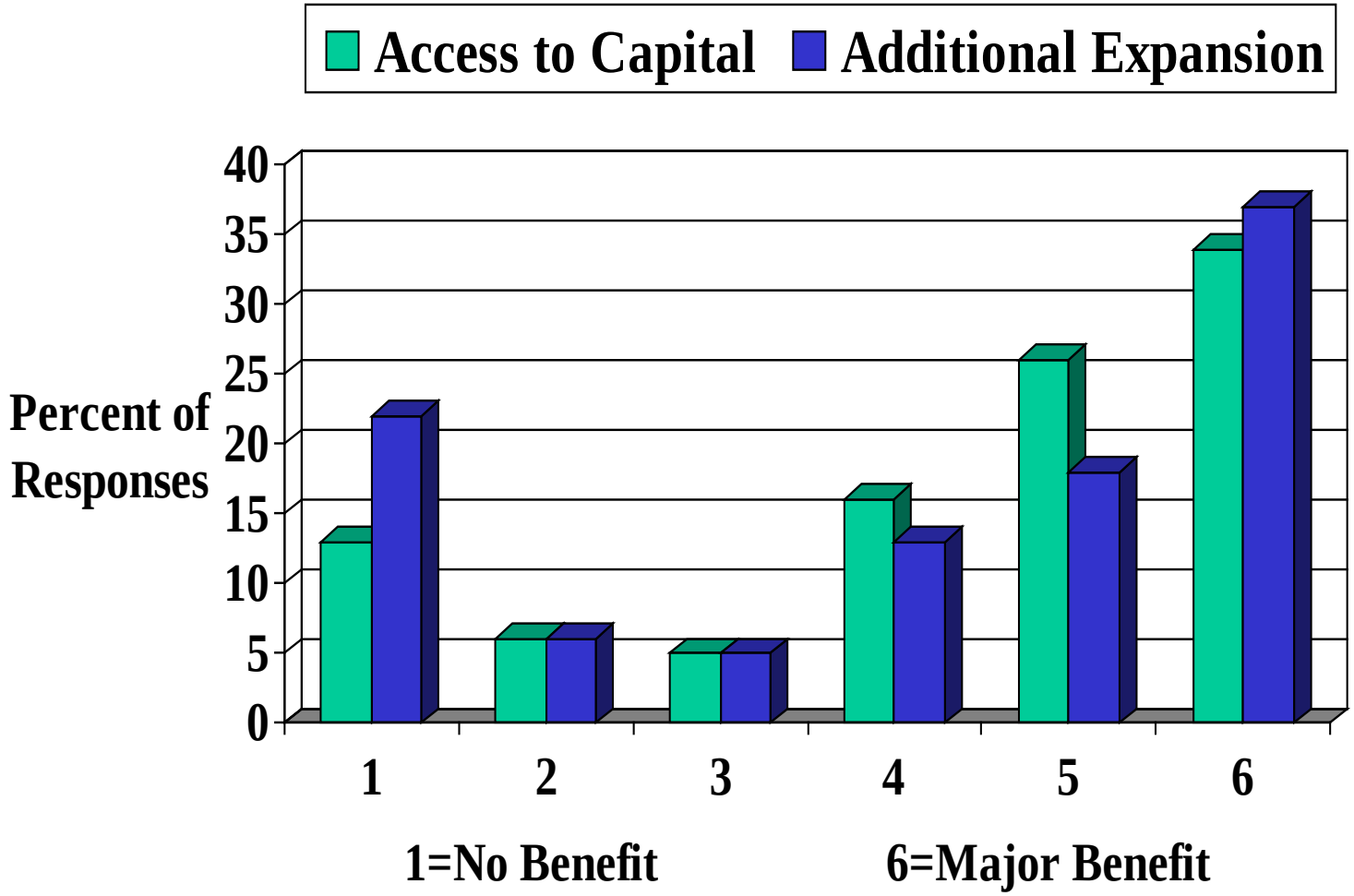
- **Benefits to contractors**
  - reduces capital requirements
  - shares production risk
  - shifts site risk to grower
- **Benefits to growers:**
  - reduces capital requirements
  - shares production risk
  - shifts market risk to contractor

How satisfied are hog producers?

Firm Type	Satisfaction Rating 1 = very dissatisfied 6 = very satisfied
Independent	3.7
Contractors	4.7
Growers	4.9

Grower Benefits from Production Contracts

Lawrence & Grimes 2001 Hog Survey



Grower Benefits from Production Contracts

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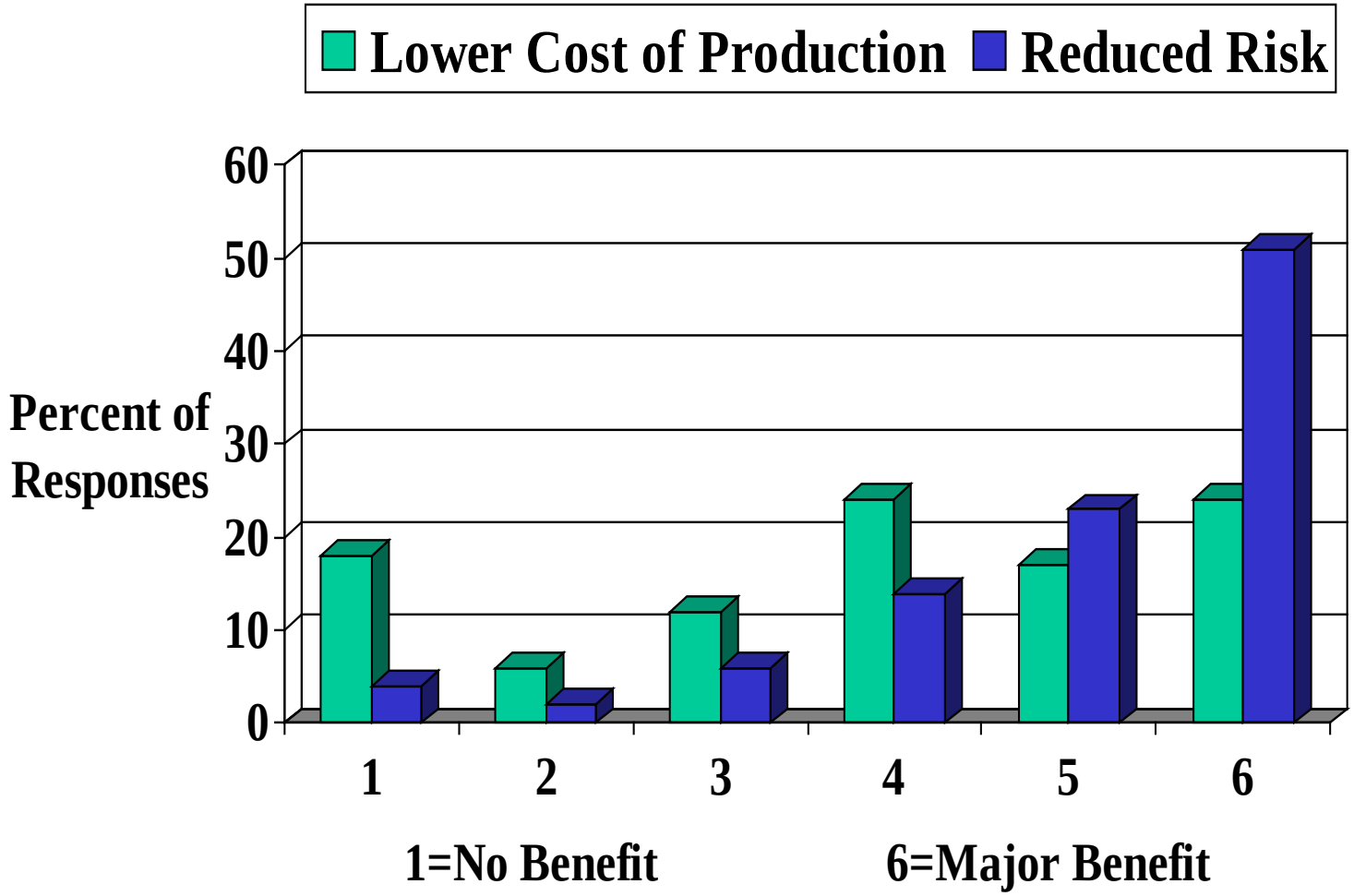
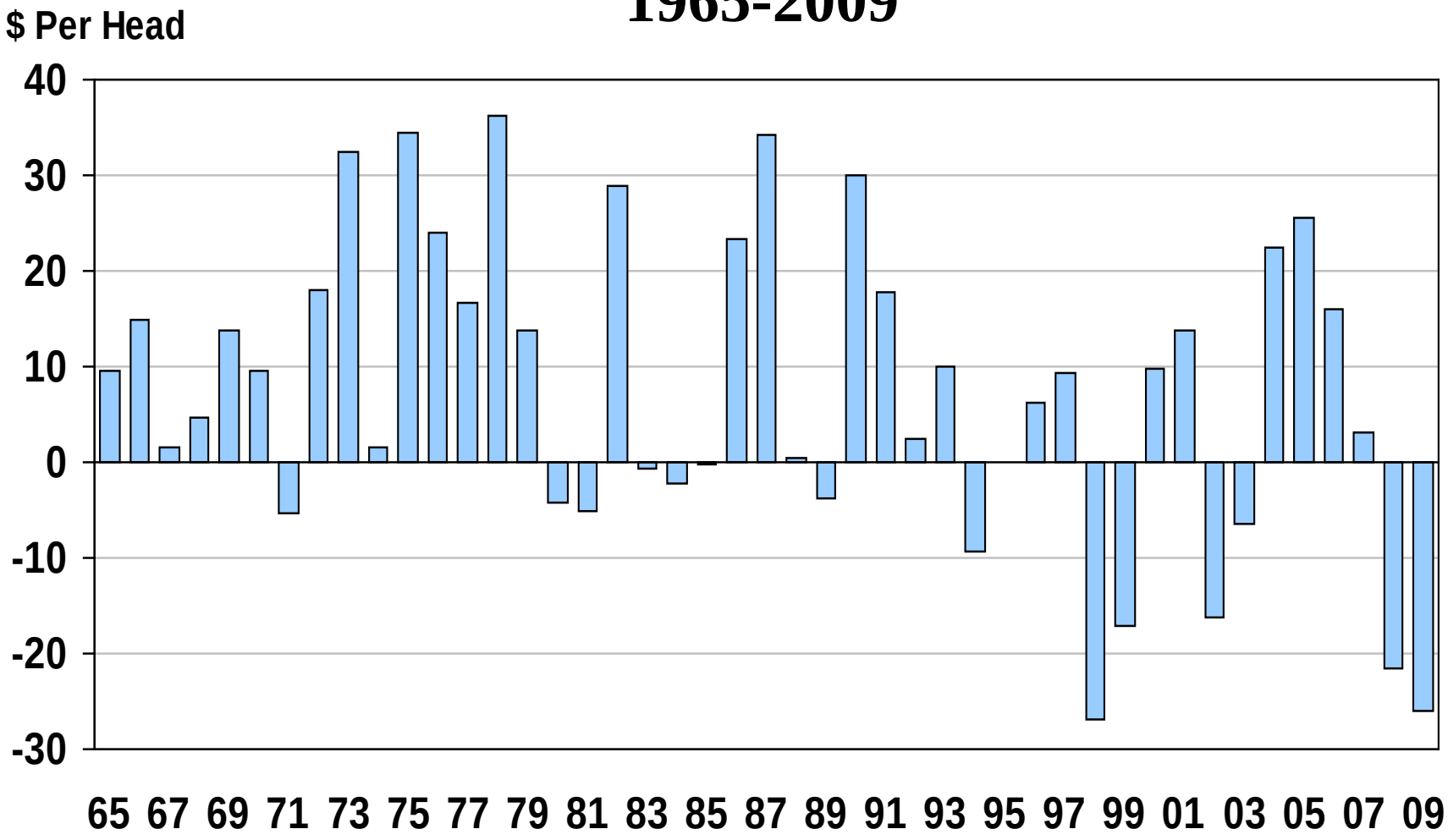


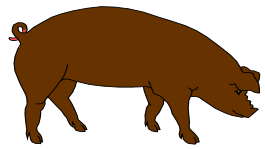
Iowa Farrow to Finish Profits, 1965-2009



Source: John Lawrence, Iowa State University

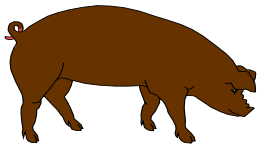
Long Running Trends in Animal Agriculture

1. Expanding production
2. Fewer & bigger operations
3. Specialized farms
4. Integration
5. **Contracting**
    - A. Production contracts
    - **B. Marketing contracts**



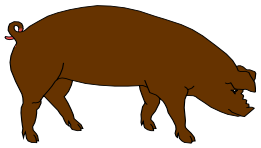
Marketing Barrows & Gilts 2009

- Sell them (76%)
  - Live weight (3%) or carcass weight (73%)
  - Negotiated (11%) or formula price (65%)
  - Contract formula (65%)
    - Futures market (7%)
    - Cutout value (6%)
    - Feed cost (3%)
    - Published hog price (40%)
    - Other (10%)
- Butcher them (24%)
  - Eat the pork (<0.1%)
  - Sell the pork (24%)



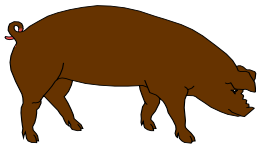
Marketing Contracts

- Why are producers using marketing contracts?
  - It simplifies their life
    - Lower transactions costs
  - It assures shackle space
  - In some cases, it reduces price risk
  - It increases producer income
  - Acquire additional carcass data
  - Easier to get financing



Marketing Contracts

- Why are packers offering marketing contracts?
  - It simplifies their life
    - Lower transactions costs
  - It assures a supply of known animals
  - In some cases, it reduces price risk
  - Improves trace ability
  - It provides them a better animal

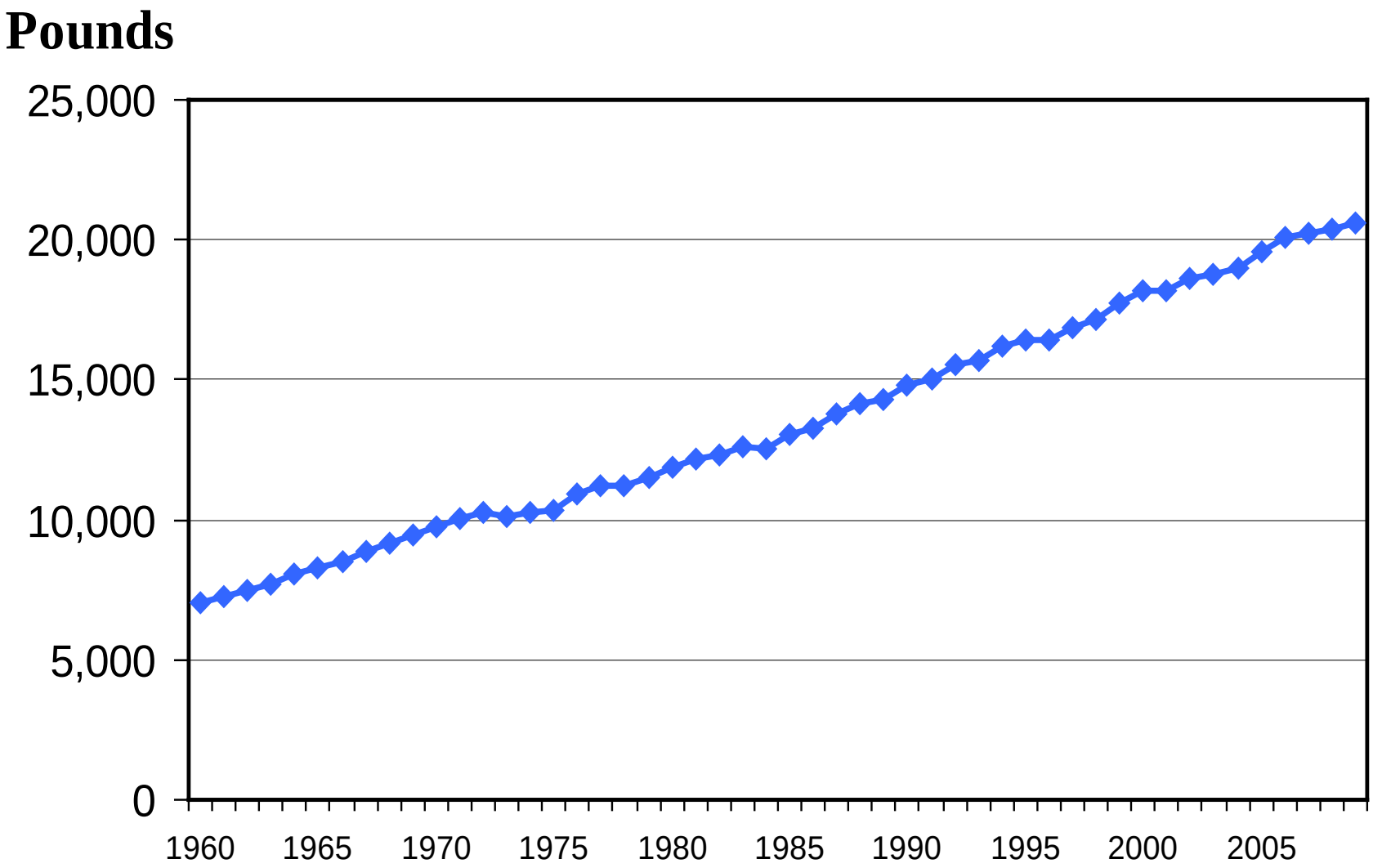


Long Running Trends in Animal Agriculture

1. Expanding production
2. Fewer & bigger operations
3. Specialized farms
4. Integration
5. Contracting
6. **More efficient**

U.S. Beef&Veal Production Per Cow, 1960-2009

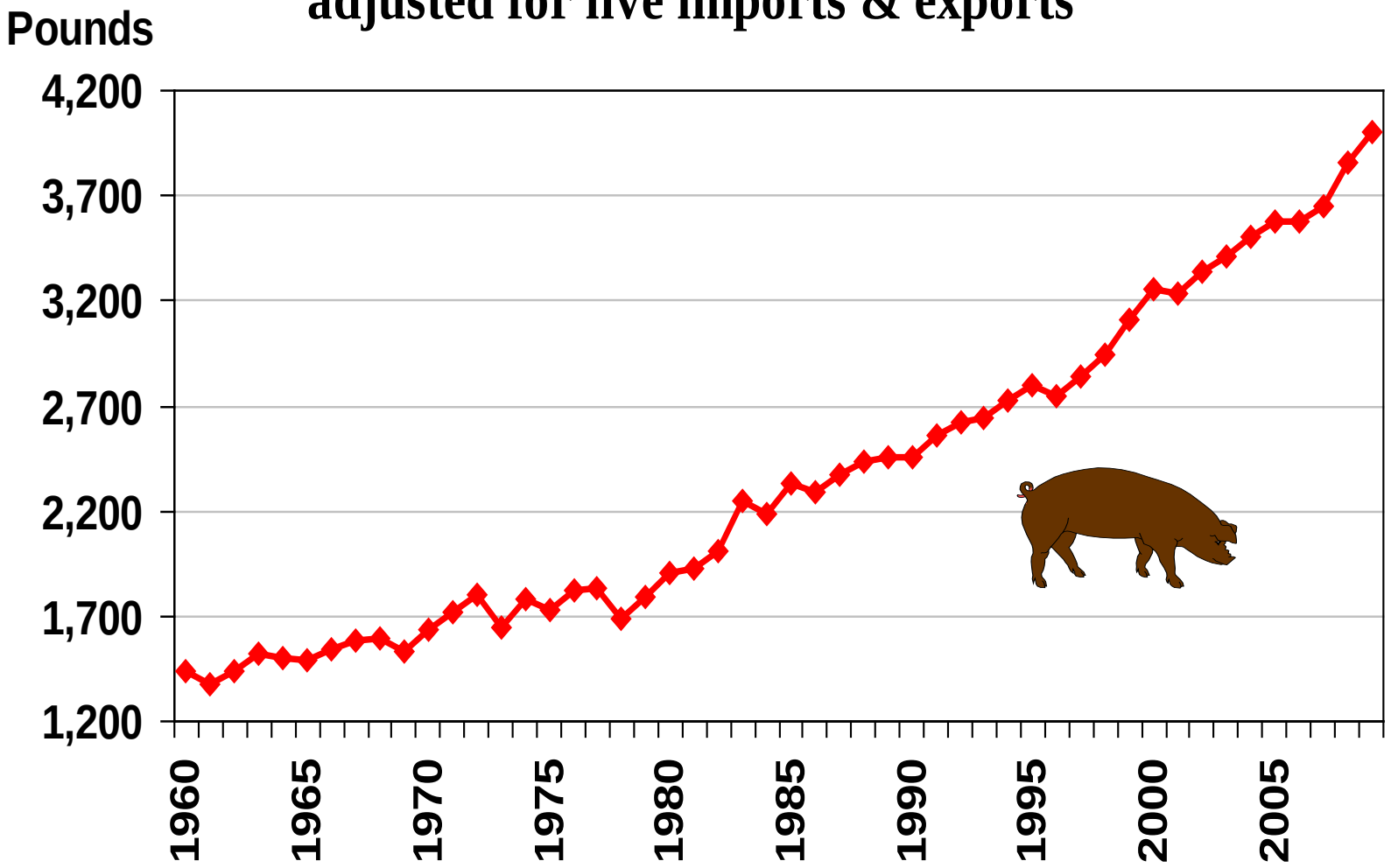
U.S. Milk Production Per Cow, 1960-2009



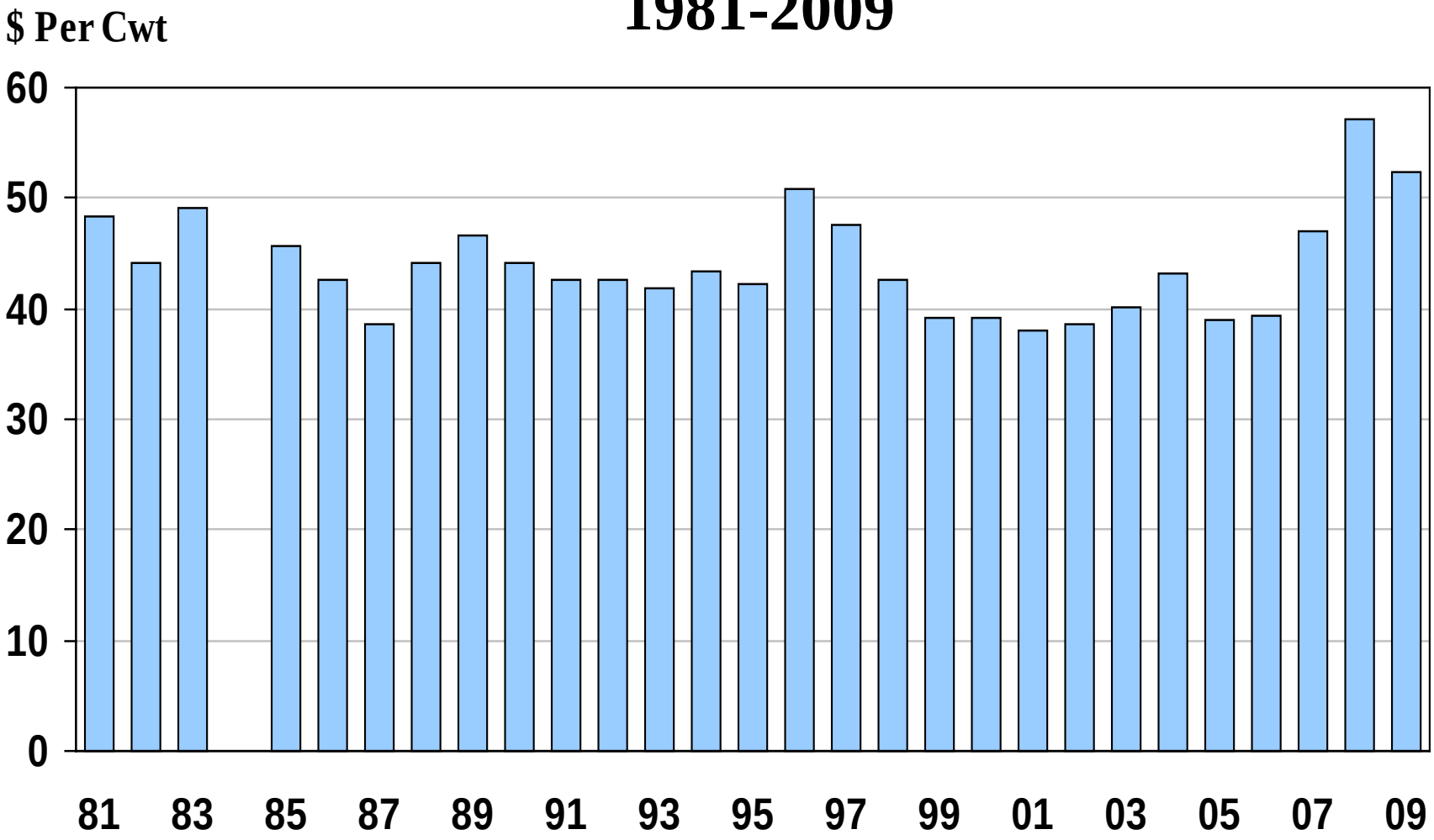
Source: USDA/NASS

Annual U.S. Pork Production Per Sow, 1960-2009

adjusted for live imports & exports

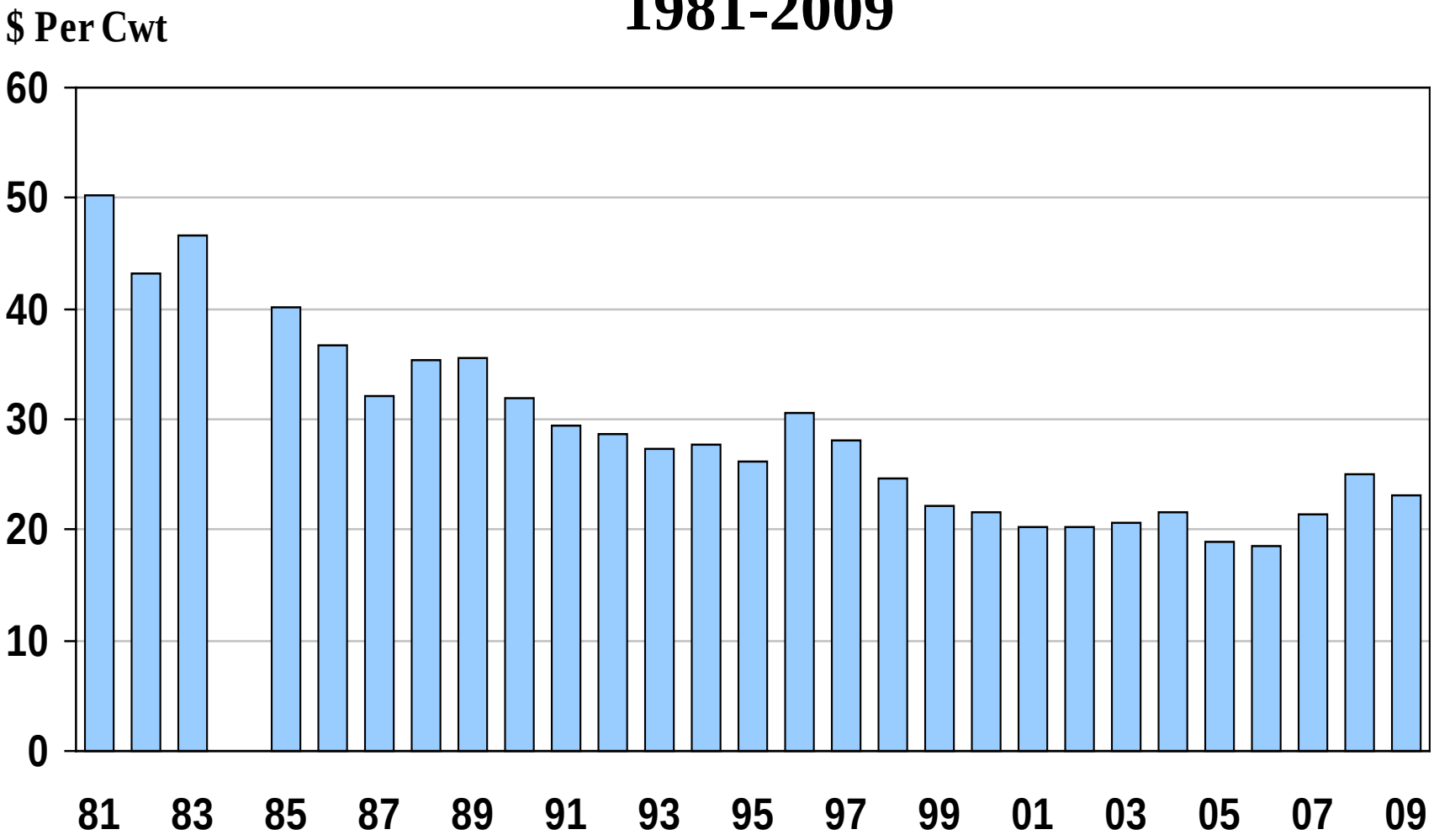


Iowa Farrow to Finish Cost of Production, 1981-2009



Source: John Lawrence, Iowa State University

Iowa Deflated Cost of Production, 1981-2009



Source: John Lawrence, Iowa State University

Long Running Trends in Animal Agriculture

Why more efficient?

A. Knowledge accumulates

Long Running Trends in Animal Agriculture

Why more efficient?

A. Knowledge accumulates

B. New technology

Technology is neither good nor bad, nor is it neutral.

Litters Sired by Artificial Insemination 1997, 2000, 2003, 2006

Firm Size *(thousand head mktd. annually)*	1997	2000	2003	2006
1 - 3	10%	23%	23%	22%
3 - 5	21%	33%	66%	69%
5 - 10	39%	40%	79%	79%
10 - 50	58%	65%	91%	88%
50 - 500	75%	95%	98%	100%
500+	84%	91%	100%	100%

Long Running Trends in Animal Agriculture

1. Expanding production
2. Fewer & bigger operations
3. Specialized farms
4. Integration
5. Contracting
6. More efficient
7. **Shrinking footprint**

Long Running Trends in Animal Agriculture

Shrinking footprint

A. Less land, less runoff

Indoor production

1960: fewer than 10% hogs

2006: 94% of hogs

Long Running Trends in Animal Agriculture

Shrinking footprint

A. Less land, less runoff

B. Healthier animals

indoor production protects animals from weather, parasites & disease carriers

Swine Health Historical Perspective

(Considerations provided by TJ Fangman)

YEAR	Trichinella Prevalence (Human cases/yr)	Int & Ext Parasites	Resp Disease	Enteric Disease	Repro Disease	FE	ADG
2000's	<0.001% (<12 cases/yr)**	+/- (Confined Production)	++ (PRRSv)	+	++ (PRRSv)	<2.85	1.85+
1980's	0.125% (100 cases/yr)*	++	+++	+++	+++	3.40	1.65
1960's	0.66% (200 cases/yr)*	+++++	+++++ (Hog Cholera eradicated)	+++++	+++++ (SMEDI Etiology determined)	3.70	1.50
1920-1940	1.41% (300 cases/yr)*	++++++	+++++	++++++	++++++	4.0	1.35

**www.wrongdiagnosis.com

*CDC Trichinellosis Surveillance---United States, 1997-2001;52(SS06);1-8, 7-25-03

Disease of Swine 5th Ed 1975

Long Running Trends in Animal Agriculture

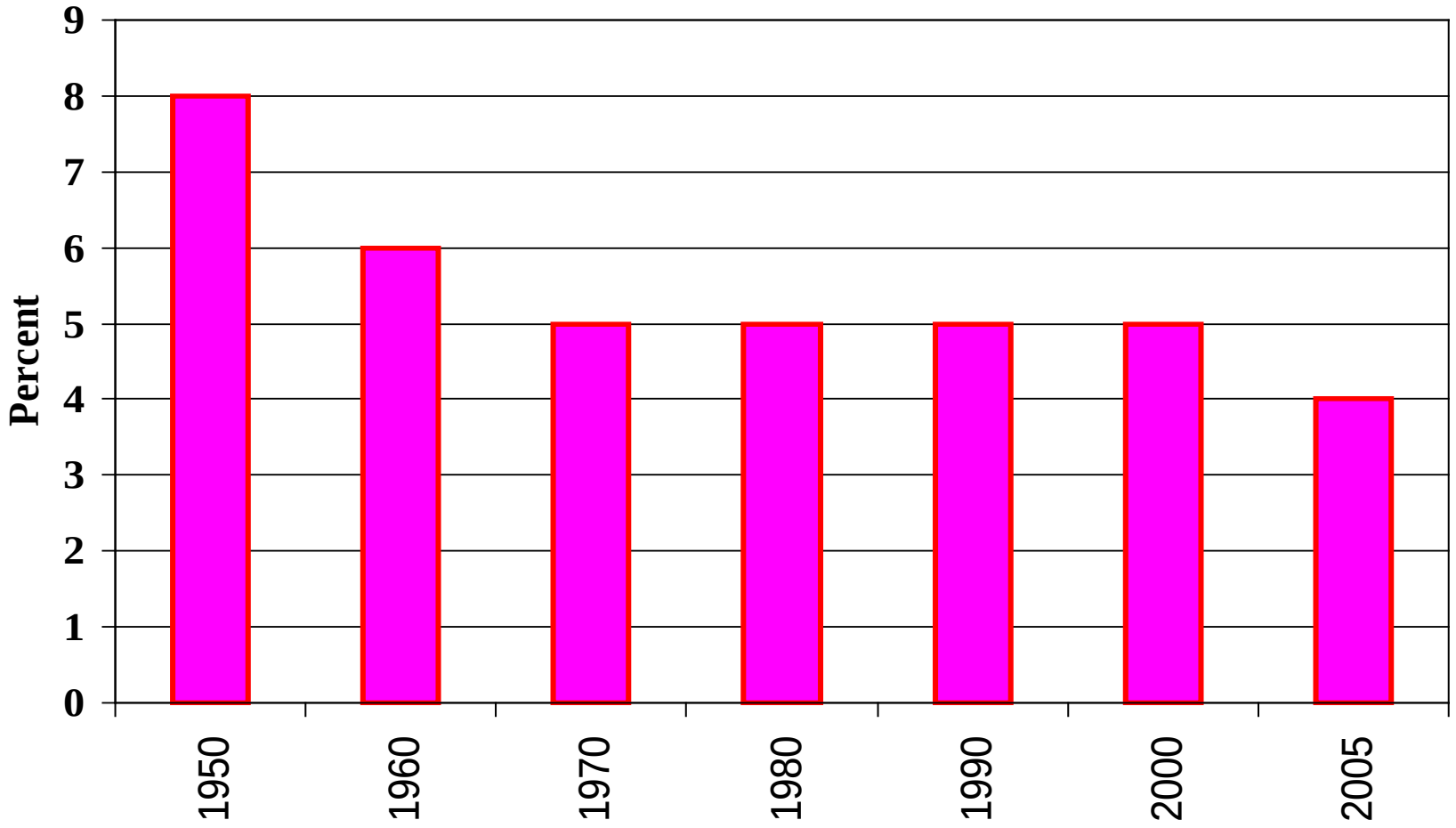
Shrinking footprint

A. Less land, less runoff

B. Healthier animals

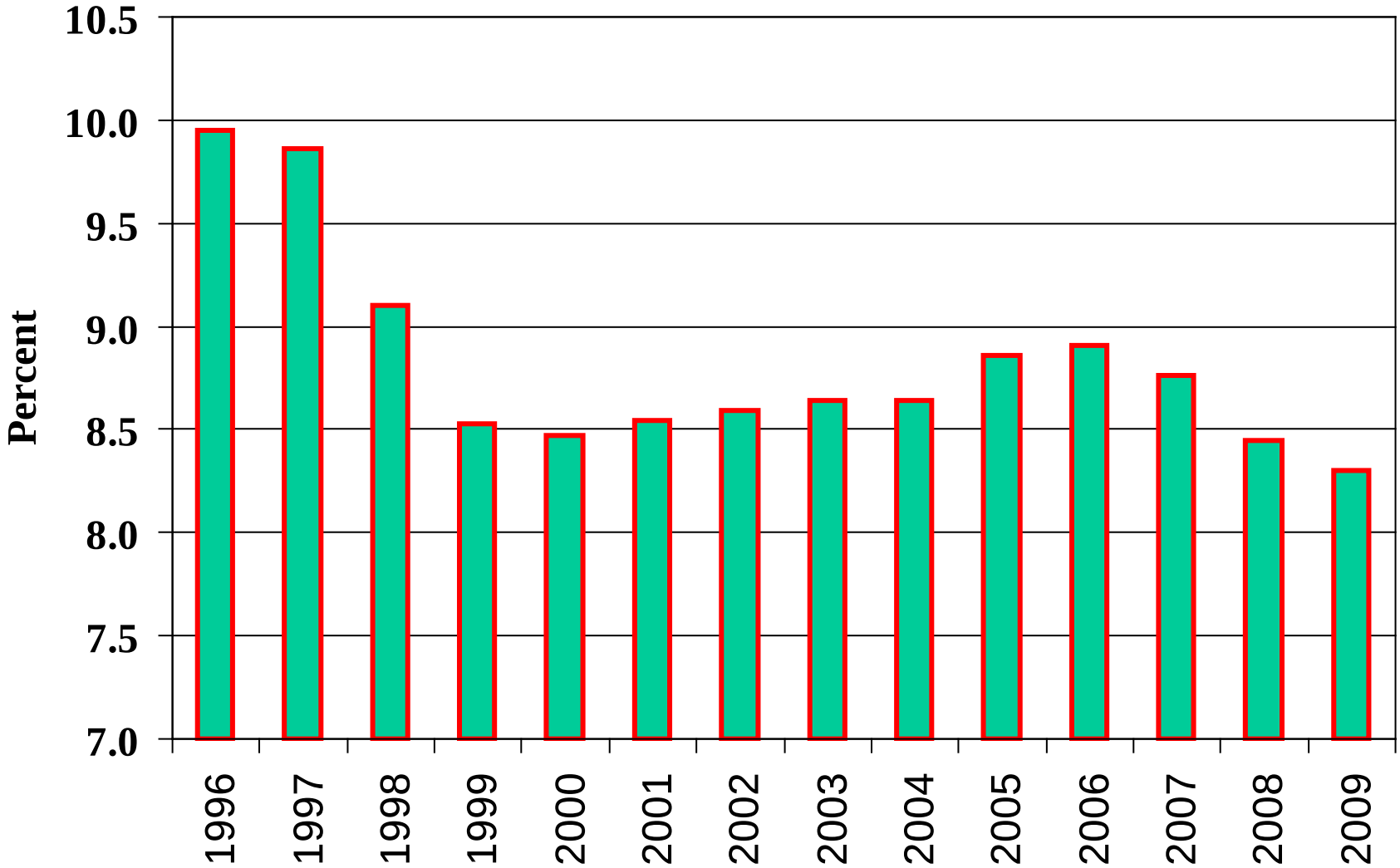
less death loss

Broiler Death Loss

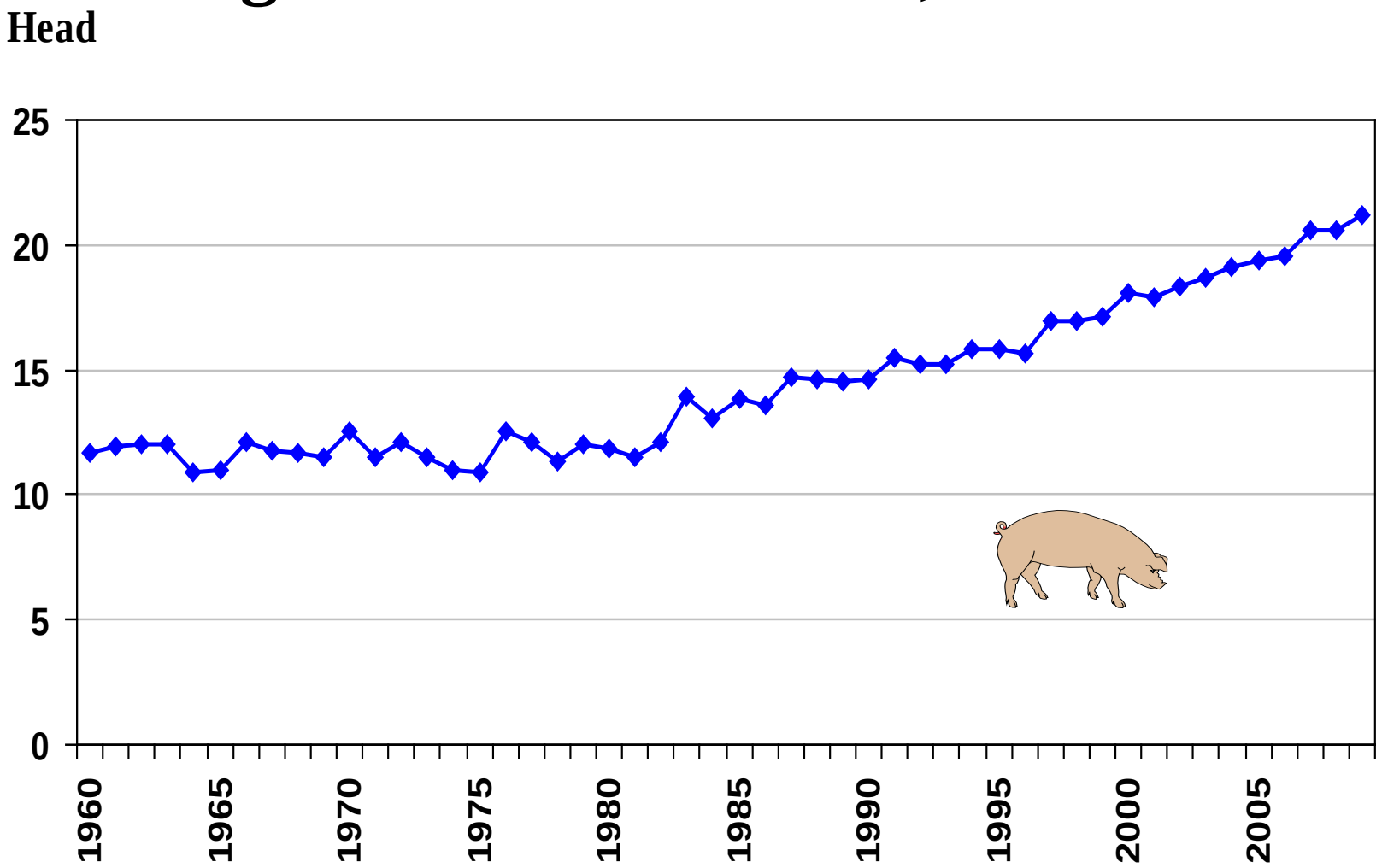


Source: National Chicken Council

Canadian Pre-Weaning Death Loss, 1996-2009



Pigs Per Sow Per Year, 1960-2009



Long Running Trends in Animal Agriculture

Shrinking footprint

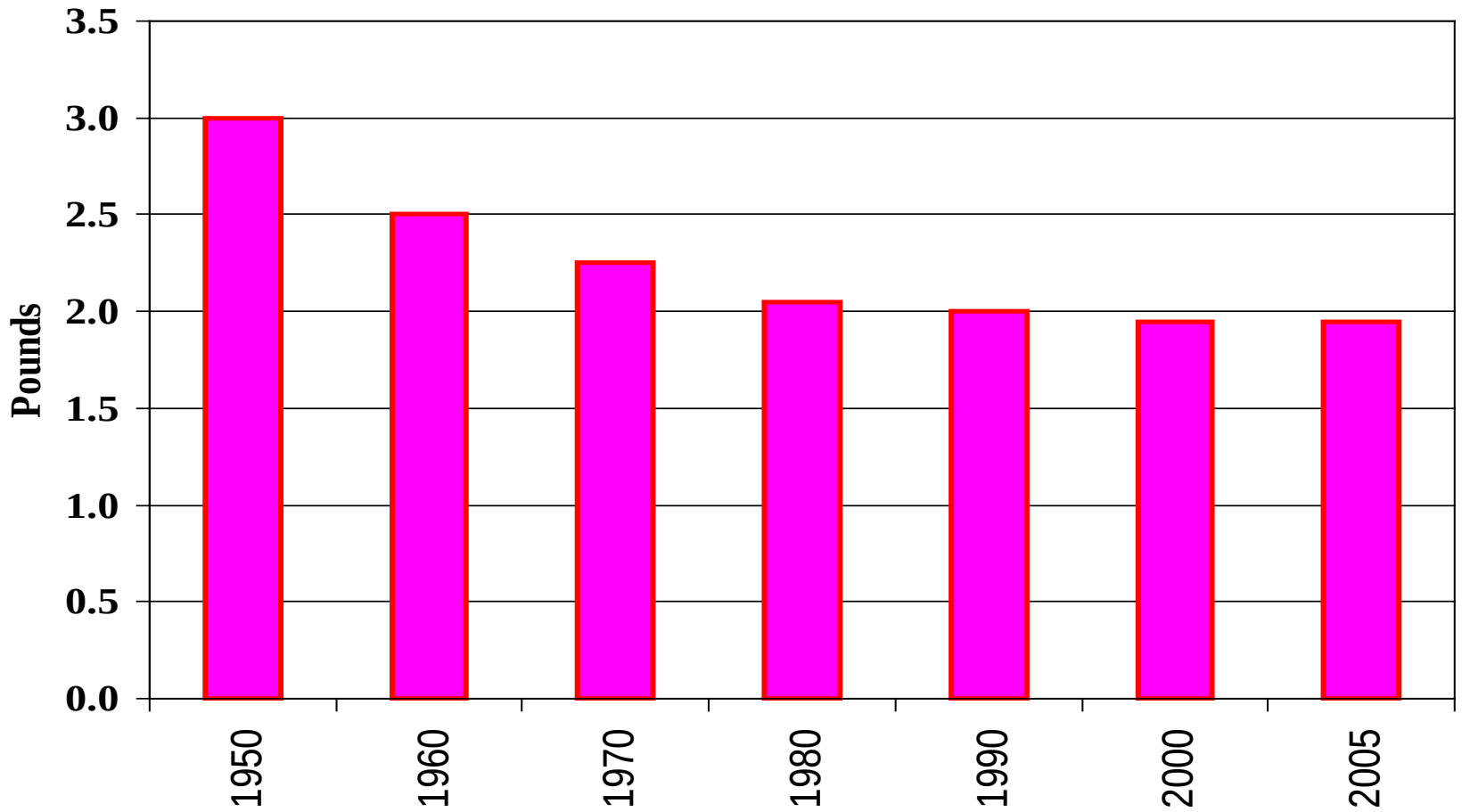
A. Less land, less runoff

B. Healthier animals

C. Less feed & less manure

Broiler Feed Conversion, 1950-2005

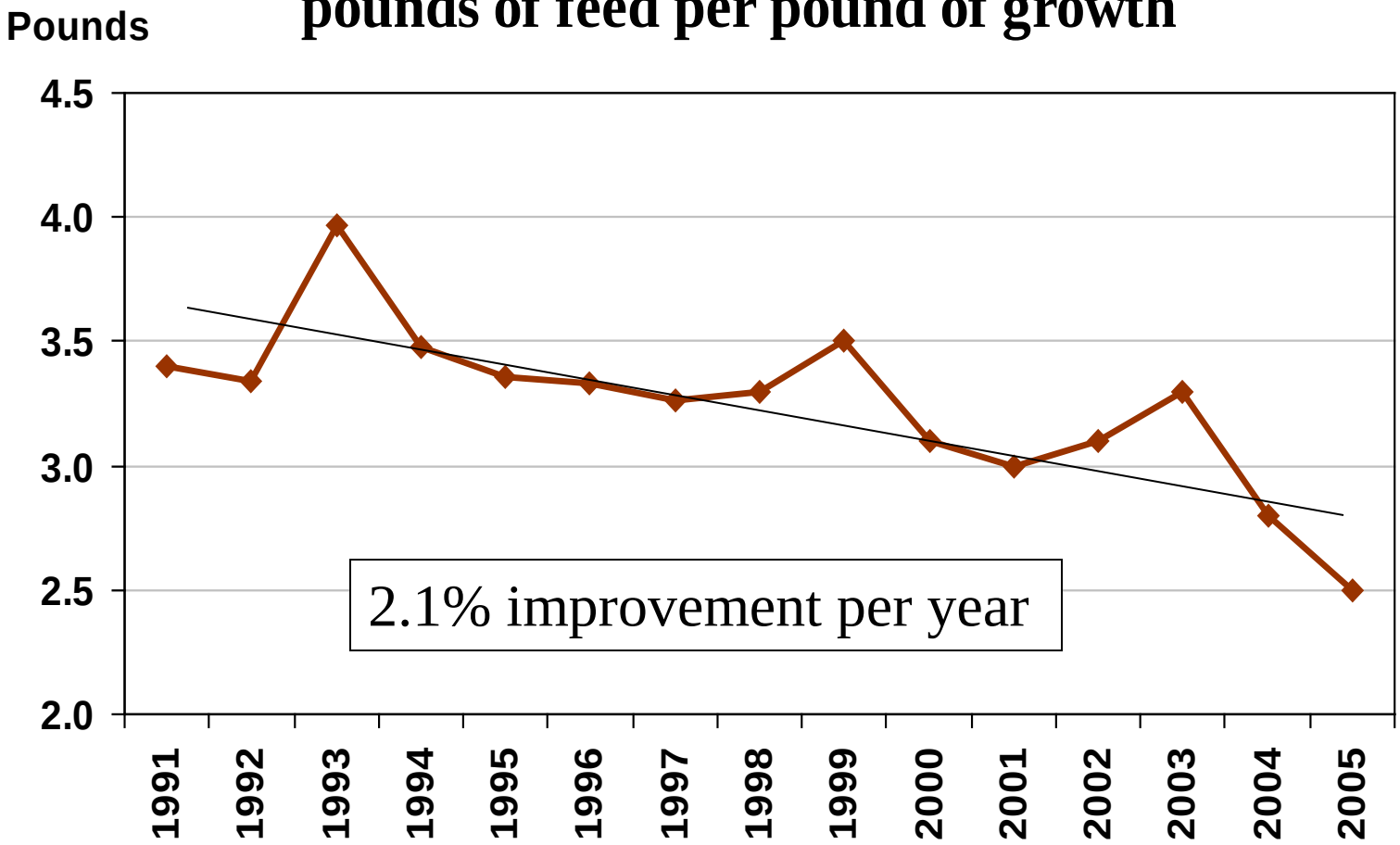
pounds of feed per pound of growth



Source: National Chicken Council

Whole Herd Feed Conversion, 1991-2005

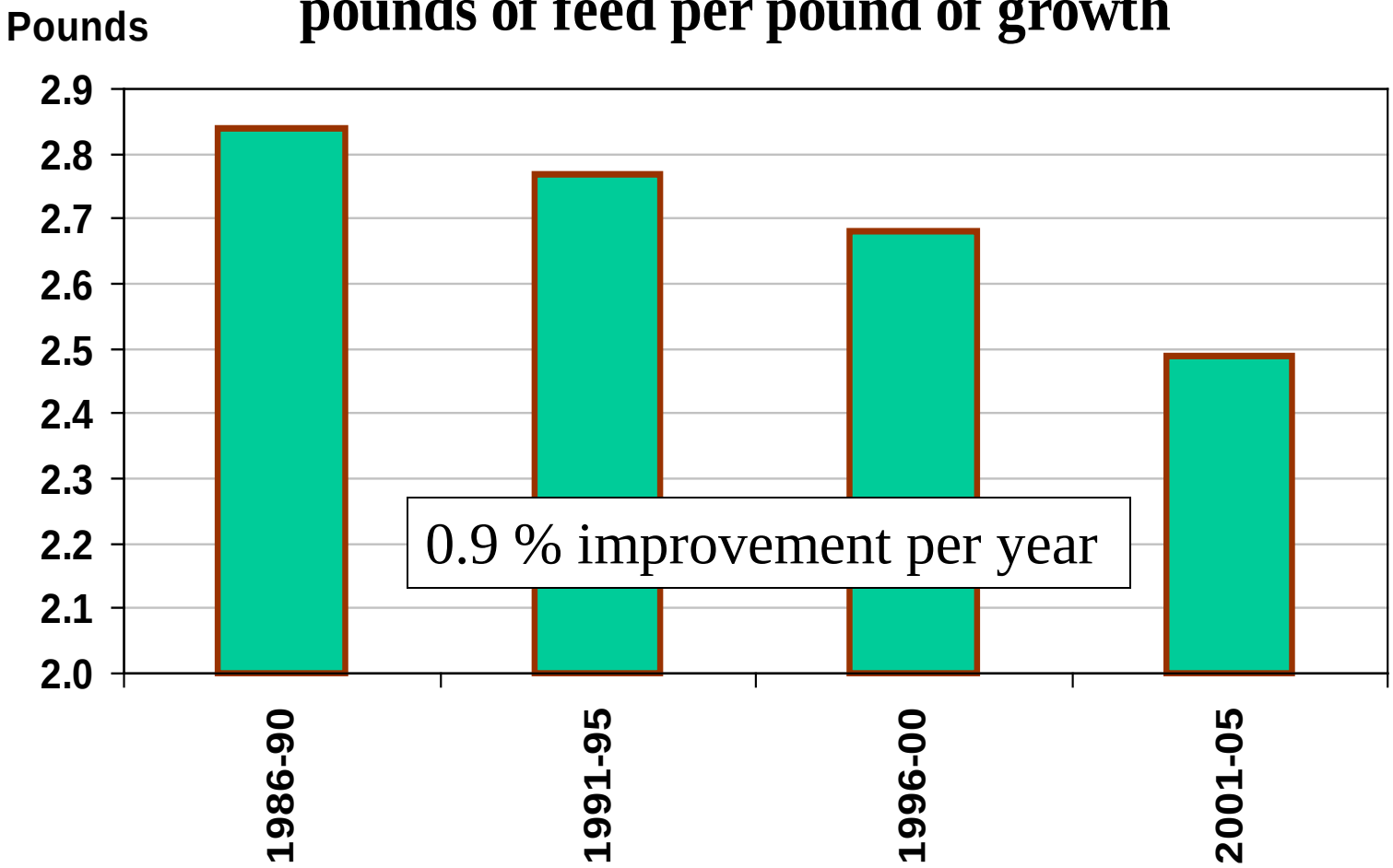
pounds of feed per pound of growth



Source: Missouri family hog farm

Hog Feed Conversion: 45 lbs. to Market

pounds of feed per pound of growth



Source: Large hog integrator

Long Running Trends in Animal Agriculture

U.S. pork production is growing 3 times as fast as hog feed consumption and hog manure production.

Long Running Trends in Animal Agriculture

Shrinking footprint

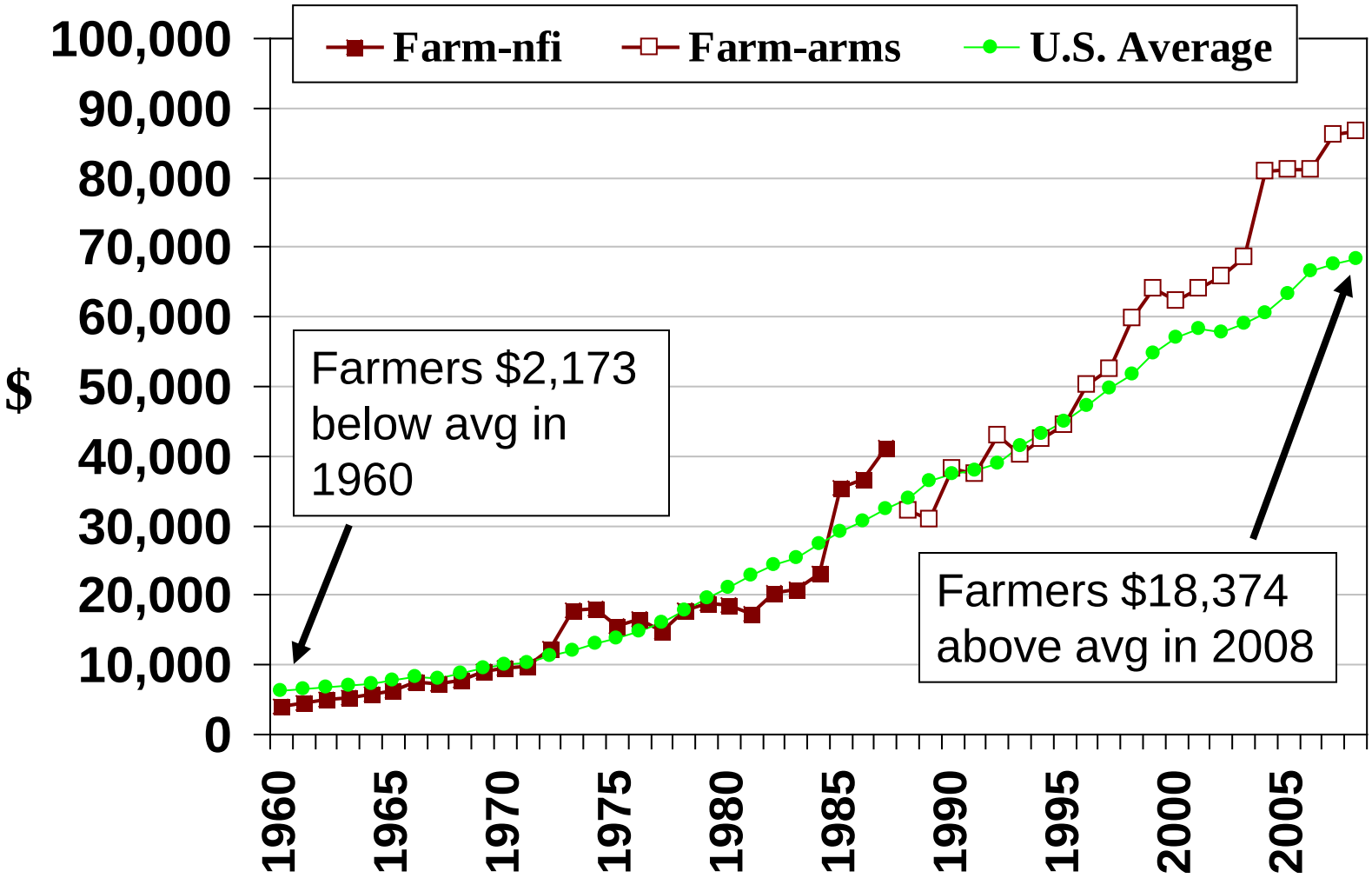
A. Less land, less runoff

B. Healthier animals

C. Less feed & less manure

D. Fewer & wealthier farmers

U.S. Household Income, 1960-2008



Source: USDA/ERS

Long Running Trends in Animal Agriculture

Shrinking footprint

A. Less land, less runoff

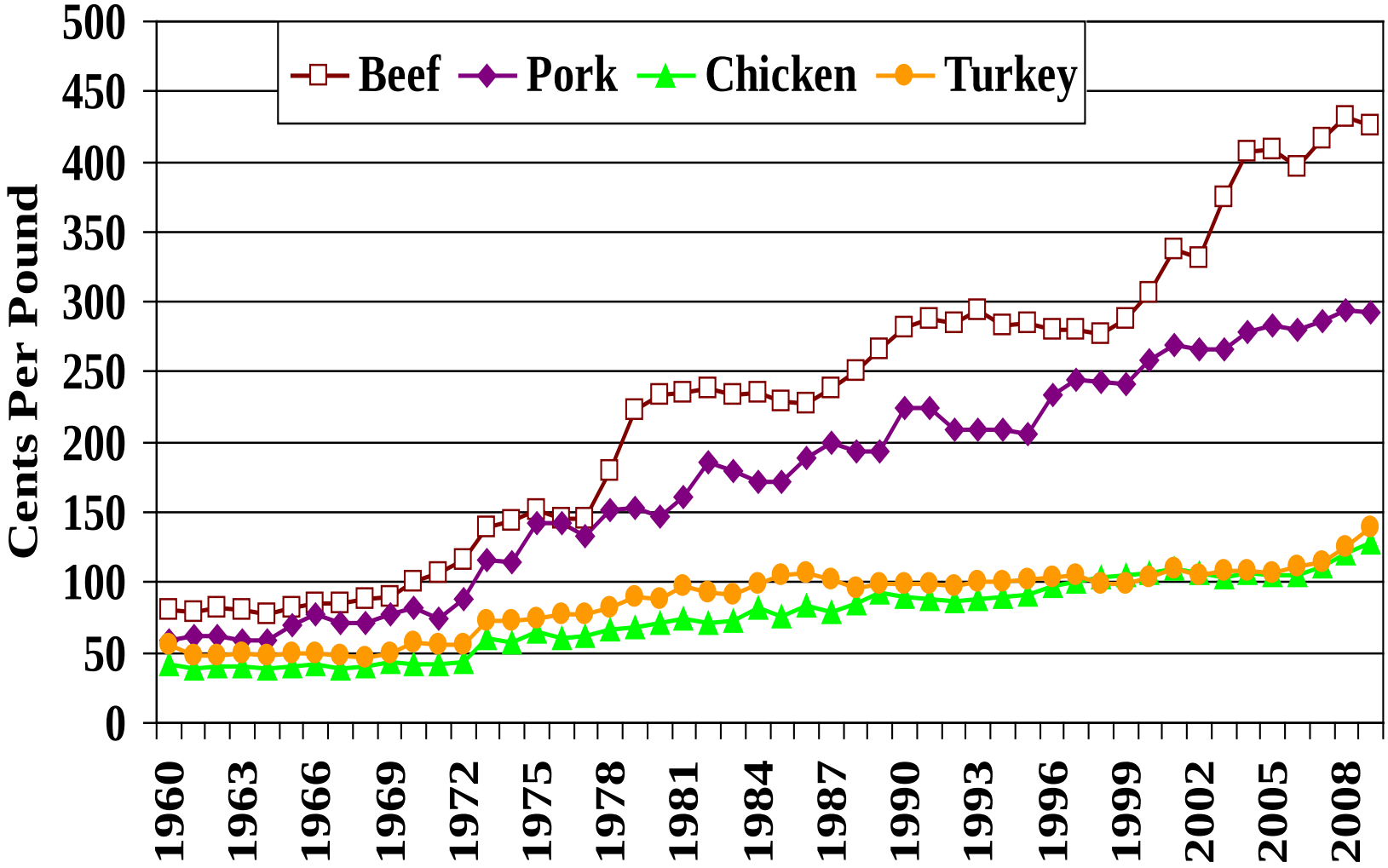
B. Healthier animals

C. Less feed & less manure

D. Fewer and wealthier farmers

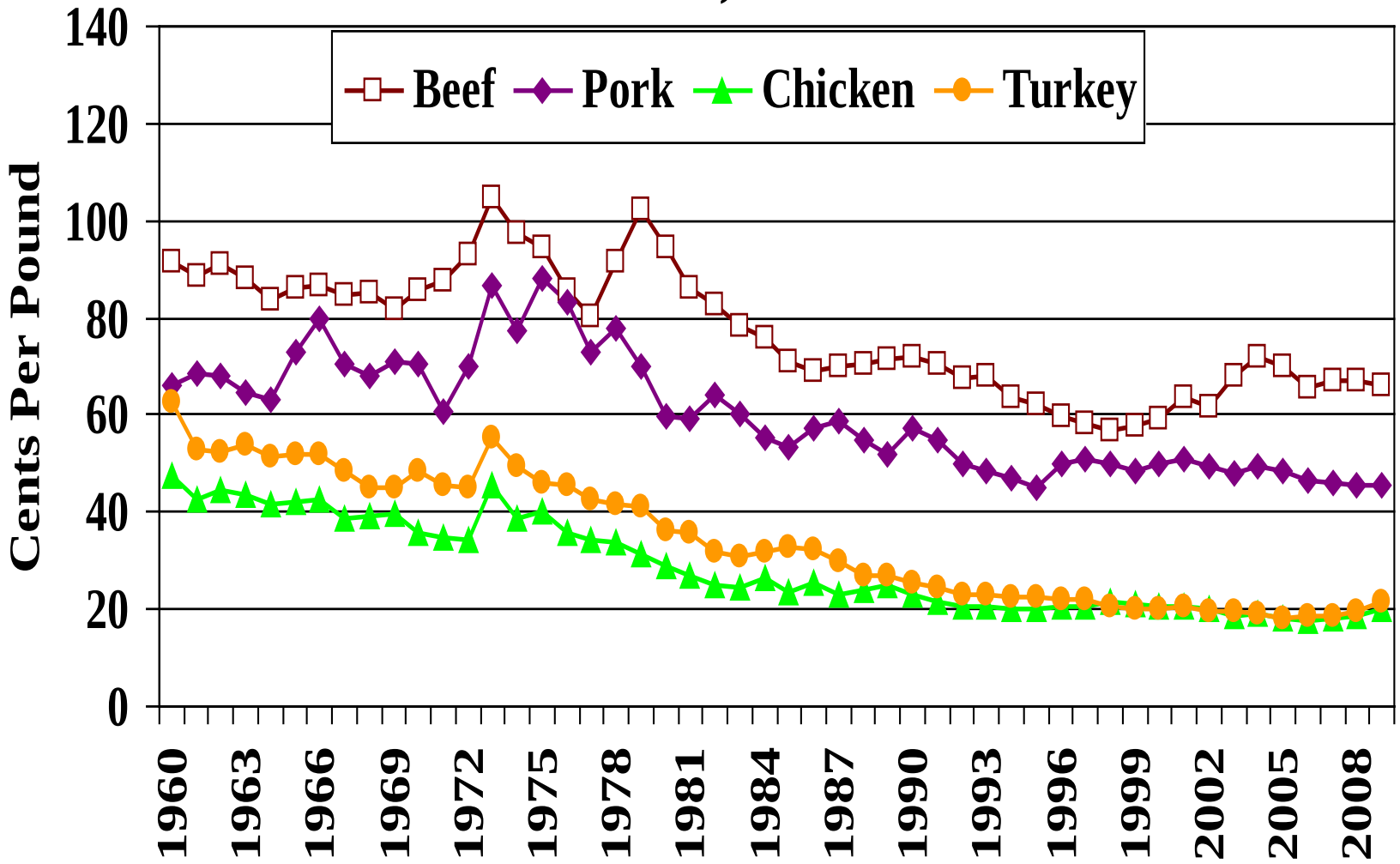
E. Consumers

Retail Price of Meats, 1960-2009



Deflated Retail Price of Meats

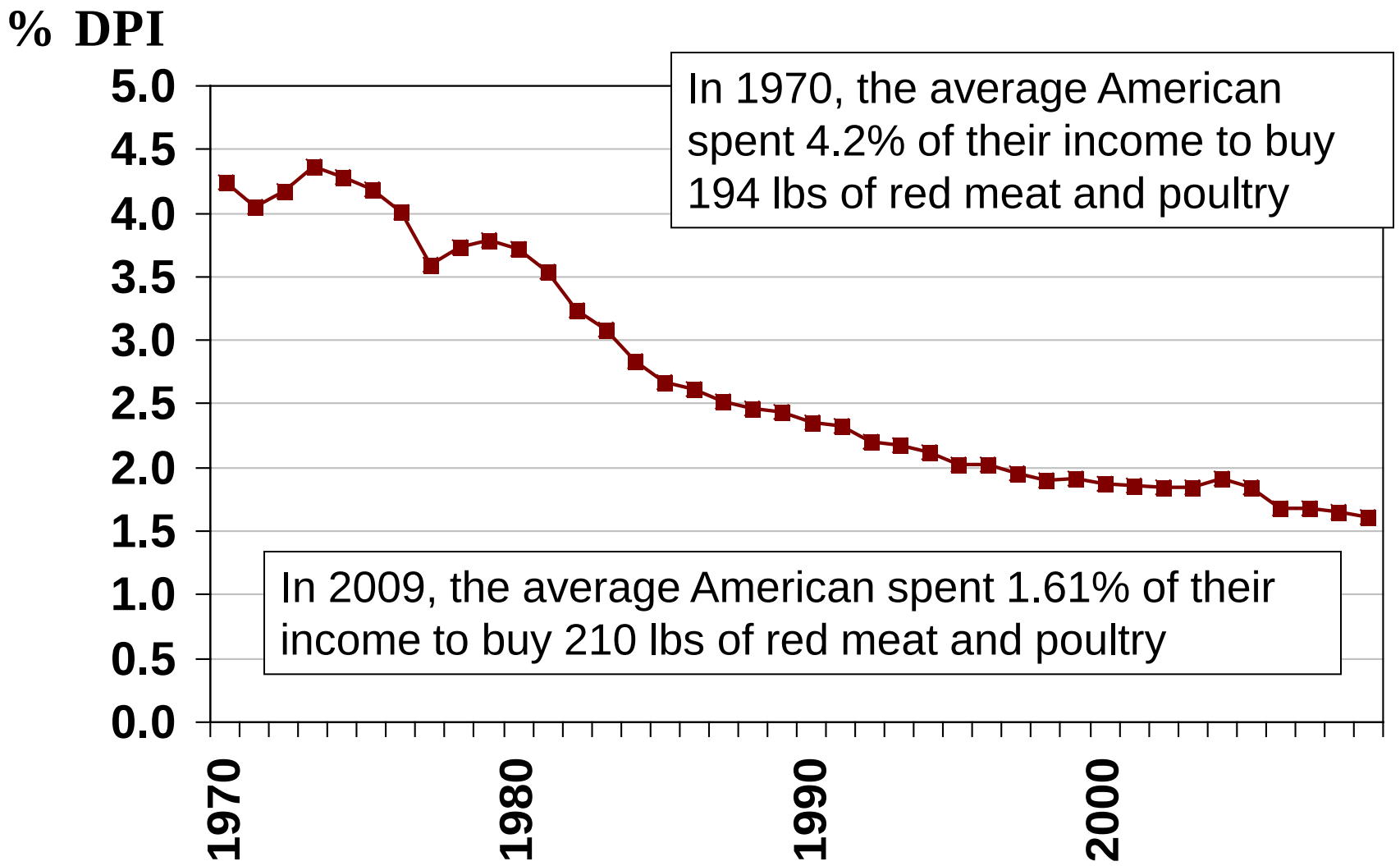
1960-2009, 1967 $



From 1960 to 2009, the Deflated Average Retail Price of….

- Beef decreased by 27%
- Pork decreased by 31%
- Chicken decreased by 58%
- Turkey decreased by 65%

U.S. Meat Expenditures, 1970-09



Source: Livestock Marketing Information Center

Questions?

Consumer trust in the U.S. food system: Implications for communication and regulation

Stephen G. Sapp
Iowa State University

Consumer Trust in the U.S. Food System

Implications for Communication and Regulation

Dr. Stephen Sapp

Department of Sociology, Iowa State University
The Center for Food Integrity
CMA Consulting
Gestalt, Inc.
MarketSense, Inc.

The U.S. Food System

- The U.S. food system provides a large quantity of safe, wholesome, and relatively inexpensive food to hundreds of millions of persons.
- This system faces real and perceived challenges to its credibility arising from:
  - More complex food chains.
  - More complex food processing.
  - More food imports.
  - More direct threats to its safety.

The U.S. Food System

- These challenges are further complicated by the fact that U.S. consumers want to be actively involved in making food-related policy, but most are geographically and conceptually far removed from the food system.
  - Most persons live off the farm.
  - Most persons do not know how food is produced, processed, and distributed.

Sociological Problem

- Therefore, we have a critical societal system that:
  - faces significant challenges, and
  - is guided in part by citizens with little knowledge about it.
- This mismatch requires that citizens place much trust in representatives of the U.S. food system.

Sociological Problem

How can food system representatives *communicate* with the public to instill trust?

or, said more broadly:

How can critical social systems work effectively in a large, complex society?

The Risk Communication Trilemma

- **Horn #1: Let the experts decide.**
  - Because most citizens do not understand the great complexity of the U.S. food system, they might be best off leaving decisions to the experts.
  - The solution to risk communication, therefore, might be to “Let science be the guide for policy regarding the U.S. food system.”

The Risk Communication Trilemma

- This approach has some advantages because consumers are:
  - Ignorant: One cannot help but be.
  - Skeptical: This comes naturally.
  - Untrusting: Citizens should be!
- Too often, however, representatives of the U.S. food system assume that ignorant, skeptical, untrusting consumers are irrational, irresponsible, and unreasonable ones.

The Risk Communication Trilemma

- Relating to consumers in this manner is not an effective way to instill trust.
- The bottom line: We all are ignorant, skeptical, and untrusting. In a democracy, all citizens are allowed by law to participate in policy formation.
- Therefore, Horn #1 cannot easily be resolved because consumers cannot be asked to sit down and shut up.

The Risk Communication Trilemma

- **Horn #2: “Educate Consumers.”**
  - This approach makes sense and appeals to our sense of shared democracy.
  - It is without doubt a necessary component of risk communication.
  - But it has limitations:

The Risk Communication Trilemma

- **Horn #2: “Educate Consumers.”**
  - The paradox of democracy: There are lots of cooks in the kitchen and experts disagree.
  - All technologies are flawed and all have negative consequences for some segments of the population.
  - In the short run, negative information carries disproportionate weight.

The Risk Communication Trilemma

- **Horn #2: “Educate Consumers.”**
  - All technologies, whether they are associated with large, commercial agriculture or small, “sustainable” agriculture, have limitations.
  - When these limitations are made public, the public becomes skeptical.

The Risk Communication Trilemma

- **Horn #2: "Educate Consumers."**
  - Therefore, educating consumers can actually decrease trust rather than increase it!
  - The bottom line: Education is a necessary component of risk communication, but not a sufficient one to instill trust.
  - Therefore, Horn #2 cannot easily be resolved because negative information has disproportionate weight.

The Risk Communication Trilemma

- **Horn #3: “Blame the Media.”**
  - This approach has intuitive appeal because media reports “amplify” negative information.
  - It sometimes can seem unreasonable to have to respond to media reports on statements that have little scientific merit.

The Risk Communication Trilemma

- **Horn #3: “Blame the Media.”**

  However, one must accept that:

  - The media has a job to do.
  - The media has ethical responsibilities to report both sides.
  - Most of the time, media representatives act responsibly.

The Risk Communication Trilemma

- **Horn #3: “Blame the Media.”**
  - The bottom line: Blaming the media does not instill trust.
  - Therefore, Horn #3 cannot easily be resolved because the democracy we desire requires protection of free speech.

The Risk Communication: Solution

- **Diffusion of Innovations Approach**
  - This approach has been well known and well researched for over 50 years.
  - The approach has been implemented successfully in thousands of applications worldwide for many years.
  - This approach offers a solution to the risk communication trilemma.

The Risk Communication: Solution

- **Diffusion of Innovations Approach**

1. Identify opinion leaders: Trusted, respected, third-party persons/organizations.

2. Obtain endorsements from opinion leaders.

   - Opinion leaders beat the trilemma by instilling trust upon representatives of the societal system. Through their endorsements, they “deem” representatives to be trustworthy.

The Risk Communication: Solution

- **Diffusion of Innovations Approach**

  This approach works, but begs the questions:

  1. How do opinion leaders gain trust?
  2. How can representatives of the U.S. food system gain trust, apart from endorsements from opinion leaders?

Risk Communication: Trust!

1. What are the key determinants of public trust in the U.S. food system?

2. What actions can institutional actors, whether established or new, large or small, take to gain and retain public trust?

The Sociological Approach

- Here are just *some* of the variables used to explain consumer trust in the U.S. food system:

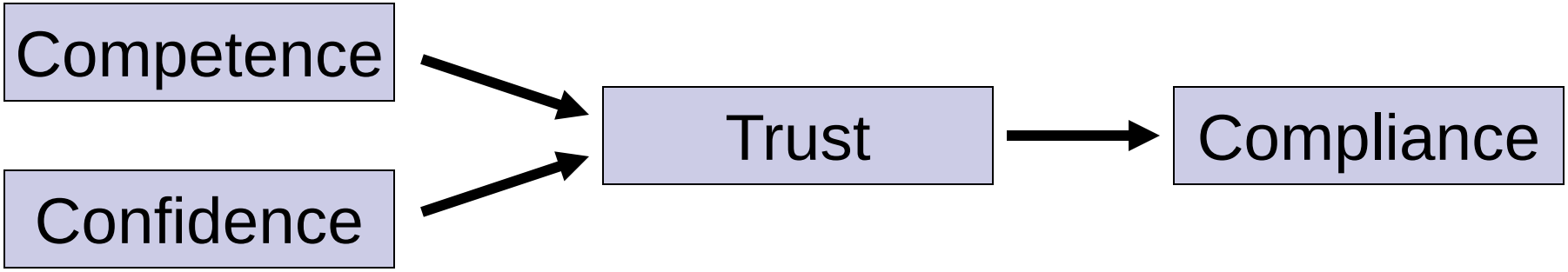
perceived risks
complexity
age
familiarity
value similarity
anomie
source credibility
observability
income
media attention
stigma
alienation
perceived benefits
relative advantage
sex and gender
compatibility
trialability
race and ethnicity
prior exposure
education…..

The Sociological Approach

- Of course, a simpler model would be preferable!
- We seek a model that:
  1. explains much of the variance in trust,
  2. with just a few variables,
  3. that are easily understood, and
  4. actionable.

Consumer Trust Model

- A diagram of the Consumer Trust Model:



- Where Compliance refers to willingness to heed the recommendations of others. This variable is used to evaluate the external validity of the measure of trust, as an indicator of commitment to a source of information.

Testing the Consumer Trust Model

- Nationwide survey of 2,008 adults (2007-2009).
- Measurements on competence, confidence, trust, compliance, and statistical controls.
- Five areas of the U.S. food system: food safety, nutrition, worker care, environmental protection, animal welfare.
- 7-9 pertinent representatives within each area (e.g., producers, processors, grocers, regulators, restaurants, advocacy groups).

Results

This research design yielded 41 tests of the consumer trust model. These are the results:

R-Square	Avg.	Low	High
Trust	.745	.590	.837
Compliance	.495	.299	.713

Standardized Estimates

Path	Avg.	Low	High
Trust → Compliance	.676	.520	.792
Competence → Trust	.216	.154	.311
Confidence → Trust	.668	.579	.768

Conclusions

- The results indicate that the model:
  1. explains much of the variance in trust,
  2. with just a few variables,
  3. that are easily understood,
  4. and actionable.
- Confidence is the key driver of consumer trust in the U.S. food system.
- These results were replicated in 2008 and 2009 for the U.S. food system and in 2009 on another topic of public controversy (i.e., power lines).

Implications of the Findings

- Communicating about the competence of food system representatives is important for gaining and maintaining consumer trust.
- Even more important for gaining and maintaining consumer trust is instilling confidence in food system representatives.
- Future research needs to identify specific actions that reflect competence and instill confidence.

Policy Issues

- The self-interest of maintaining consumer trust infers industry encouragement and support for recommendations offered by opinion leaders.
- Point: Opinion leaders in the U.S. food system (USDA, FDA, EPA, etc.) typically ask for more regulations as a means of instilling trust.
- Therefore, maintaining trust often infers support for more regulation of the food system!

Policy Issues

- This conclusion seems reasonable.
- Consider, however, the potential negative consequences for small and medium size food companies of supporting greater legislation.

Policy Issues

- Economies of Scale
  - Conforming with regulations requires a burden of time and expertise.
  - These burdens weigh less heavily upon large firms compared with small and medium size firms.
  - Therefore: The greater the regulation, the greater the advantage for larger firms.

Policy Issues

- Two-Edged Sword
  - New regulations bring about greater safety, but new regulations might bring about greater industry control by a few large firms.

  1. Small and medium size firms cannot oppose new regulations for fear of appearing to be “anti-safety.”

  2. Government agencies might appear to endorse favoritism if they set different regulations for different size firms.

Policy Issues

- Summary
  - Smaller firms might find it difficult to beat the “trilemma” by relying upon the diffusion of innovations approach because the actions of opinion leaders tend to create policies that create disproportionate burden on these firms.
  - Therefore, smaller firms must rely more on changing institutional approaches as a means to instilling consumer trust in them as representatives of the U.S. food system.

The Policy Dilemma

Horn #1: Maintain proper functioning of critical social systems.

Horn #2: Encourage entrepreneurship.

Consumer Trust in the U.S. Food System

Implications for Communication and Regulation

Thank You!

Panel: Trends in society and their impact on our future food-animal systems

Charlie Arnot
Center for Food Integrity

The Center for Food Integrity

Building consumer trust and confidence in the contemporary U.S. food system

Charlie Arnot

Charlie.Arnot@FoodIntegrity.org

CFI Mission

To build consumer trust and confidence in the contemporary U.S. food system by…

- *sharing accurate, balanced information*
- *correcting misinformation*
- *modeling best practices and*
- *engaging stakeholders*

Freedom to Operate

Social License

Social License

Definition: The privilege of operating with minimal formalized restrictions (legislation, regulation, or market requirements) based on maintaining public trust by doing what's right.

Public Trust: A belief that activities are consistent with social expectations and the values of the community and other stakeholders.

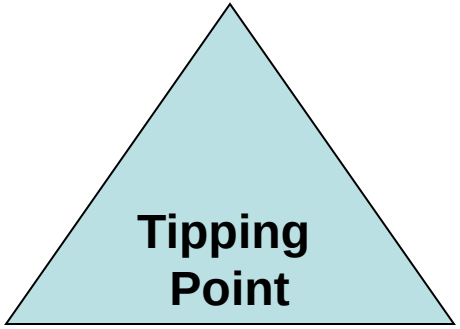
The Social License To Operate

Flexible
Responsive
Lower Cost

Rigid
Bureaucratic
Higher Cost

Social License

- **Ethics**
- **Values**
- **Expectations**
- **Self-Regulation**



Single triggering event
Cumulative impact

Social Control

- **Regulation**
- **Legislation**
- **Litigation**
- **Compliance**

High Trust
Complete Autonomy

Low Trust
Prohibition

The Social License To Operate

Proactive

Reactive

Market Intervention Can Shift Balance
- Customer Mandates
- Consumer Boycott

Industry Engagement

Education, BMP's, Certification, Verification

Lobbying, Regulatory Affairs, Litigation

Social License

Social Control

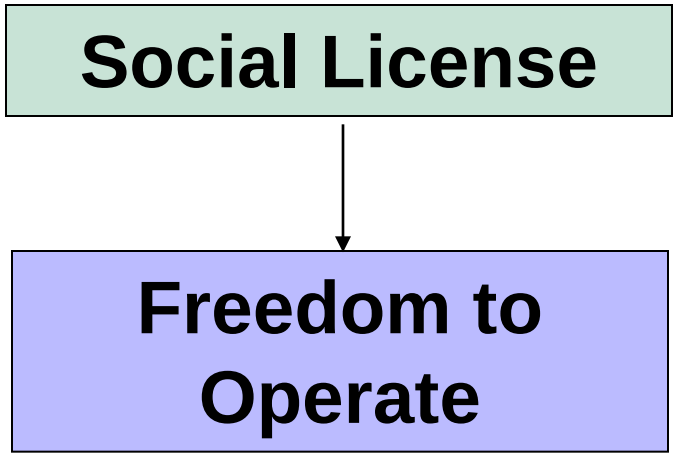
Social benefit perceived greater than social cost

Tipping Point

Social cost perceived greater than social benefit

Change in social norms (values, ethics, expectations) can shift tipping point

Earning and Maintaining the Social License (Sapp/CMA)



Trust

Influential Others

Competence

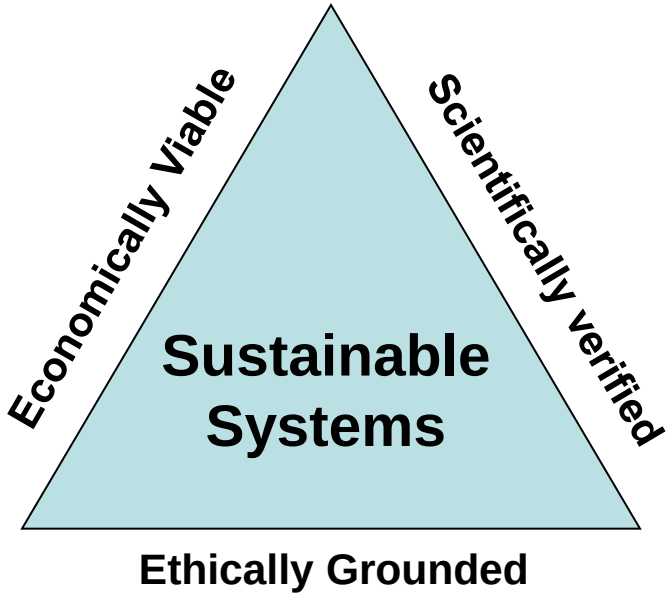
Confidence

Balancing for Success

Economically Viable

- ROI
- Demand
- Revenue
- Cost Control
- Efficiency

Profits



Scientifically Verified

- Data Driven
- Repeatable
- Measurable
- Specific

Objectivity

Ethically Grounded

- Compassion
- Responsibility
- Respect
- Fairness
- Truth

Value Similarity

The Good ‘Ol Days…

When many people think of farming they envision barns in pastoral settings and a farmer pulling a plow behind a tractor …

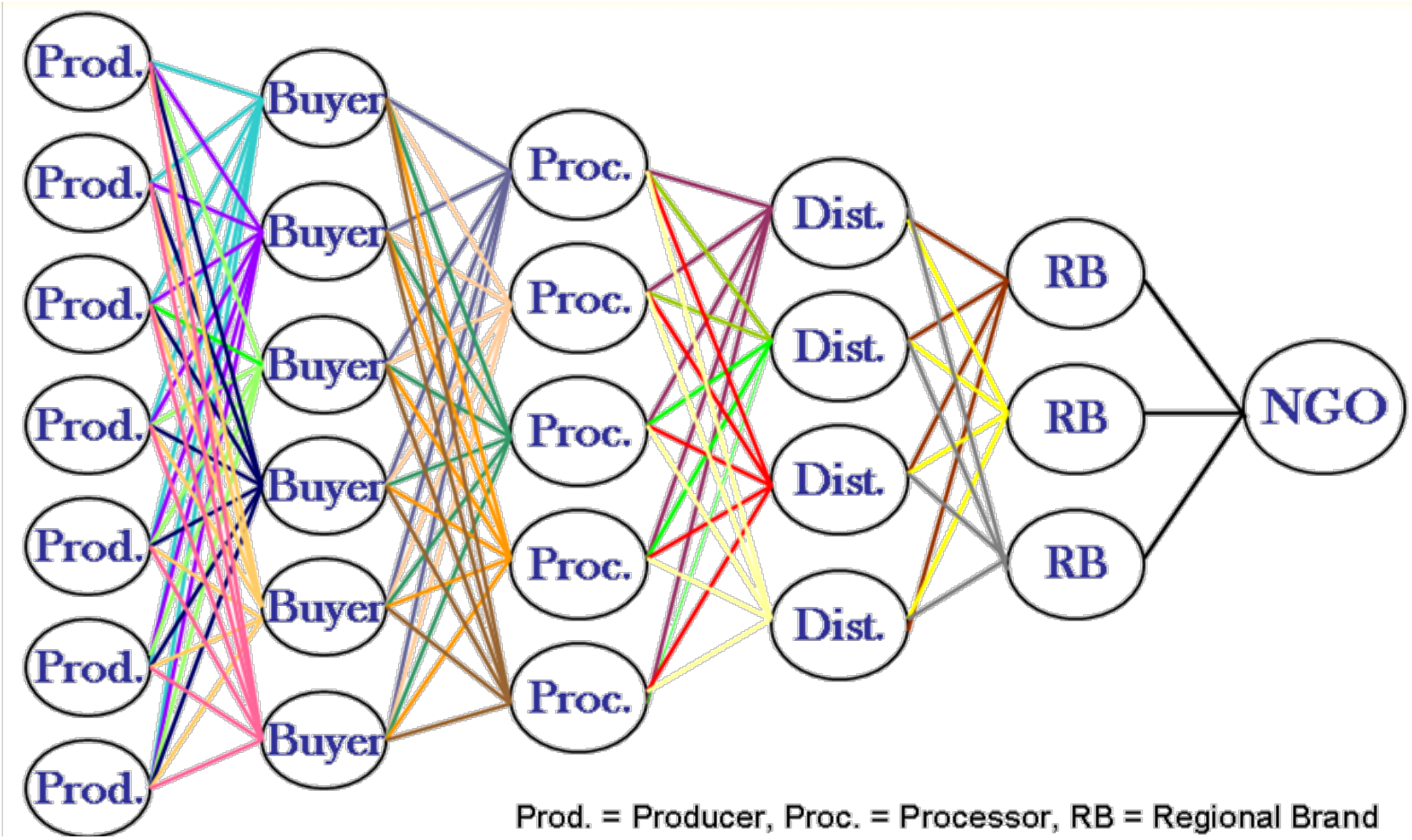
The Good ‘Ol Days…

Comparing modern agriculture with a farmer pulling a plow is like comparing a new car with the classic ’57 Chevy …

The Good ‘Ol Days…

- No power steering
- No air conditioning
- No seat belts
- No air bags
- No computers to manage performance
- Horrible gas mileage
- No emissions controls

Agrarian Model

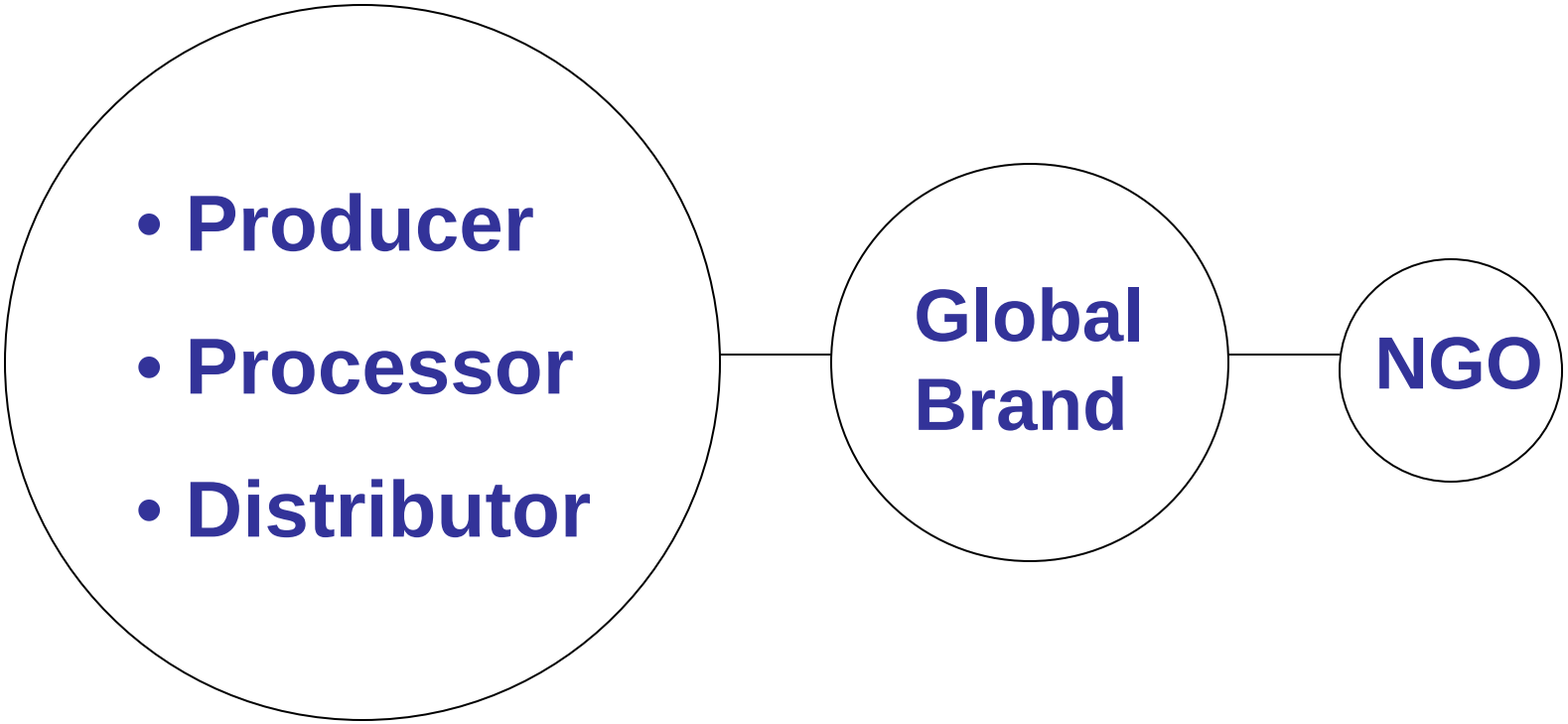


Changing Industry

In the United States today:

- The top ten food retailers sell more than 75% of food.
- The top four beef packers process more than 80% of beef.
- The top ten chicken companies produce 79% of chicken.
- The top 50 dairy cooperatives produce 79% of the milk.
- The top 60 egg companies produce 85% of eggs.
- The top 20 pork producers produce more than 50% of pork.

Integrated Model




RECALL
Goldman's Blankfein On Why They've Done Nothing Wrong
Joe Klein Takes On the GOP's Scare Tactics
No Laughing Matter: Comedy in The Age of Obama
TIME
WARNING: This hamburger may be harardous to your health. Why the American food system is bad for our bodies, our economy and our environment— and what some visionaries are trying to do about it.
Newsweek
FEAR
& THE FLU
THE NEW AGE OF PANDEMIC
BY LAURIE GARR
FEED YOUR CHILDREN WELL
MY FIGHT AGAINST CHILDHOOD OBESITY
BY MICHELLE OBAMA
DEATH
FOOD, INC.
FORGET ORGANIC. EAT LOCAL
The Omnivore's Dilemma
A NATURAL HISTORY of FOUR MEALS
MICHAEL POLLAN
Author of
THE BOTANY OF DESIRE
Joe Klein: How Al Gore Could Save The Democrats
Hillary Clinton On Why She Won't Quit
TIME
The Clean Energy Myth
BY MICHAEL GRUNWALD
Politicians and Big Business are pushing biofuels like corn-based ethanol as alternatives to oil. All they're really doing is driving up food prices and making global warming worse— and you're paying for it

Consumer Trust in the Food System

Summary Slides

October 2009

Thank You to the 2009 Consumer Trust Research Sponsors

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NATIONAL PORK PRODUCERS COUNCIL

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NATIONAL Turkey FEDERATION

Family Owned Since 1939
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Quantitative Research
Summary of Findings

Quantitative Methodology and Sample Design

- Respondents were recruited to participate in the study through Survey Sampling International's consumer Web panel
  - Survey Sampling International is a world leader in providing actively managed sample sources for Web-based surveys.
- Total of 2018 completed surveys (sampling error at 95% confidence level +/- 2.2%)
- The Web surveys averaged 25 minutes and data collection took place in August and September of 2009
- Split sample to accommodate the survey content

Respondent Profile

- 57% female and 43% male
- 72% were primary shoppers in the house
- ~87% shop once or twice per week
- Representative of the typical U.S. food shopper regarding:
  - education
  - income
  - political orientation
  - vegetarian practices
  - consumer advocacy

Concern About Issues

- Consumers were asked to indicate how concerned they were about several life and current event issues
- Used a 0 to 10 scale where “0” meant they had no concern about the issue and “10” meant they were very concerned about the issue:
  - 0 to 3 ratings indicate relatively low level of concern
  - 4 to 7 ratings indicate relatively ambivalent level of concern
  - 8 to 10 ratings indicate relatively strong level of concern
- **Highest concerns included** (based on mean scores):
  - The U.S. Economy (8.44)
  - Rising Energy Costs (8.29)
  - Rising Cost of Food (8.23)
  - Rising Health Care Costs (8.21)
  - Personal Financial Situation (8.04)
- **Lowest Concern** (based on mean scores):
  - Global Warming (6.05)

Mean Summary of Concerns About Issues

Issue	Mean
The U.S. Economy	8.44
Rising Energy Costs	8.29
Rising Cost of Food	8.23
Rising Health Care Costs	8.21
Personal Financial Situation	8.04
Food Safety	7.67
U.S. military involvement in Iraq and Afghanistan	7.22
Access to accurate information to make healthy food choices	6.60
Humane Treatment of Farm Animals	6.43
Obesity in America	6.37
Global Warming	6.05

(n=2066)

Consumer Trust in the Humane Treatment of Farm Animals

Consumers were asked to rate the following stakeholders on **COMPETENCE, CONFIDENCE, RESPONSIBILITY and TRUST** in the area of ensuring the humane treatment of farm animals.

Farmers/ Producers	Food Companies/ Processors	Grocery Stores	Restaurants	Federal Regulatory Agencies	State Regulatory Agencies	Advocacy Groups

Summary of Humane Treatment of Farm Animals Ratings

(0 to 10 Scale)

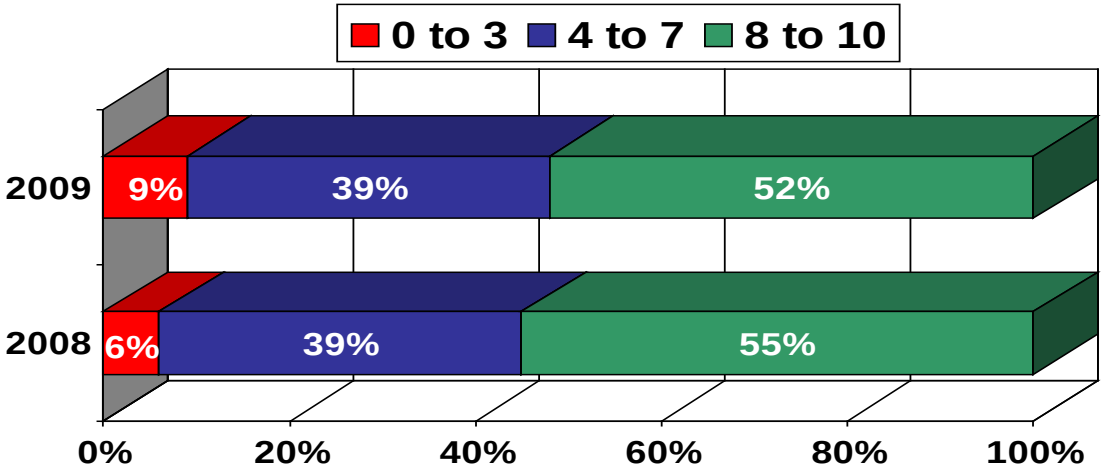
(n=1039)				
Segments	**Competence**	**Confidence**	**Trust**	**Responsibility***
Farmers/producers	6.78	6.46	6.41	39.07
Advocacy groups	5.67	5.51	5.22	9.72
State regulatory agencies	5.59	5.19	5.01	11.50
Federal regulatory agencies	5.56	5.17	4.98	13.22
Food companies/ processors	5.03	4.72	4.52	13.49
Grocery stores	4.95	4.86	4.73	7.23
Restaurants	4.76	4.72	4.54	5.77

*** 100 point allocation**

- Consumers hold farmers/producers primarily responsible for humane treatment of farm animals, but they lack confidence and trust in all groups to ensure it.

Farm Animal Welfare

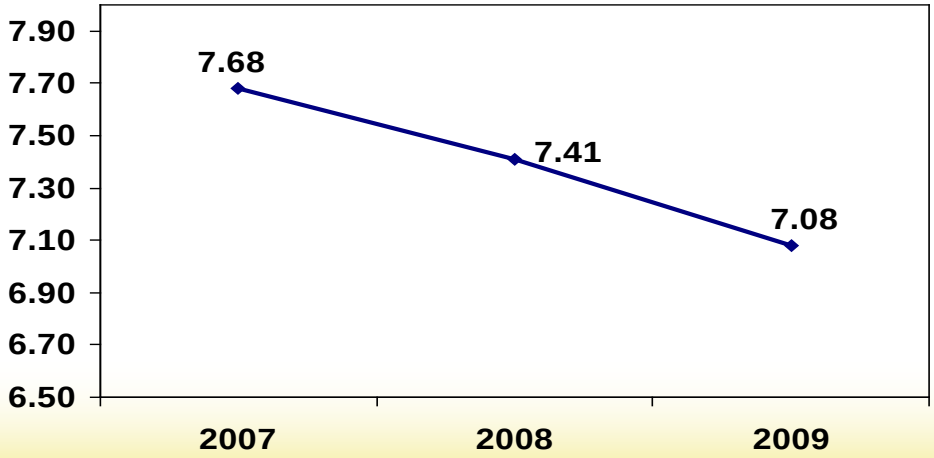
“If farm animals are treated decently and humanely, I have no problem consuming meat, milk and eggs.”



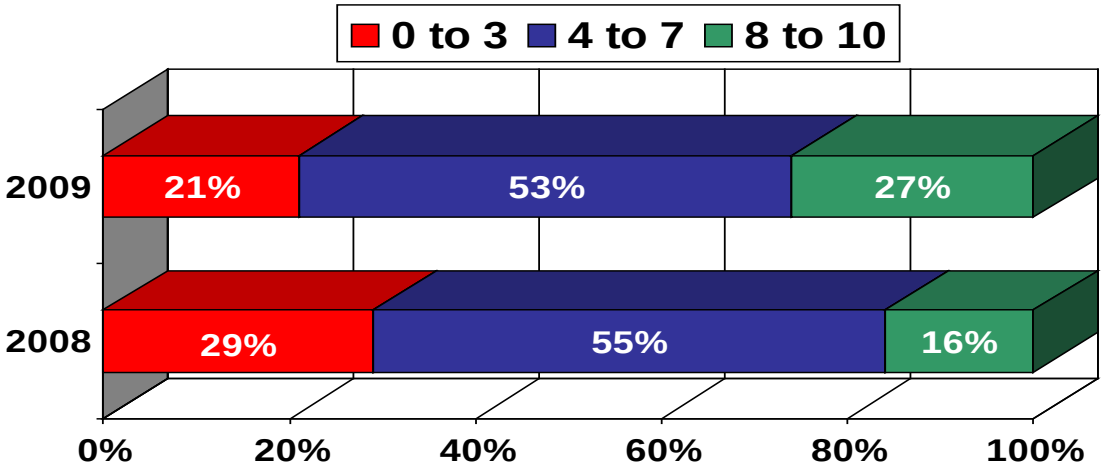
2009 Mean 7.08

2008 Mean 7.41

Three Year Mean



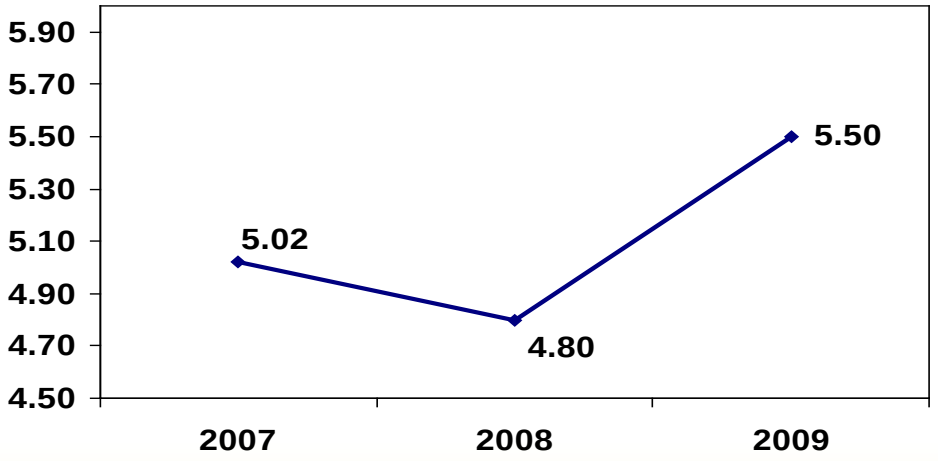
“U.S. meat is derived from humanely treated animals.”



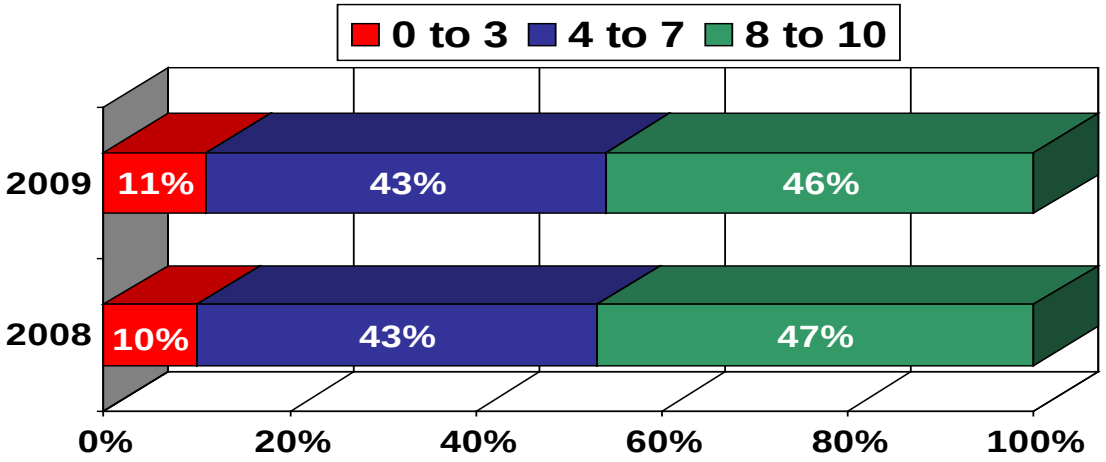
2009 Mean 5.50

2008 Mean 4.80

Three Year Mean



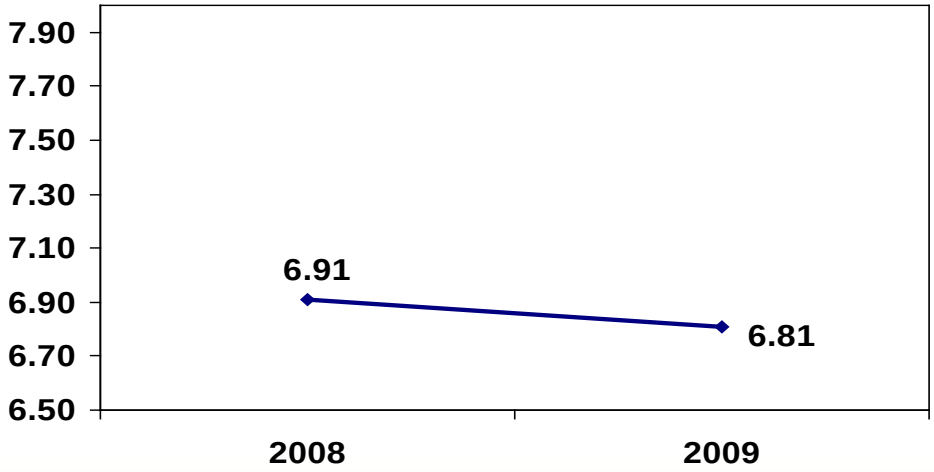
“I would support a law in my state to ensure the humane treatment of farm animals.”



2009 Mean 6.81

2008 Mean 6.91

Two Year Mean



The Center for Food Integrity

Building consumer trust and confidence in the contemporary U.S. food system

Charlie Arnot

Charlie.Arnot@FoodIntegrity.org

Panel: Trends in society and their impact on our future food-animal systems

Janet Riley
American Meat Institute

Social Trends and the Future of Animal Ag

Janet M. Riley
Senior Vice President
Public Affairs and Member Services

Americans and Food

- Less connected to ag
  - Fewer than five percent on farms
  - Separated by generations
- Unsure of where food comes from
- Have basic knowledge void that many will readily admit
- Knowledge void is an opportunity for industry – and activists

Social Media Trends

- Two-thirds (64%) of online Americans use social media
- Americans share updates about their life (43%), what they are currently doing (36%), and places they are going (31%),
- One-quarter express dissatisfaction with companies, brand or products (26%), talking about companies, brands or products they like (23%) or giving product reviews & recommendations (19%).
- More than one-third (38%) of Americans say they aim to influence others when expressing their preferences online and almost half (46%) feel the can be honest on the Internet.
- All age groups who use social media are equally likely to share their dissatisfaction with a company, brand or product via social media (25 to 30%)

Harris Interactive, 2010

Facebook vs. Twitter vs. Text

- 87 percent of Americans aware of Twitter
- 7 percent of Americans actually use Twitter
- 88 percent of Americans are aware of Facebook
- 41 percent use Facebook
- Teens average 2,900 texts per month
- 65 percent of adults send and receive texts
- Americans texting exceeds cell phone use

Edison Research/Arbitron, 2010
Pew Internet and American Life Project

What's the real significance of these trends?

"A lie gets halfway around the world before the truth has a chance to get its pants on."

– **Winston Churchill**

Impact

- Shorter attention spans
- Seeking easy answers and instant-gratification
- Reduced social skills
- Reduced critical thinking

Source: Comments by Dr. Susan Greenfield, Oxford University, in the Daily Mail

Cultural Trends

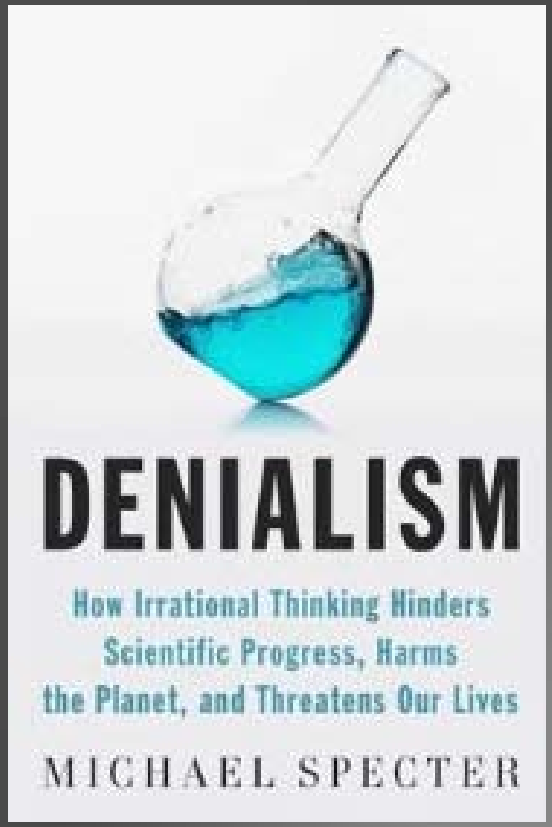
- Very few boundaries in the social media world
- Constant “connection” in virtual fashion through texting and social utilities Math and science weak relative to other nations
- Young people taking the big idea over the details
- Gaming, YouTube means visually focused

News Media

- Less specialization/more generalization
  - Murder and Mustard
- Many don't have time for the background interview
- More commentary/POV reporting
- Shorter soundbites – eight seconds
- Endless deadlines, instant reporting
- More liberal than conservative and much more liberal than their readers/viewers (Pew Center 2006)

Michael Specter, *Denialism*

- Documents fear and distrust
- Feelings over facts
- “People wrap themselves in their beliefs so tightly that you can’t set them free. Even the facts will not set them free.”



Declining Trust

- Do you believe most Americans can be trusted or you can't be too careful in dealing with people?
- 1960: 60 percent trust most people
- 1970s: below 50 percent
- 1990: 40 percent trust most people
- 2006: just 32 percent trust most people

Source: *True Enough*, by Farhad Manjoo

Why do people trust each other less?

- Interact less with one another
- Watch TV more and reality is distorted
- Many feel that those in whom they've placed trust – corporations, churches and government – have proved unworthy
- Shifting from generalized trust (trust of people broadly) to particularized trust (where we only trust people like ourselves. Particularized destroys generalized.

Source: *True Enough*, by Farhad Manjoo

“Truthiness”

- Coined by Stephen Colbert to describe the reality that people choose to accept
- Could be Keith Olbermann reality, Lou Dobbs reality or Bill O’Reilly reality
- Continually reinforce our own reality and choose to trust it and distrust others

Films

- Supersize Me
- Fast Food Nation
- Food Inc.
- Lovemeatender – to come!
- American Meat – to come!

Books

- *Fast Food Nation (Chew on This)*
- *Omnivore's Dilemma*
- *Eating Animals*
- *Omnivore's Dilemma (And the Youth edition)*
- *Food Rules*

Even if you don't read the book, you likely will read stories about the book or hear the author on TV or radio.

Who do food activists want Americans to believe we are?

Local Hero Joel Salatin

- Polyface Farms
- Dressed like Huck Finn
- Open farm with tours
- Back to basics
- Warns against big industry, technology, fear of the future

Eric Schlosser and Michael Pollan

- Books and films are penetrating schools
- Project a common man image
- Argue for slow food, local food, organic food
- Criticize what they believe to be lack of transparency in food industry
- Market food nostalgia

Top Myths

% Strongly/Somewhat Agree	
Hormone use in poultry production is a health concern	65%
Eating too much red meat can increase the risk of heart disease because it contains saturated fat	64%
Hormone use in beef production is a health concern	64%
Americans today are eating more meat and poultry; more than the 5 to 7 ounces recommended for adults each day	64%
Hormone use in pork production is a health concern	60%
Antibiotic use in livestock production is a health and safety concern for meat and poultry consumers	60%
Antibiotics use in livestock production is increasing	58%

Opinions, Voids and Opportunities

- Lots of opinions
- Lots of “I just don’t know”
- Problem will worsen as we become less connected to agriculture
- When there is a knowledge void, we have an opportunity
- Void can be filled with correct or incorrect information

Strategic Imperatives

- Connect in ways that are *meaningful*
  - *Enter their world*
  - *Bring them into yours*
- ***Communicate shared values in a world that trusts less***
- ***Consider strategies to increase transparency***
  - *Chris Chinn videos*
- ***Be ready to communicate rapidly and concisely***
- ***Think, speak and communicate visually***

Thank you!

Panel: Trends in society and their impact on our future food-animal systems

Jay Vroom
CropLife America

Trends in Society and Their Impact on our Future Food-Animal Systems

June 8, 2010

Jay Vroom
President and CEO
CropLife America
Washington, DC

21st Century Problems

- Increasing Population
- Improved Nutrition in China and India
- Water Shortage
- Global meat demand is projected to double by 2050

CropLife AMERICA

Technology is Crucial

The United Nations predicts world population will exceed ***9 billion*** by mid-century and has called for a ***100 percent increase*** in world food production by ***2050***.

World Population Prospects: The 2006 Revision. 2007. United Nations Population Division, New York.

Technology is Crucial

70 percent of the world's additional food needs can be ***produced only with new and existing*** agricultural technologies.

United Nations FAO, 2002

The Dynamic Face of Agriculture

Modern Agriculture

- Organic Agriculture
  - All-Natural
- No-Till Farming
  - Locally Grown
  - Fair Trade
- Integrated Pest Management
  - Hormone-Free

Responsible Food Production

Smart Use

- Precise application and fewer inputs

Better Results

- Increased productivity and higher yields

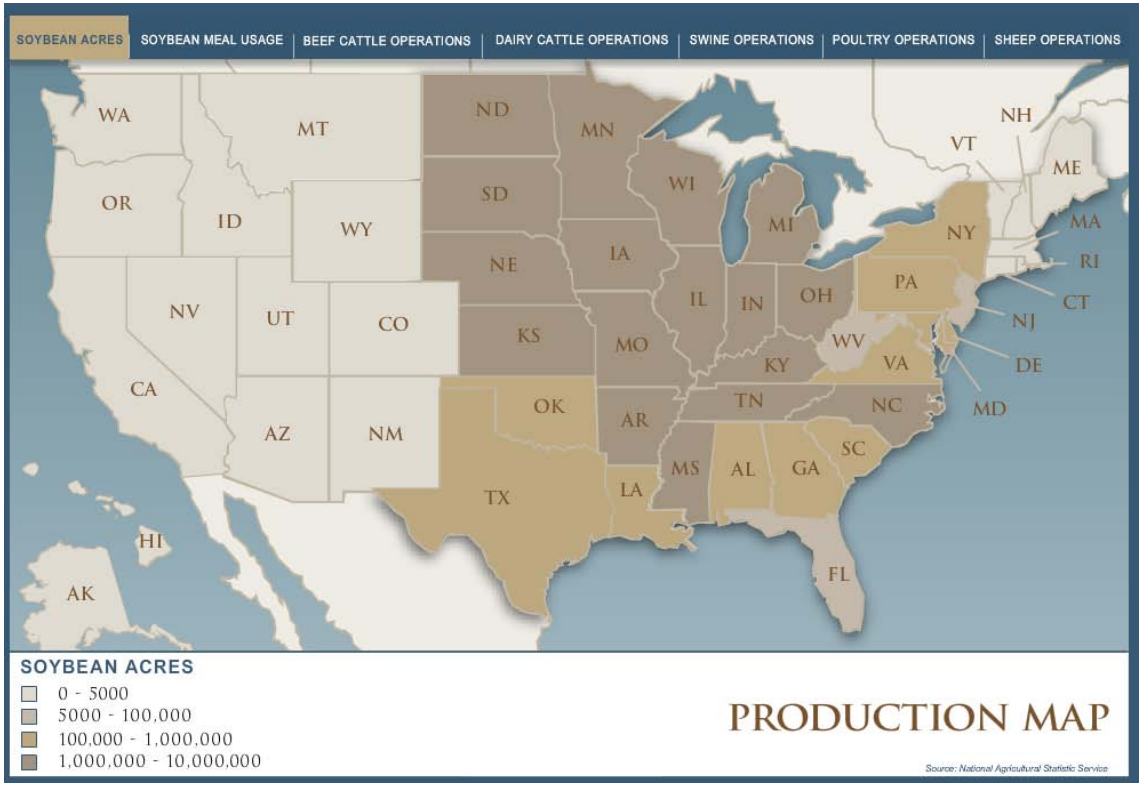
Affordable Products

- Affordable supply of nutritious food and produce

CropLife ☆AMERICA☆

A Synergistic Relationship

Soybeans and Livestock



Source: United Soybean Board

Value of Crop Production in 2009

- Field and Miscellaneous crops, $128 billion
- Fruit and Nut crops, $17 billion
- Vegetables, $ 12.5 billion
- Total all crops, $157.5 billion

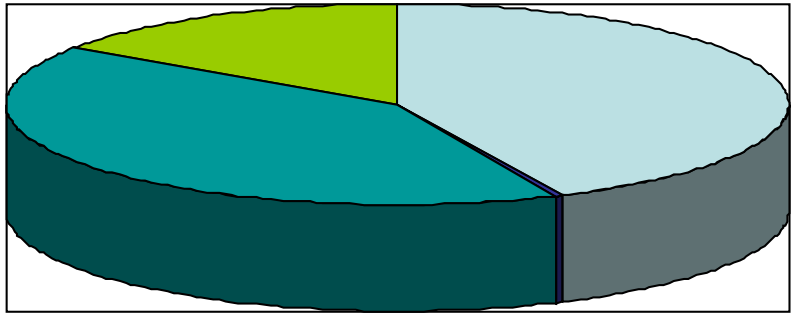
($168 billion in 2008)

USDA, ERS

Grains to Feed: Livestock and Poultry #1 Customer

2008/2009

- **Feed 43.2%**
- **Seed .3%**
- **Food & Fuel 41%**
- **Exports 15.5%**

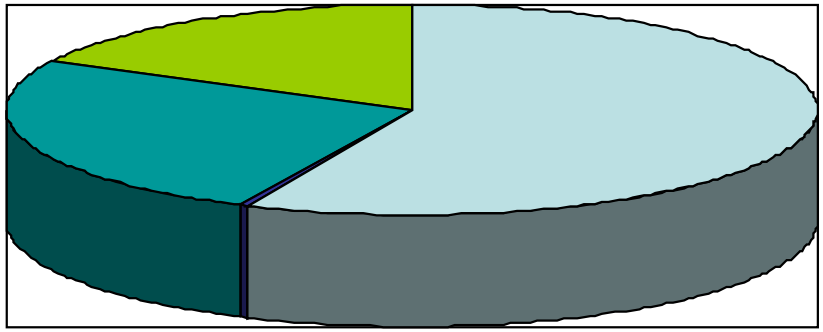


Source: USDA, World Agricultural Outlook Board: World Agricultural Supply and Demand Estimates, 6/3/2010.

Grains to Feed: Livestock and Poultry #1 Customer

2004/2005

- **Feed 51.7%**
- **Seed .3%**
- **Food & Fuel 23.2%**
- **Exports 16.0%**



Source: USDA, World Agricultural Outlook Board: World Agricultural Supply and Demand Estimates, 6/3/2010.

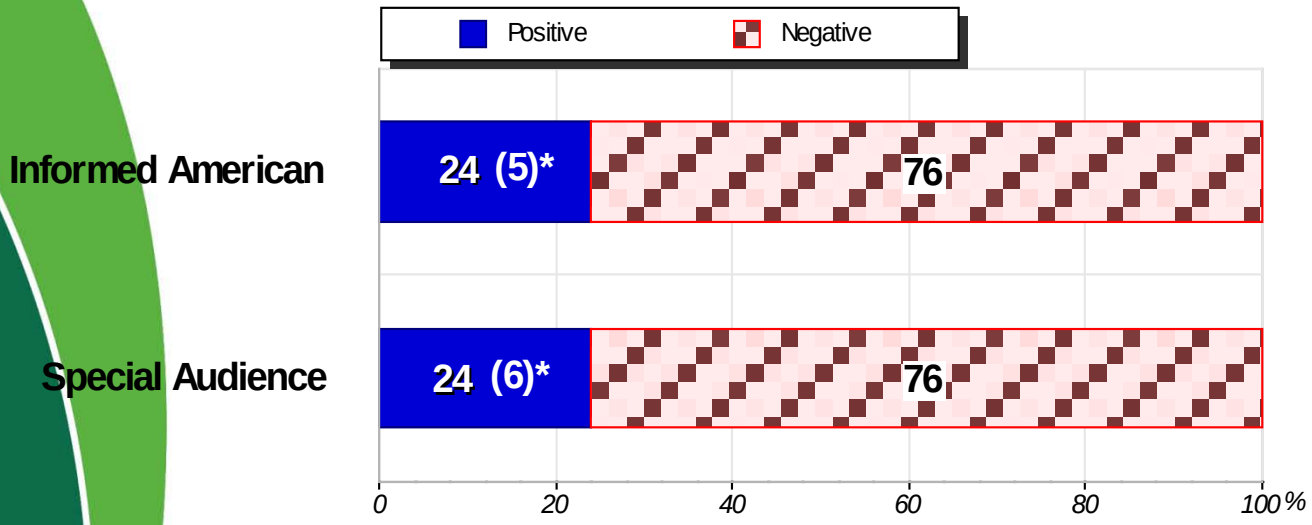
What are the Trends in Society?

Charlton Research Survey

- Web survey of 85 questions over 25 minutes to 1300 adults nationwide
- 800 Informed Americans
- 500 Special Audience
  - Policy Leaders
  - Health Experts
  - Scientists

The Words are Key

Strong negative response to the word **“pesticides”**



Top Responses - those Positive:
Kills bugs, insects, pests/Insect free
Necessary/Increase production/Protects crops/food
Safety Issues/Should be used properly

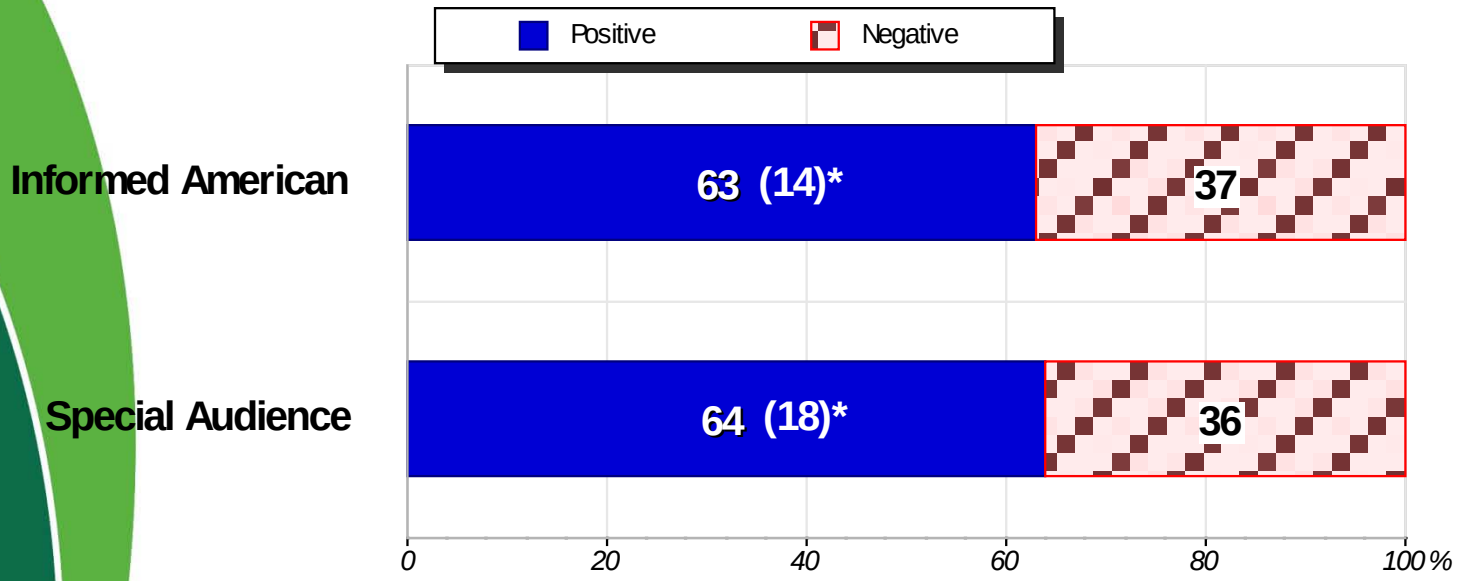
Top Responses - those Negative:
Poison/Poisonous/ Toxic
Harmful/Dangerous/Bad
Chemicals
Disease/Illness/Not healthy
Cancer
DDT

** Indicates % very positive*

Source: Charlton Research

The Words are Key

Audiences more receptive to **“crop protection”**



Top Responses - those Positive:

Prevents damage to crops/Protection from disease, pests or harmful substances
No pesticide/No chemicals/No poison/Natural/Organic
Safety/Security

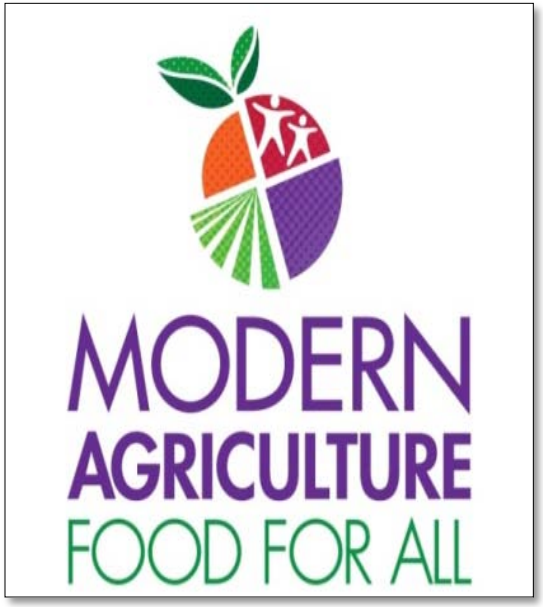
Top Responses - those Negative:

Insecticides/Herbicides/Chemical spray/Pesticides
Government Control/Subsidies/Protection
Chemical Use

** Indicates % very positive*

Source: Charlton Research

Key Findings: Promote Modern Agriculture



CropLife America is leading a major initiative to encourage the widespread adoption of the term "modern agriculture" when describing the wide majority of positive and beneficial production practices employed by America's farmers.

Attitudes Change Based on Facts

- Gaining trust from the consumers and thought leaders
  - Before messaging discussion, 55% of informed Americans and 61% of special audience “favored” use of pesticides in agriculture
  - After messaging discussion, 81% of informed Americans and 78% of special audience “favored” use of pesticides in agriculture

Key Findings: Four Effective Messages

 # 1 Crop Protection = Greater Yields and Quality

 # 2 Crop Protection = Highly Regulated

 # 3 Crop Protection = Research and Innovation

 # 4 Crop Protection = Careful Stewardship

Key Findings: Most Effective Messaging

Message #1

The agricultural input industry, by supplying farmers with important and necessary crop inputs, is committed to helping produce an affordable and sustainable supply of food to help feed a hungry world.

Crop Protection =

Greater Yields and Quality

Key Findings: Most Effective Messaging

Message #2

The agricultural input industry works closely with government agencies and other organizations to ensure that farmers have access to the technologies required to support modern and safe agricultural practices.

Crop Protection =

Highly Regulated

Key Findings: Most Effective Messaging

Message #3

Constant innovations in the development of agricultural inputs and farming practices provide growers with the tools that they need to reduce their environmental footprint and to make farming more sustainable.

Crop Protection =

Research and Innovation

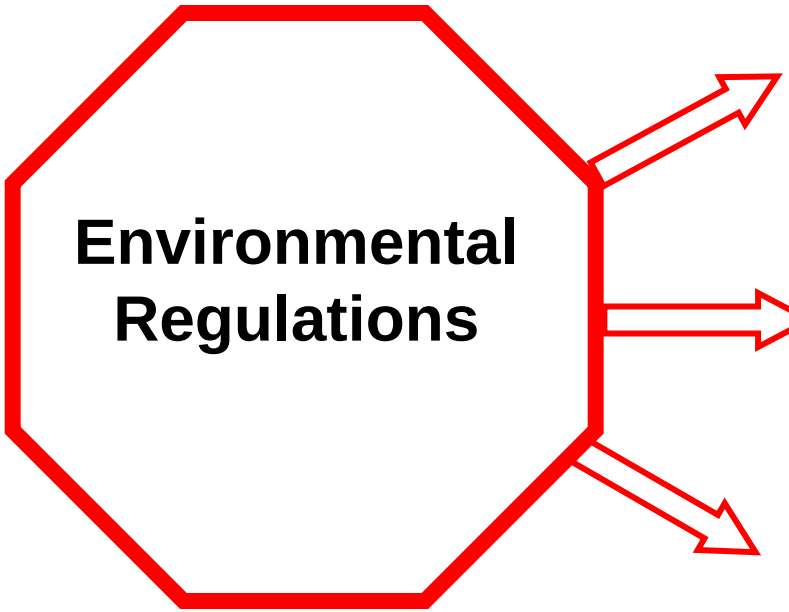
Key Findings: Most Effective Messaging

Message #4

The modern agricultural practices adopted by today's farmers ensure that all inputs are used with care and only when required.

Crop Protection = Careful Stewardship

Crop Protection Regulations: Impacting Livestock



Clean Air

Clean Water

Eco-Risk

Endangered Species

Endocrine Disruption

Spray Drift

Law Suits

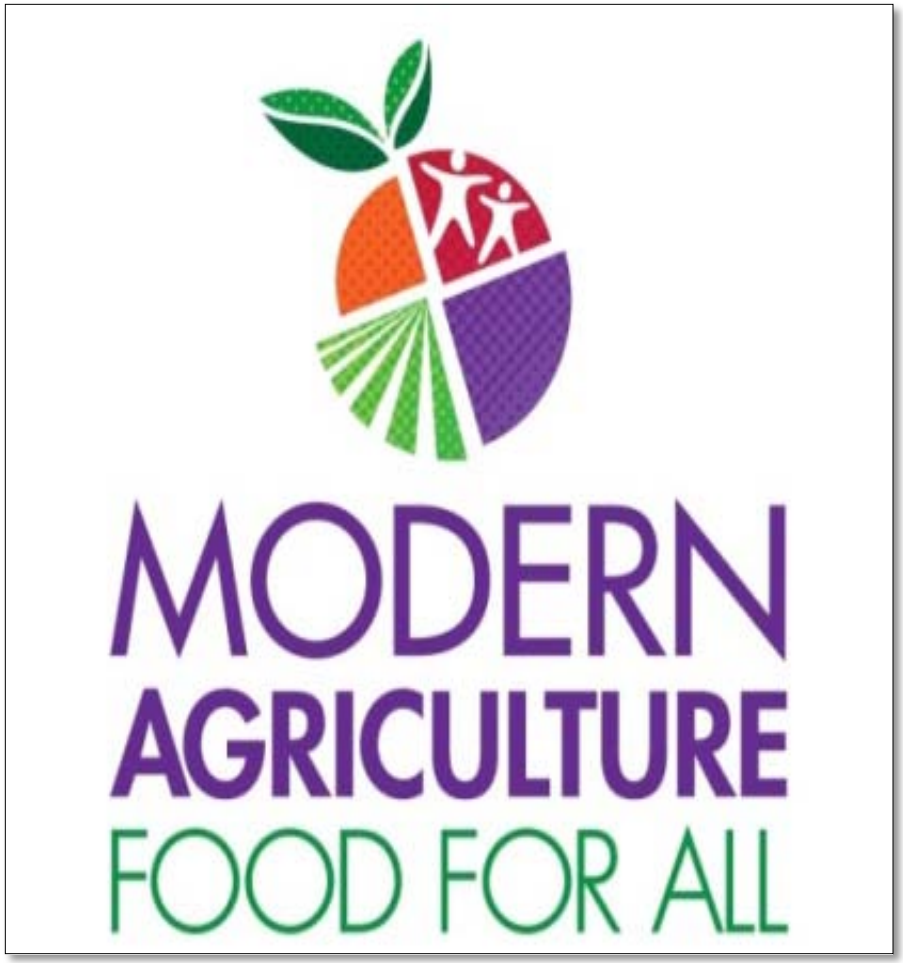
CropLife ☆AMERICA☆

Meeting the Regulatory Challenges

Comprehensively Addressing Environmental Issues:

- Clean Water
- Clean Air
- Spray Drift & Volatile Organic Emissions
- Ecological Risk Assessment
- Endangered Species

Future Food Systems through Modern Agriculture



CropLife AMERICA

More information

Jay Vroom
President and CEO
CropLife America

www.croplifeamerica.org

www.croplifefoundation.org

Follow us on Twitter!

http://twitter.com/croplifeamerica

Ethical and practical implications of food-animal agriculture

Paul Thompson
Michigan State University

Ethical and Practical Implications of Food Animal Agriculture

Paul B. Thompson

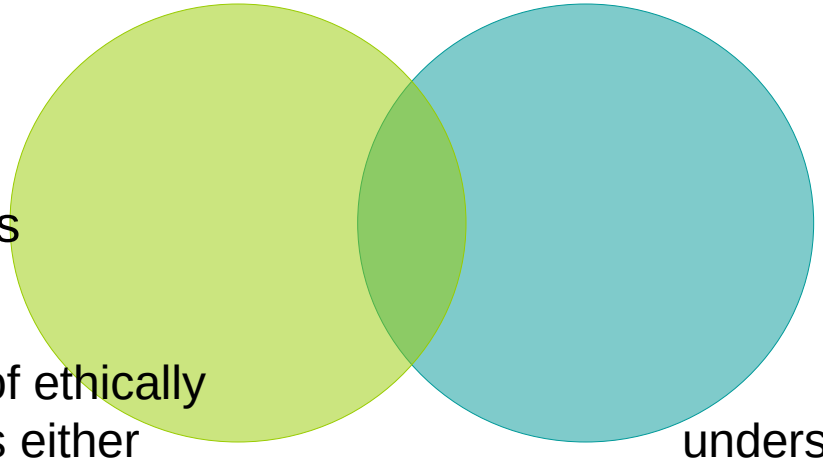
W.K. Kellogg Professor

of Agricultural, Food and Community Ethics

Michigan State University, East Lansing USA

What is (Agri)Food Ethics?

Practical Food Ethics



Critical Food Ethics

The pursuit of ethically justified ends either through the purchase and consumption of food or through political influence on food and farm policy.

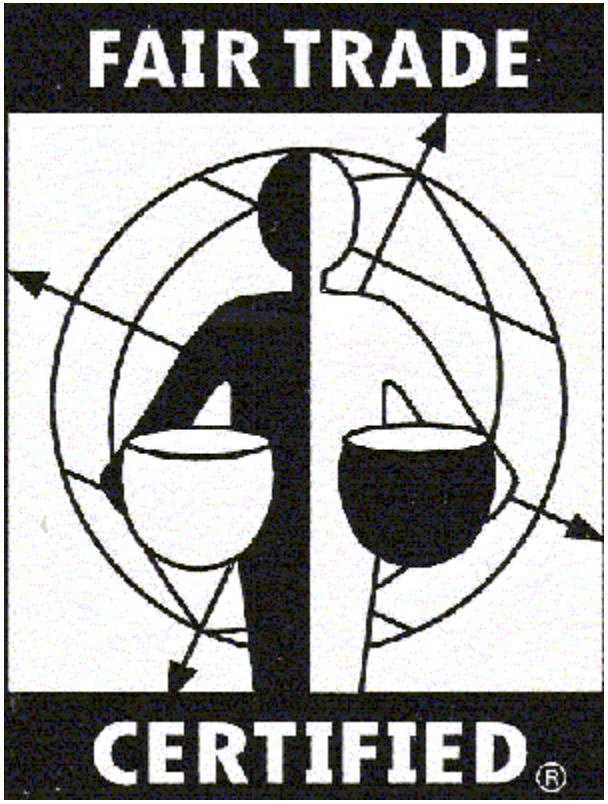
Attempts to understand, analyze and discuss the legitimate ends and structure of the agrifood system.

What is (Agri)Food Ethics?

Practical Food Ethics

Critical Food Ethics

Practical Food Ethics



- Various civil society and for profit groups have developed marketing arrangements that return a higher share of the purchase price to small farmers and farm labor.

Practical Food Ethics

- Regulatory and consumer-based efforts to ensure or improve humane treatment of farm animals

Practical Food Ethics

- Ethical vegetarianism and veganism
  - Eliminate consumption of animals and of animal proteins

Practical Food Ethics

- The Rise of Organic Markets
  - An international phenomenon arising out of several distinct philosophical and historical orientations
  - Moving rapidly toward relatively consistent standards

Practical Food Ethics

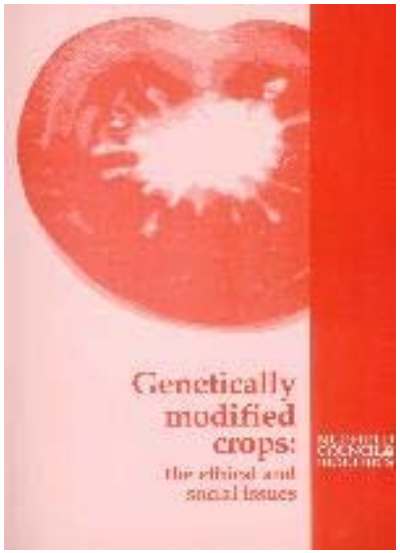
- "Eat Local"
  - Reduce environmental impacts from transport and storage of foods
  - Support local community development and sense of place
  - Connect to farmers

Critical Food Ethics

- Food and Agricultural Organization of the United Nations
  - FAO Ethics Papers
  - FAO Readings in Ethics

Critical Food Ethics

- National bioethics committees that have taken an interest in food
  - European Group on Ethics report on animal cloning for food: 16 January 2008



Critical Food Ethics

Professional organizations such as the European Society for Agriculture and Food Ethics (EURSAFE) and the Agriculture, Food and Human Values Society

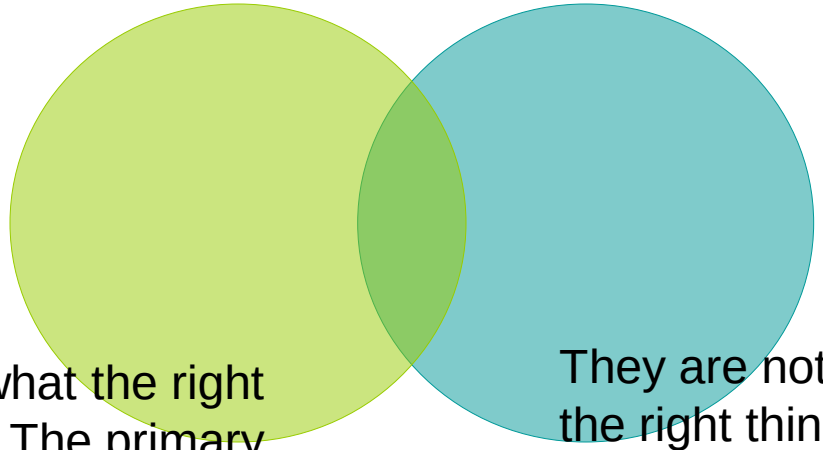
http://www.eursafe.org/

Agriculture, Food, & Human Values

http://www.afhvs.org/

What is Food Ethics?

Practical Food Ethics

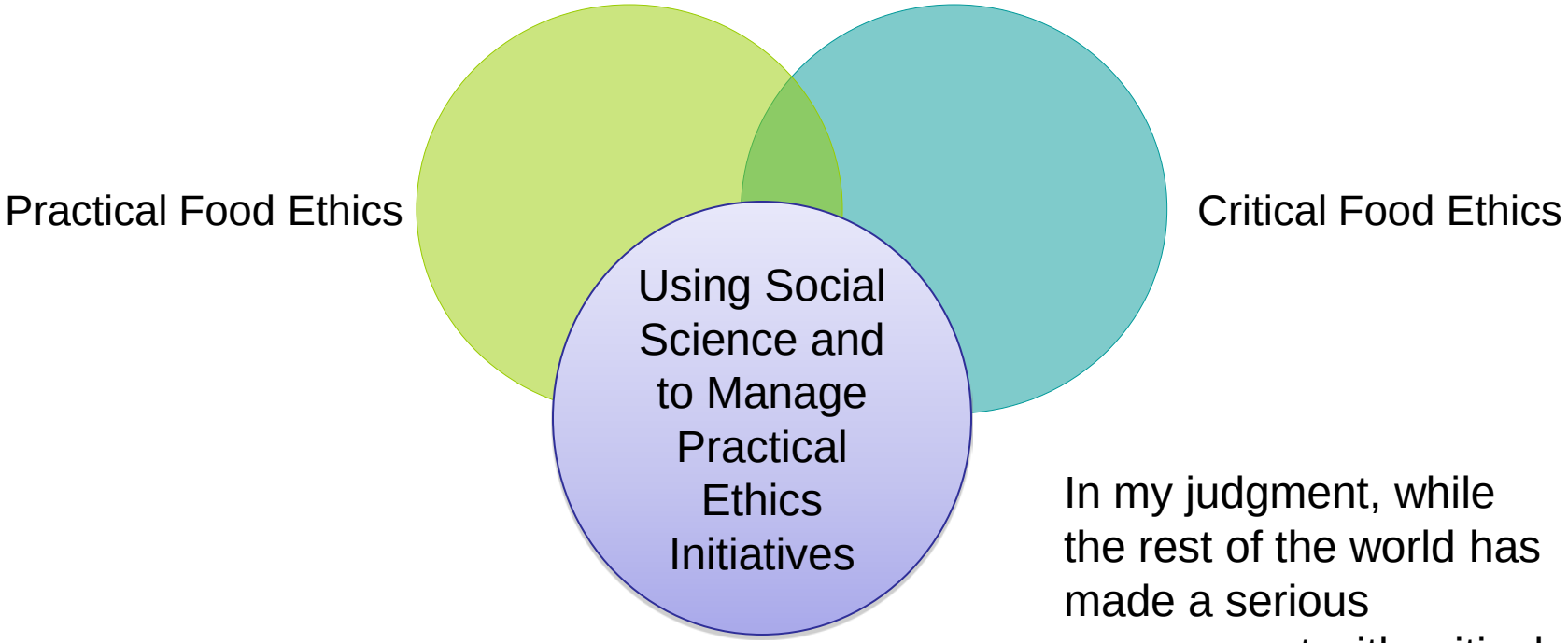


Critical Food Ethics

They know what the right thing to do is. The primary focus is on strategy and actions that can be taken to actually do it.

They are not at all sure what the right thing to do is. The focus is on deliberation, inquiry and discourse to discover it.

What is NOT Food Ethics?



In my judgment, while the rest of the world has made a serious engagement with critical ethics, the U.S. has not.

Questions and Strategy for Critical Food Ethics

Industrial Philosophy of Agriculture

- Agriculture is just another sector in the industrial economy.
- Norms for performance are just like those in any sector of an industrial economy.
- Be efficient.
- Internalize costs.

Be efficient

- Produce commodity goods in a manner consistent with the utilitarian maxim:
- Action should achieve “the greatest good for the greatest number”

Be efficient

- Produce commodity goods in a manner consistent with the utilitarian maxim:
- Action should achieve “the greatest good for the greatest number”
- Reducing people employed in agriculture means they are freed for other pursuits.

Be efficient

- Produce commodity goods in a manner consistent with the utilitarian maxim:
- Action should achieve “the greatest good for the greatest number”
- Lowering the costs of food and fiber means resources can be spent on other (more) things.

Be efficient

- Produce commodity goods in a manner consistent with the utilitarian maxim:
- Action should achieve “the greatest good for the greatest number”
- Cheaper food benefits the poor more than the rich because the poor spend more of their income on food.

Be efficient

- Produce commodity goods in a manner consistent with the utilitarian maxim:
- Action should achieve “the greatest good for the greatest number”
- BUT: Efficiency has social costs. With fewer farmers, people must migrate to other jobs, other places.

Be efficient

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But this ethical logic of justification operates within assumed ethical constraints.

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Internalize costs

- Efficiency is always achieved with reference to background rules and regulations that frame the trade-offs people are willing to make.
- Secure property rights.
- Personal protection from harm and threat.
- Basic liberties: free speech, assembly and liberty of conscience.

Internalize costs

- Efficiency is always achieved with re
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Industrial practices that impose cost on others without their consent do not reflect the “true cost” and putative efficiencies are misleading.

Therefore the legitimacy of an efficiency claim depends on the legitimacy and completeness of the background rules and regulations.

The background rules and regulations must reflect and assure the protection of key moral rights.

For Example…

- Chemical pesticides…
  - Lower overall production, storage and processing costs

A Good Thing

  - Impose health costs on farm workers and on vulnerable consumers (children, immune deficient

A Violation of their Rights

Lower prices due to chemical pesticides do not represent true efficiencies until rights respected (or costs are Included in the calculation).

In fact, it provides one sketch of the work that needs to be done in critical food ethics.

In fact, it provides one sketch of the work that needs to be done in critical food ethics.

Have existing agricultural production systems lived up to the norms and ideals of the industrial philosophy?

In fact, it provides one sketch of the work that needs to be done in critical food ethics.

Have the poor benefited from efficiencies?

Does our system of rules and regulations protect us from imposed costs?

What about future generations and distant peoples?

And it provides an ethical strategy for asking new questions:

How should we include animals when think about imposing costs on others?

Is it useful to think of biodiversity or ecosystems as having rights or intrinsic value?

Agrarian Philosophy of Agriculture

- Farming and foodways draw upon regionally unique aspects of climate, soil and habitat.
- They play a critical role in fixing or determining the moral identity of a people.

Agrarian Philosophy of Agriculture

Agriculture is *NOT* just another sector of the industrial economy!

Food and farming demand a type of moral consideration unto their own kind.

Agrarian Philosophy of Agriculture

1. Associated values of communal spirit, place prosperity and social capital…
2. The i… the loss o… ity and the co…
3. An er… nded in cou… ecosystems…

A story that is too long and too complex for the present context… Articulating and reconstructing the potential contributions of an agrarian vision is not something that can be done in a 30 minute presentation.

Industrial vs. Agrarian

- Costs and benefits
- Rights and duties

- Conduct & Character
- Community Identity

Ethical issues can be identified, specified and debated *within* each of these approaches, or *between* these approaches.

Industrial vs. Agrarian

- Costs and benefits
- Rights and duties

- Conduct & Character
- Community Identity

A ust live up
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This approach has been short circuited by analysts who treat critique as an expression of taste.

Agriculture
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This approach has been thoroughly marginalized in the U.S. public sphere.

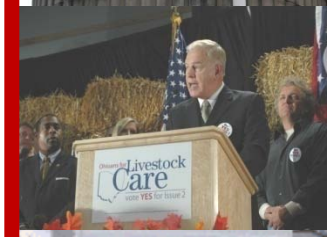
Contemporary farmers, agricultural scientists and ag leaders are caught in the tension between these sometimes incompatible visions.

thomp649@msu.edu

Panel:
How can we move forward? The need for a collaborative vision

Jack Fisher
Ohio Farm Bureau

Ohioans for Livestock Care



OHIO FARM BUREAU

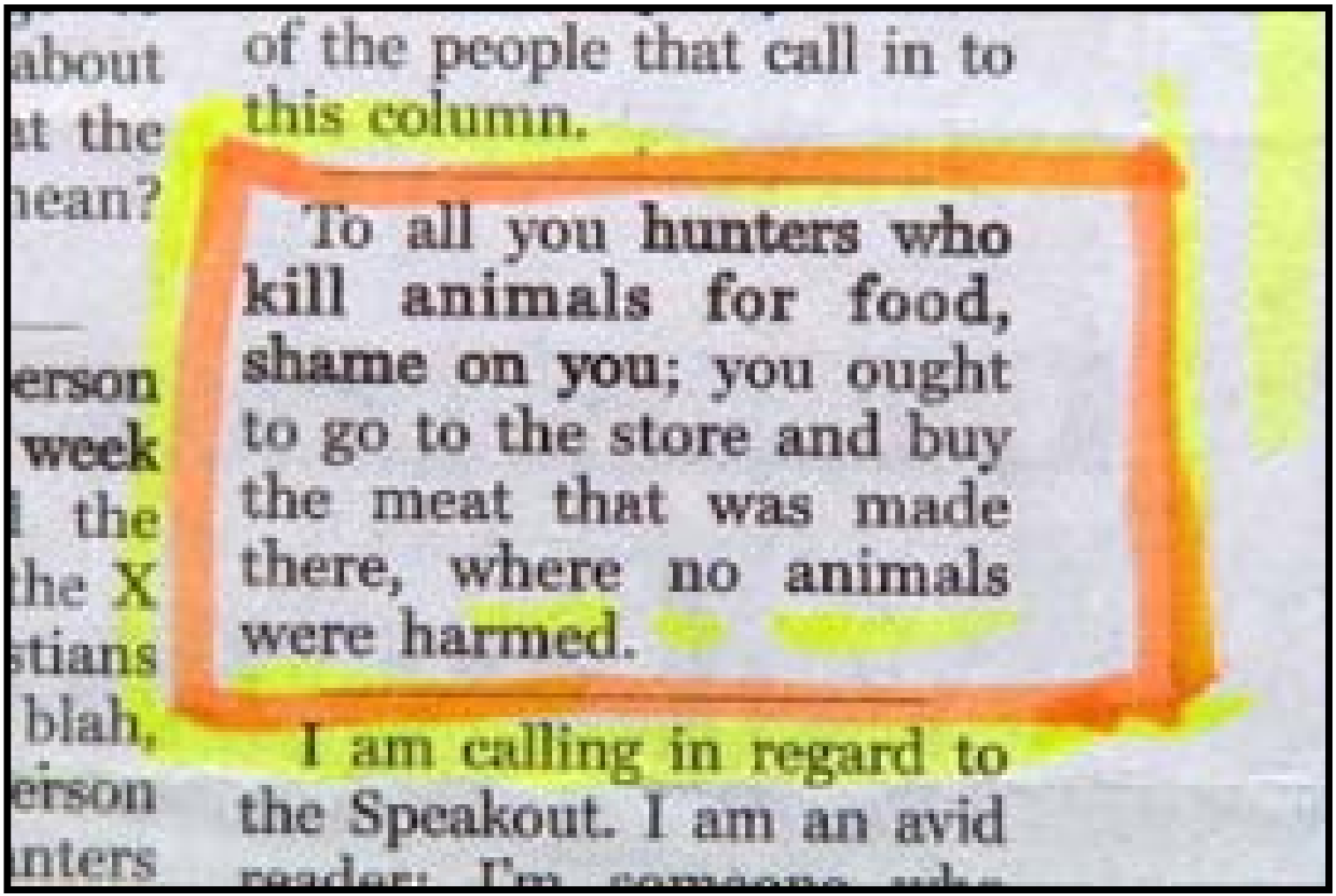
John C. “Jack” Fisher
Executive Vice President
Ohio Farm Bureau Federation

OHIO FARM BUREAU®

"All business in a democratic society begins with public permission and exists by public approval."

~ Arthur W. Page

Challenges with the Public



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of the people that call in to this column.

To all you **hunters who kill animals for food, shame on you**; you ought to go to the store and buy the meat that was made there, where no animals were harmed.

I am calling in regard to the Speakout. I am an avid

Predictable Behaviors by the Public

- Like to make own choices
- Don’t like to be ‘put at risk’
- Believe anecdotes over statistics
- Look for impact on themselves
- Distrust industry & government
- Trust farmers

The Plan: A *Proactive* Approach

- **Ohio Farm Bureau Federation**
- 6 major Ohio farm groups
- Form Ohioans for Livestock Care Corp./PAC
- Paid media
- Social media
- Earned media
- Fundraising strategy
- Coalition building
- Accounting and legal support
- National model

Ohioans for Livestock Care

Ohio Soybean Association
– President
Ohio Corn Growers
– Secretary
Ohio Farm Bureau Federation
– Treasurer
Ohio Pork Producers
Ohio Poultry Association
Ohio Cattleman Association
Ohio Dairy Producers Assoc.


50,000
signs!!!
Over 100 billboards
YES
FOR
ISSUE
2
Safe, Local Food.
Excellent Animal Care.

Allies and Supporters

- **Bi- Partisan Support**
- **Over 500 community and state leaders**
- **Ohio Republican and Democratic Parties**

Catholic Conference of Ohio

OVMA

OHIO ASSOCIATION OF Second HARVEST FOODBANKS

88 CCAO County Commissioners' Association of Ohio

OHIO RESTAURANT ASSOCIATION

OHIO CHAMBER OF COMMERCE

AMERICAN HUMANE
Protecting Children & Animals Since 1877

November 3: Victory!

Margin: 64% to 36%

40% Voter Turnout

87 of 88 counties

Only 13 counties w/ less than 60%

Only 2 counties w/ less than 55%

Only 1 county w/ less than 50%

Won all major urban counties

The Board

- **The Governor appointed 10 Ohioans**
  - ✓ One family farmer
  - ✓ Two veterinarians (including the state vet)
  - ✓ One food safety expert
  - ✓ One local Humane Society representative
  - ✓ Two representatives of state farm organizations
  - ✓ One dean of an Ohio college of agriculture
  - ✓ Two Ohio consumers

- **The Speaker of the House and President of the Senate each named a farmer** (11-12)

- **Director of Ohio Department of Agriculture is a member and chair of the Board**

What the Board Does

<u>Set standards</u> for the care and well-being of livestock and poultry in Ohio:

- **Maintain food safety**
  - ✓ **Protect locally grown and raised food**
  - ✓ **Make decisions based on fact, science and data**

In setting standards, they must consider…..

- **Overall animal health**
- **On-farm biosecurity**
- **Animal disease prevention**
- **Food safety**
- **Affordability of food supplies**
- **Best farm management practices**
- **Animal morbidity /mortality data**

THE HUMANE SOCIETY
OF THE UNITED STATES

Mission Statement:

Celebrating Animals, Confronting Cruelty

Seven Out of Ten Americans Wrongly Believe that HSUS is a Pet-Shelter "Umbrella Group“

(Nationwide Poll conducted by Opinion Research Corp.)

“We would be foolish and silly not to unite with people in the public health sector, the environmental community, [and] unions, to try to challenge corporate agriculture.”

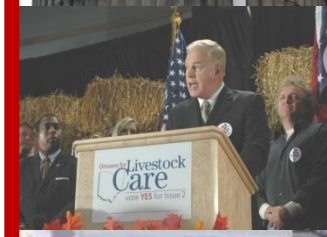
Wayne Pacelle, President & CEO of HSUS

2010: Here They Come Again

- HSUS has proposed their own measure
- Petition language has been certified and signatures are being gathered
- 402,275 signatures are needed by 6/30
- November 2010 ballot—a big year
- Ohioans for Humane Farms
- Farmer endorsement request letter

Ohioans for Livestock Care

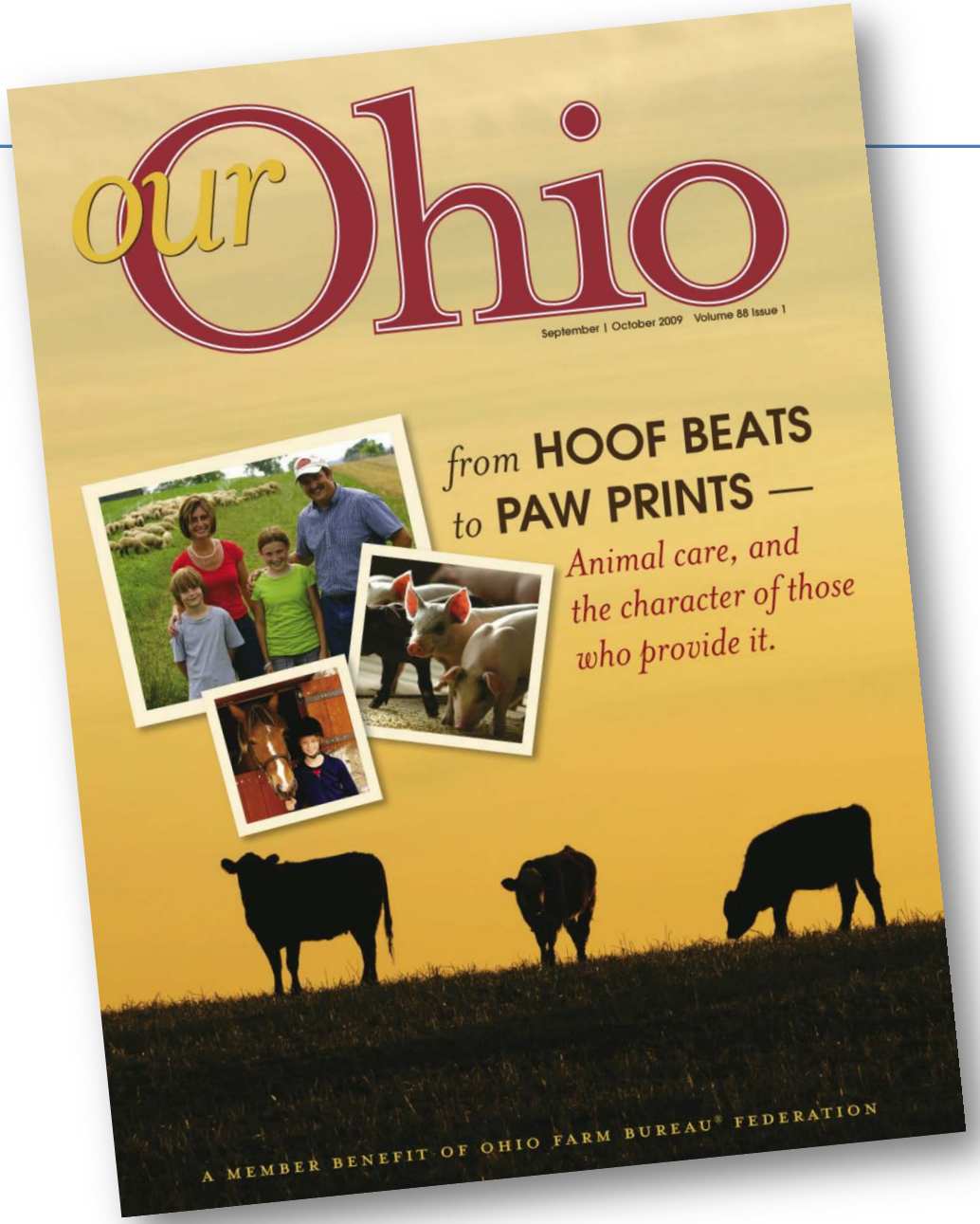
OHIO FARM BUREAU



Lessons Learned

- Ag-Team Unity and Coordination - Don't have threatened species run the campaign
- Share what we know and tear down the walls
- Farmers must "own" the animal welfare issue
- Stop the bad actions
- Get in front of the issue
- Much more on-line engagement (social media)
- Don't approach on state-by-state basis

OHIO FARM BUREAU®

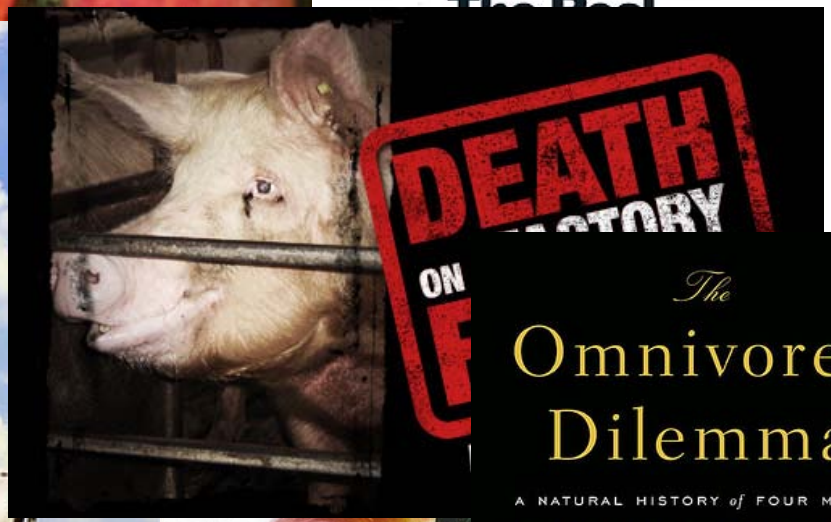


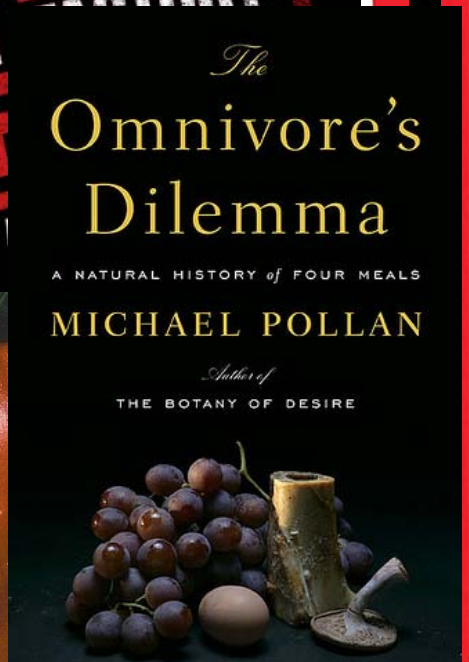

RECALL

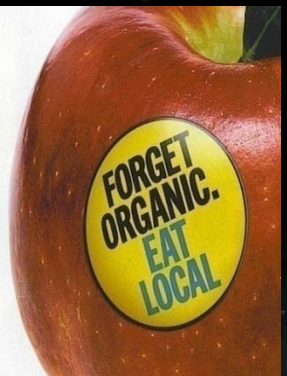

Goldman's Blankfein On Why They've Done Nothing Wrong
Joe Klein Takes On the GOP's Scare Tactics
No Laughing Matter: Comedy in The Age of Obama
TIME
WARNING: This hamburger may be hazardous to your health. Why the American food system is bad for our bodies, our economy and our environment—and what some visionaries are trying to do about it.


Newsweek
FEAR
& THE FLU
THE NEW AGE OF PANDEMICS
BY LAURIE GARRETT


YOU'LL NEVER LOOK AT DINNER THE SAME WAY
FOOD, INC.


DEATH


The
Omnivore's Dilemma
A NATURAL HISTORY of FOUR MEALS
MICHAEL POLLAN
Author of
THE BOTANY OF DESIRE

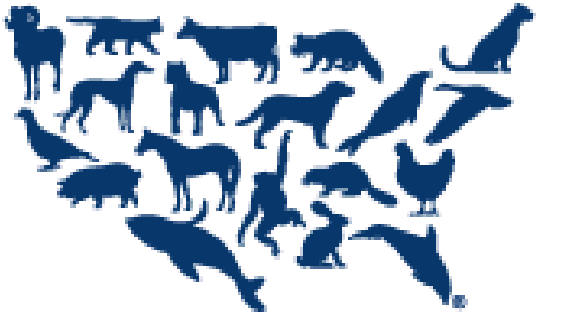

FORGET ORGANIC. EAT LOCAL


Joe Klein: How Al Gore Could Save The Democrats
Hillary Clinton On Why She Won't Quit
R.E.M. Rises from The Dead
TIME
The Clean Energy Myth
BY MICHAEL GRUNWALD
Politicians and Big Business are pushing biofuels like corn-based ethanol as alternatives to oil. All they're really doing is driving up food prices and making global warming worse—and you're paying for it

Center for Food and Animal Issues


API
ANIMAL PROTECTION INSTITUTE


PETA
PEOPLE FOR THE ETHICAL
TREATMENT OF ANIMALS


THE HUMANE SOCIETY
OF THE UNITED STATES


Farm Animal Reform Movement
FARM

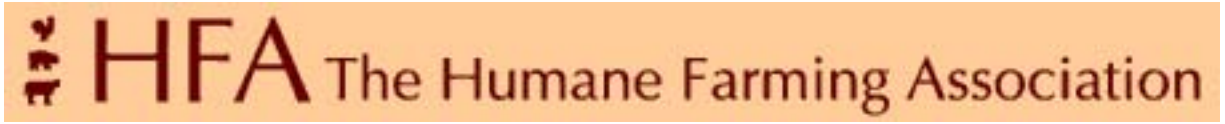

MERCY FOR
ANIMALS


AMERICAN HUMANE
Protecting Children & Animals Since 1877


Friends of Animals


ASPCA
THE AMERICAN SOCIETY FOR THE
PREVENTION OF CRUELTY TO ANIMALS

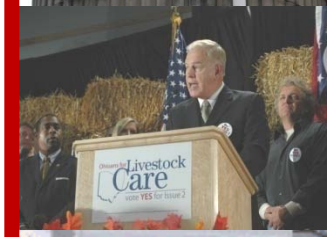

Animal Legal
Defense Fund


THE HFA The Humane Farming Association


farmsanctuary
rescue • education • advocacy

Ohioans for Livestock Care

OHIO FARM BUREAU



Panel:
How can we move forward? The need for a collaborative vision

Chandler Goule
National Farmers Union

"How can we move forward?: the need for a collaborative vision"

CAST Animal Agriculture Symposium
June 9, 2010

A Unified Vision

- In the 1950s 15% of the U.S. population was at the most, 1 generation away from the farm
- In 2010, many consumers have no connection to their food source
- Educating our end users and consumers about agriculture is key to our success

Farmers Union

Avoiding the Wedge

- Any strategist will tell you that to weaken a group, organization, government or theory you should drive a wedge between the functioning parts
- Agriculture falls victim to the wedge strategy by its own accord between each other and by outside groups

Farmers Union

Coexistence Exist

- Agriculture as a whole needs to realize there is a place for everyone:
  - Conventional Agriculture
  - Organic Agriculture
  - Sustainable Agriculture
  - Agriculture of different sizes

WE MUST ALL WORK TOGETHER

Farmers Union

Collaboration Is Key

- Money will be short this year for the Farm Bill
- Working with our nutrition counterparts in the farm bill is not a maybe but a must
- Combined efforts to work together to educate the public about the importance of domestic food security
- Providing the safest food supply

Farmers Union

Conclusion

- Working together to speak out to consumers and the media about what we are doing that is good, healthy and environmentally friendly
- Finding common grounds within our own industry
- Coexisting with all sectors
- Providing an abundant, affordable, and safe food supply

Thank You

Chandler Goule
Vice President of Government Relations
National Farmers Union
Cgoule@nfudc.org or 202-554-1600

Panel:
How can we move forward? The need for a collaborative vision

Christine Bushway
Organic Trade Association


Government Relations


Consumer Education


International Trade


Public Affairs

Sustaining Animal Agriculture:
Balancing bioethical, economic & social issues

How can we move forward?
The need for a collaborative vision

Christine Bushway
Executive Director & CEO
Organic Trade Association

Organic Agriculture – A Voluntary Production and Handling Regulation

Organic refers to the way agricultural products are grown, raised and processed.

It includes a system of production, processing, distribution and sales that assures consumers that the products maintain the organic integrity that begins on the farm.

SINCE 1985 Organic trade association

Organic Agriculture

- Setting the stage for U.S. National organic standards, the U.S. Congress adopted the Organic Foods Production Act (OFPA) in 1990 as part of the 1990 Farm Bill.

- This action was followed by over a decade of public input and discussion, which resulted in a National Organic Program final rule published by the U.S. Department of Agriculture (USDA) in December 2000 and implemented in October 2002.

- These stringent standards put in place a system to certify that specific practices are used to produce and process organic

Formalized Public Input

- ☑ Required by Law –
  Organic is accountable to the public
  - Citizen Advisory Panel: National Organic Standards Board
    - Includes farmers, ranchers, scientists, consumer protection advocates, certifiers and retailers
    - Has statutory authority over allowed and prohibited materials

Organic Animal Agriculture

- *A Trend That Is Here To Stay!*

- Organic sales in the United States reached $26.6 billion in sales in 2009.
  - +5.5% despite a tough economy

- Organic food now accounts for 3.7% of all food products sold in the U.S.
  - 11% of fresh fruits and vegetables consumed are organic
  - 5.3% of dairy products consumed are organic

- Organic is recognized as one of the fastest growing sectors of agriculture

Source – OTA's 2010 organic industry survey

U.S. Organic Food Retail Sales Forecast Looking Strong

Organic companies report upbeat in earnings

Releasing its second quarter results for the period ending April 11, **Whole Foods Market**, the largest US organic retail chain, reported that its sales had increased by 13 percent, the best results reported in several years.

Meanwhile, **UNFI**, the largest distributor of organic products, reported second quarter earnings ending Jan. 30 had increased by 15 percent.

Organic trade association SINCE 1985

Impacts of Organic Regulation on Food-Animal Agriculture - Economics of production

- U.S. organic farms on average have higher sales, higher production expenses, and higher operating profit than U.S. non-organic farms

	Organic Farms	*All Other Farms*
Gross Sales	$217,675	$134,807
Production expenses	$171,978	$109,359
Operating Profit	$45,697	$25,448

* The 2008 Organic Production Survey conducted as a follow-on to the 2007 Census of Agriculture by the U.S. Department of Agriculture's (USDA's) National Agricultural Statistics Service (NASS).

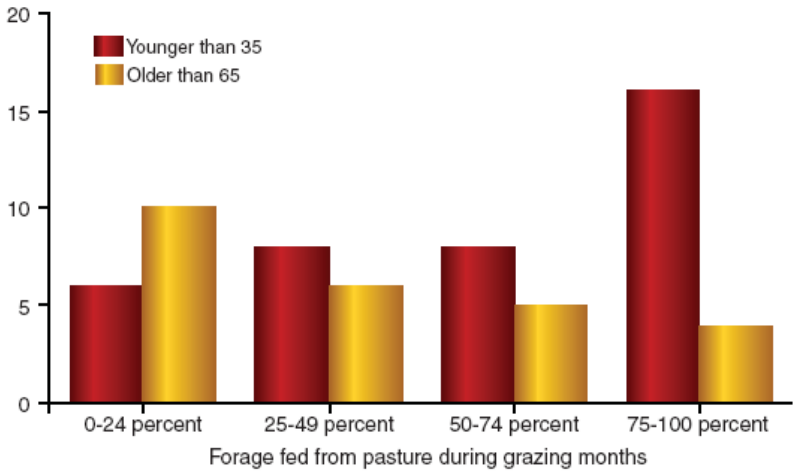
Impacts of Organic Regulation on Food-Animal Agriculture - Rural demographics

- U.S. organic farmers (avg. 54 years old) are younger than non-organic farmers (avg. 57 years old)*
- Younger farmers are more likely to adopt requirements of organic production**

Figure 11

Farm operator age, by the share of dairy forage fed from pasture

Among organic farm operators that used the most pasture for dairy feed, 16 percent were younger than 35 and only 4 percent were older than 65



Source: ERS calculations based on data from USDA's 2005 Agricultural Resource Management Survey, conducted by the National Agricultural Statistics Service and the Economic Research Service.

*The 2008 Organic Production Survey conducted as a follow-on to the 2007 Census of Agriculture by the U.S. Department of Agriculture's (USDA's) National Agricultural Statistics Service (NASS).

**USDA ERS Report Number 82

President Obama's Cancer Panel Report

- The **President's Cancer Panel Report "Reducing Environmental Cancer Risk: What We Can Do Now,"** was released May 6, 2010 recommends for consumers to choose food grown without pesticides or chemical fertilizers , antibiotics, and growth hormones to help decrease their exposure to environmental chemicals that can increase their risk of contracting cancer.

- The **Journal Pediatrics** concludes that exposure to organophosphate pesticides at levels common among U.S. children may contribute to the prevalence of attention deficit hyperactivity disorder (ADHD) in these children.

Impacts of Organic Regulation on Food-Animal Agriculture – Global effects

Organic should be PART of the solution to feeding the world

- The United Nations Food and Agricultural Organisation (FAO) in its report *Organic Agriculture and Food Security* explicitly states that organic agriculture can address local and global food security challenges.

- Organic agriculture and its' encouragement of diversified systems builds self reliance critical to food security.

- Organic agriculture can provide critical high value exports such as coffee and chocolate for small farmers world-wide

Moving Forward – A Collaborative Vision

- Organic farmers are not attacking when they communicate verified production practices

  - A free market economy is based on consumer choice
  - Providing credible information on how food is produced, according to a regulated system informs consumer choice

The Relationship between Organic Producers and Consumers:

Organic must affirm for the consumer that we are living up to the commitment of the organic program and consumer expectations.

OTA and IDFA - Collaboration

- June 10 – U.S. Court of Appeals for the Sixth Circuit, Cincinnati, Ohio to hear Oral Arguments.

- OTA and IDFA are seeking to overthrow the Ohio regulation

SINCE 1985 Organic trade association

OH Regulation – A Challenge to Free Speech

- Organic milk producers' right to make truthful labeling claims concerning their production practices.
- Potential to impact all organic producers' labeling rights.
- Consumers' right to know about how the milk they purchase is produced.

SINCE 1985 Organic trade association

Moving Forward

- Support agriculture and all agricultural livelihood
- Value diversity
- Protect consumer choice, free speech and right to know
- Remember – many organic farmers are also non-organic farmers

Organic Trade Association

Christine Bushway, Executive Director & CEO

CBushway@ota.com * (413) 376-1233

www.OTA.com

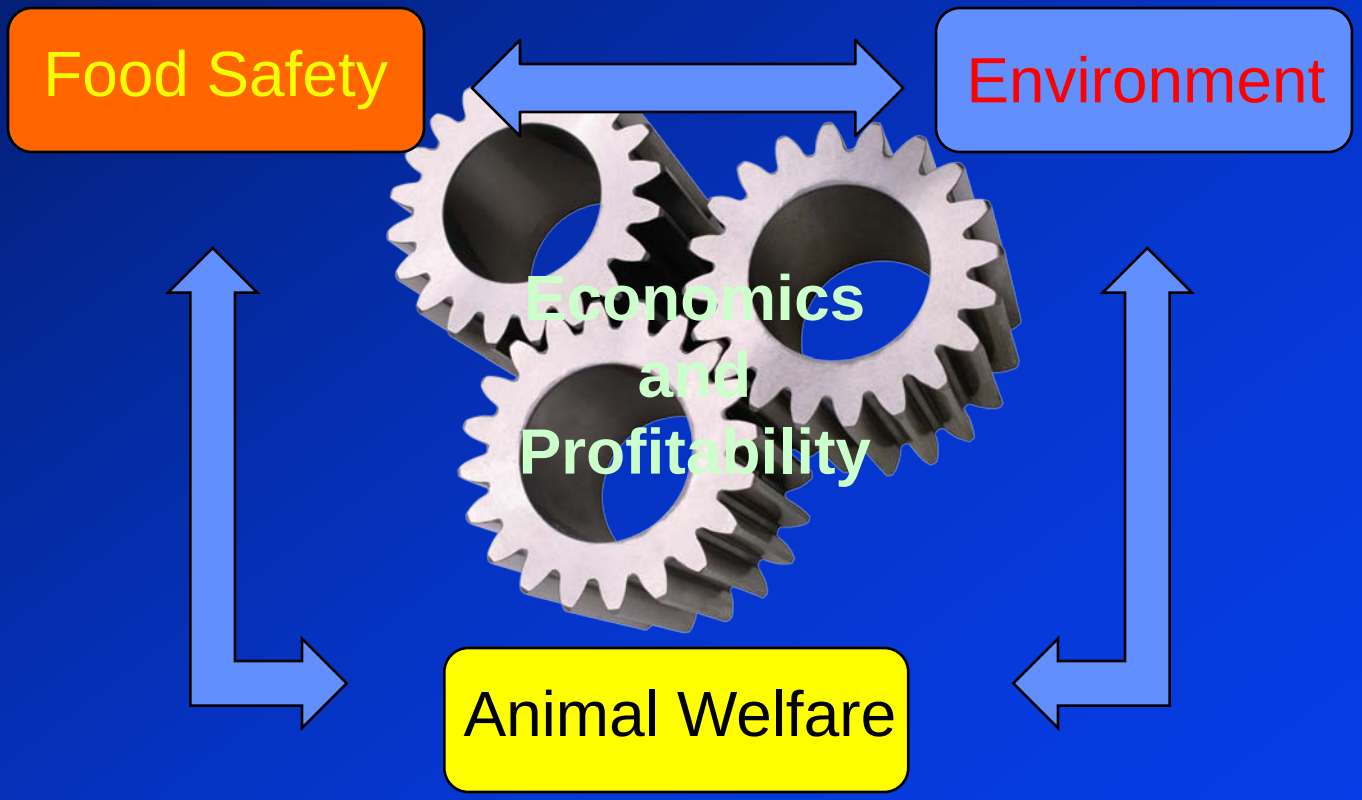
Panel:
How can we move forward? The need for a collaborative vision

Joe Stookey
North American Food Animal Well-Being Commission on Beef
University of Saskatchewan

Moving *Animal Welfare* Forward in the Beef Industry

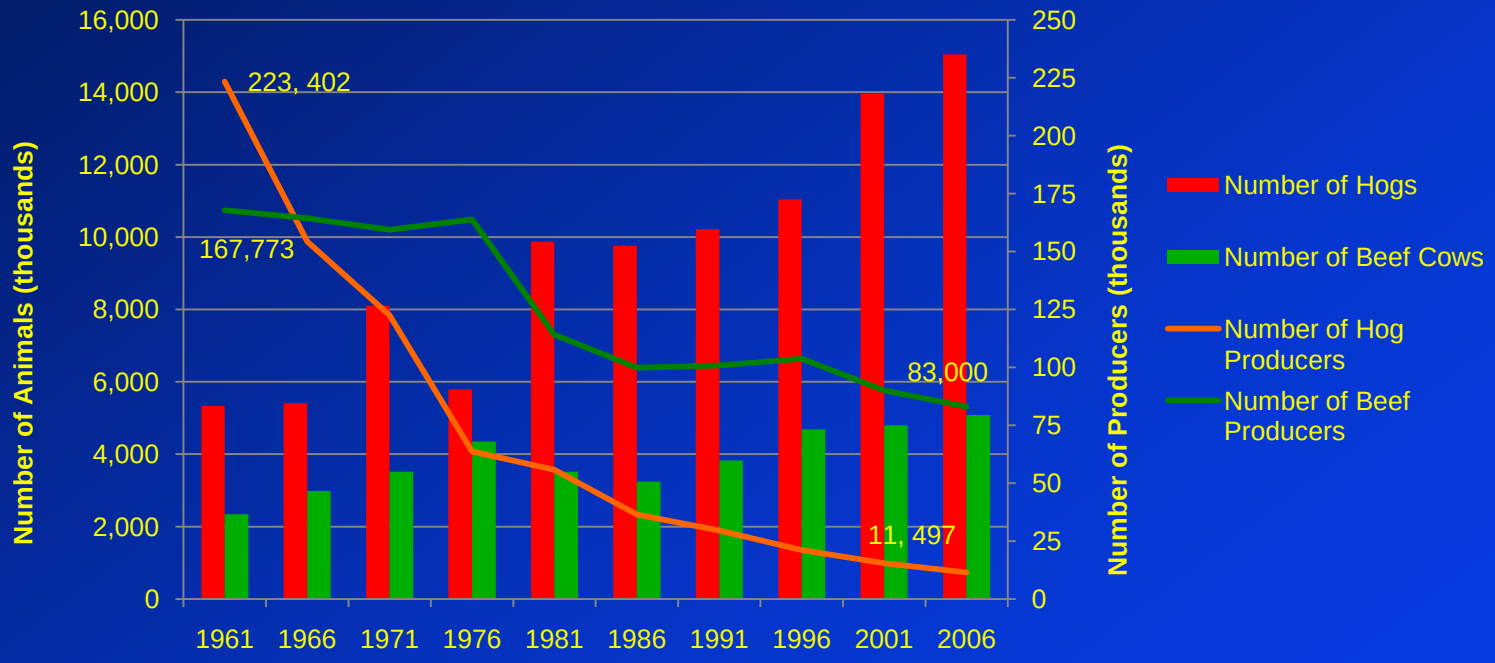
Joseph Stookey
University of Saskatchewan
co-chair North American Food Animal Wellbeing Commission - Beef

Critical Factors Influencing the Sustainability of Livestock Production Practices

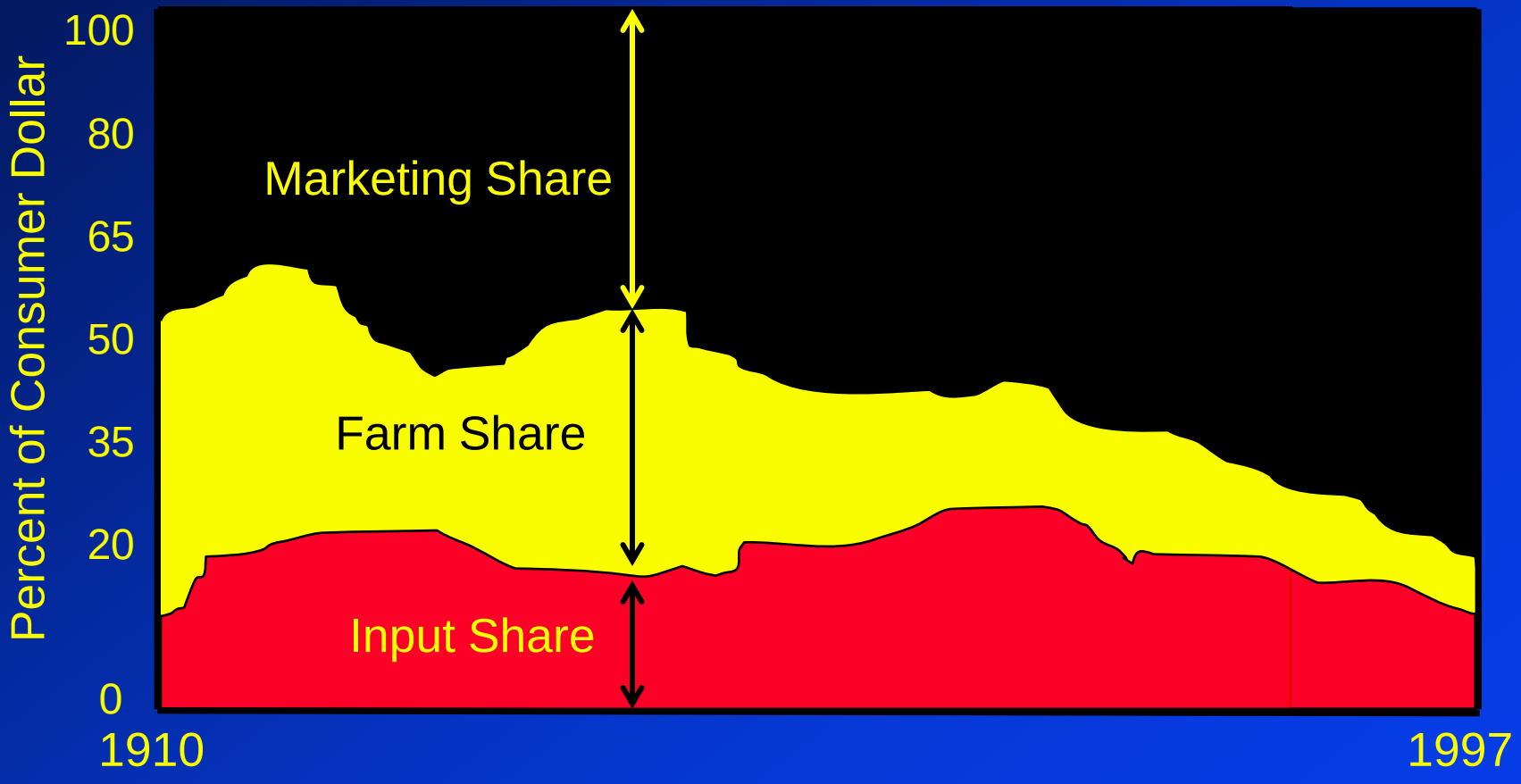


Number of beef cows and hogs in Canada and the number of producers (1961-2006)

(Source: Statistics Canada, Census of Agriculture, various year)



Distribution of a consumer's dollar spent on food between the year 1910 and 1997.



(Halweil, 2004)

Changing demographics

We have fewer farms with higher number of animals per farm.

We have moved from extensive to more intensive systems.

…with the exception of cow/calf operations! As herd size increases, ranchers move towards more extensive operations

Grandin Foundation

Food Animal Welfare Network (FAWN)

- Beef
- Eggs
- Broilers
- Pork
- Lamb
- Other?
- Other?
- Dairy

Stakeholders Include:
Consumers
Producers
The Animals
Transporters
Packers
Processors
Retailers
Restaurants
Government
NGOs

What are the responsibilities of the Beef Commission?

Identify the most important animal welfare issues facing the beef industry.

Develop standards of production for beef cattle.

Guide research needs and field investigations

Produce reports to address issues and solve problems

Independently review and endorse practices, standards and assessment tools when asked by stakeholders

Develop animal well-being monitoring system for real time feed back in outcomes of practices utilized to raise cattle

Recommend and develop animal care-giver training programs and monitor training

Represent our stakeholders interests in state and national public forums when requested by overarching commission

Top Beef Cattle Welfare Concerns as identified by NAFAWC-Beef commissioners

Environmental conditions for animals (heat, cold, dust, mud)

Painful procedures (castration, dehorning, [illegible]nding)

Weaning/Preconditioning/R[illegible]

Transportation

Non-ambulatory animals

Cattle handling

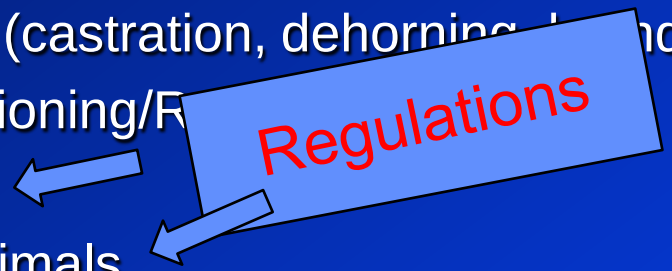
Euthanasia and disposal of chronically ill animals

Employee training

Electro-ejaculation of bulls

Unwanted dairy bull calves

Cull dairy cows



Historically it was a “sin” to waste or throw away an animal that had salvage value.

The newer social consensus is that **unnecessary pain and suffering “trumps” the potential salvage value** of a culled animal.

Top Beef Cattle Welfare Concerns
as identified by NAFAWC-Beef commissioners

Environmental conditions for animals (heat, cold, dust,

Painful procedures (castration, dehorning, branding)

Weaning/Preconditioning/Respiratory disease

Transportation

Non-ambulatory animals

Cattle handling

Euthanasia and disposal of chronically ill animals

Employee training

Electro-ejaculation of bulls

Unwanted dairy bull calves

Cull dairy cows

Additional Research

Education and Training

Dairy and Beef Industry Collaboration

Current Beef Commissioners

Dr. Bob Smith – Oklahoma State University
Dr. Carolyn Stull - University of California at Davis
Dr. Dan Thomson – Kansas State University
Dr. Dave Sjeklocha – Academy of Veterinary Consultants
Dr. Dee Griffin – University of Nebraska
Dr. Frank Mitloehner – University of California at Davis
Dr. Gatz Riddell – AABP, Executive Director
Dr. Guy Loneragan – West Texas A&M University
Dr. Hans Coetzee – Kansas State University
Dr. Jan Shearer – Iowa State University
Dr. Janice Swanson – Michigan State University
Dr. Ron Gill – Texas A&M University
Dr. Temple Grandin – Colorado State University
Dr. Tom Noffsinger – Beef Cattle Handling Expert - Benkelman, NE
Dr. Jeff Rushen – Agriculture and Agri-Food Canada
Dr. Joseph Stookey – University of Saskatchewan
Dr. Karen Schwartzkopf-Genswein – Agriculture and Agri-Food Canada
Jennifer Woods – Livestock Handling Expert – Blackie, AB Canada

International Beef advisors

Stella Maris Huertas, DMTV, MSc. Of Uruguay
Donald M. Broom, professor of animal welfare, University of Cambridge, U.K
Bernadette Earley, PhD, Animal Bioscience Centre, Grange, Ireland
Kevin Stafford, Prof of Applied Ethology and Animal Welfare, Massey University, New Zealand

North American Beef advisors

Dr. Elizabeth Parker, National Cattlemen's Beef Association (U.S.)
Dr. Jim Sartwelle, American Farm Bureau Federation (U.S.)
Dr. Tom Field, National Cattlemen's Beef Association (U.S.)
Ryder Lee, Canadian Cattlemen's Association (Canada)
Bryan Walton, National Cattle Feeders Association (Canada)
Dr. Ron DeHaven, American Veterinary Medical Association
Dr. Jamie Ritter, Federation of Animal Science Societies
Dr Juan Ramon Gonzalez, Confederación Nacional De Organizaciones Ganaderas (Mexico)
Janet Riley, American Meat Institute

Economic impact of transitioning from swine gestation stalls to group pen housing

Brian L. Buhr
University of Minnesota

Sustaining Animal Agriculture
Balancing Bioethical, Economic, & Social Issues
A World Supported by Plants and Animals

Economies of Size and Scale Applied To Biological Systems: The Case of Gestation Stalls and Group Pen Housing in the U.S. Pork Industry

Brian Buhr
Professor
Applied Economics
Univ. Of MN

CAST- Food Animal Agriculture Symposium
Washington, D.C.
June 8-10, 2010

Restrictions on Crates are Expanding

- European Union phase-out by 2013
- California Proposition 2, passed 2008, operative 2015
- Ohio ballot intiative
- Arizona/Florida Ballot Initiatives
- Oregon senate bill passed banning crates 2007
- Wendy's – 20% non-stall pork by 2008
- Smithfield Foods announces transition to pens by 2017
- HSUS Call for Elimination of Crates and Lobbying
- Colorado Voluntary Crate Phase-Out by 2008 (1/11/08)

What Are the Costs of Transitioning Commercial Production Systems?

- **Impacts on Productivity/Costs**
  - Levels and Risks
- **Capital Costs of Transition**
  - Facility Cost Comparisons
  - Facility Age and Loss of Function
- **Consumer Demand Issues**
  - What Must be Paid?
- **Market Response**
  - Relative Competitiveness
  - Net Cost to Producers and Consumers
- **General Insights/Strategic Issues**

Impacts on Productivity/Welfare

- Survey of Commercial Producers
  - No clear evidence of differences across systems.
  - Management/Labor issues
  - Variability is key
    - Greater Risk of Catastrophic Loss with Pens
    - E.g., ESF w/ 50% death loss due to conditioning
  - Need crates about 32 days minimum.
  - Need crates for ‘fall-outs’
  - If NO crates productivity will be impacted.
  - Sampling Issues: clearly early adopters, high quality. What happens when there is broader industry adoption?

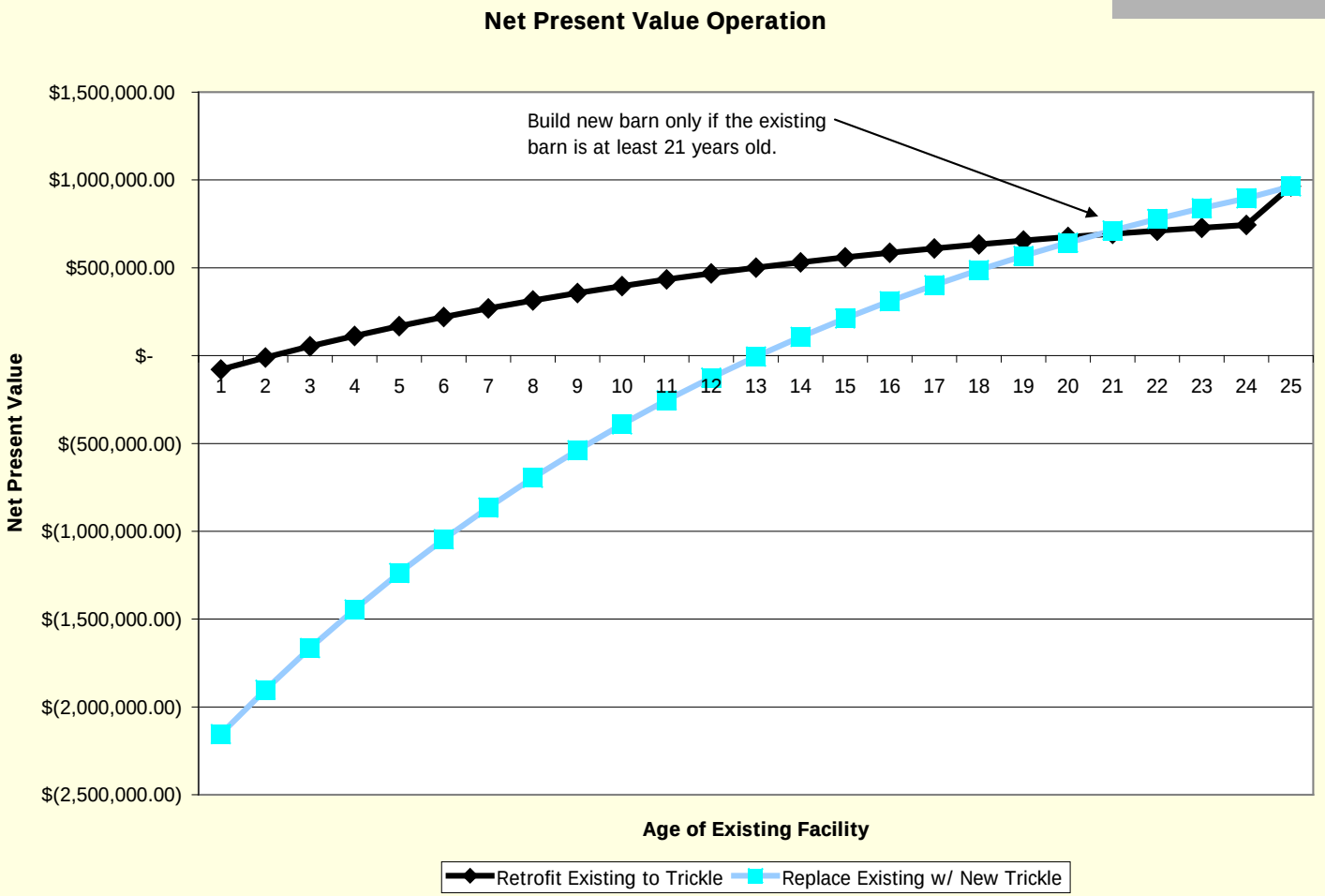
Building Investment and Costs

- **Direct Costs:**
  - Barn Design
    - Feed, flooring, pen size, building size.
  - Building Retrofit
    - Flooring configuration/footprint
- **Opportunity Cost:**
  - Pre-mature Capital Replacement

Scenarios For Analysis

- **Capital Costs Only – Best Case Scenarios**
  - No production Performance Differences.
  - Simulated all combinations of replacement timing from immediately to at end of useful life.
- **Capital Costs PLUS Productivity Differences**
  - Based on Commercial Swine Responses and their PigChamp Data (note: not sig. diff)
    - First assume 2 year transition impact.
    - Second assume ongoing impact (worst case)
    - Also included assumed higher maintenance costs for ESF facilities – not clear what these are yet.

Result 1: Retrofit vs. New Trickle



If existing barn has **is less than 21 years old**, the decision should be to **refurbish** the barn instead of building new barn.

Result 2: Most Likely Impact Per Facility: 24 Month Learning Period – Then Equal Productivity

Table 12. Infinite Horizon Net Present Value Analysis of Gestation Stalls Compared to Group Pen Gestation Housing: Capital and 24 Month Transition Period

Scenario	Trickle Feed Small Pens (Per Barn) 2400 Sow Three Cycle NPV[a]	1200 Sow Three Cycle NPV[a]	2400 Sow Percent Change NPV	1200 Sow Percent Change NPV
Continue Stall Housing	$ 1,077,068.89 [c]	$ 539,674.81		
Build New Trickle Feed Pen @ 25 years	$ 851,195.37	$ 426,731.80	-21%	-21%
Retrofit to Trickle Feed Pen @ 15 years	$ 338,634.86	$ 170,445.50	-69%	-68%
Retrofit to Trickle Feed Pen @ 5 years	$ (265,522.70)	$ (131,645.17)	-125%	-124%
Retrofit Trickle Feed Pen Average All Ages	**$ 168,129.57**	**$ 85,189.34**	**-84%**	**-84%**
Build New Trickle Feed Pen @ 15 years	$ (8,365.41)	$ (3,054.64)	-101% [b]	-101%
Build New Trickle Feed Pen @ 5 years	$ (1,671,899.26)	$ (834,833.46)	-255%	-255%
Build New Trickle Feed Pen Average All Ages	**$ (499,918.27)**	**$ (248,834.58)**	**-146%**	**-146%**

Scenario	ESF Feed Large Pens (Per Barn) 2400 Sow Three Cycle NPV[a]	1200 Sow Three Cycle NPV[a]	2400 Sow Percent Change NPV	1200 Sow Percent Change NPV
Continue Stall Housing	$ 1,434,053.54 [c]	$ 718,150.28		
Build New ESF Feed Pen @ 25 years	$ 1,190,899.95	$ 583,242.24 [d]	-17%	-19%
Build New ESF Feed Pen @ 15 years	$ 359,468.83	$ 153,985.63	-75%	-79%
Build New ESF Feed Pen @ 5 years	$ (1,256,333.94)	$ (680,060.87)	-188%	-195%
Build New ESF Feed Pen Average All Ages	**$ (118,118.77)**	**$ (92,532.45)**	**-108%**	**-113%**

[a] Three cycle NPV assumes that three barn replacement cycles occur spanning 75 years. Insignificant differences occur compared to infinite horizon problems.

[b] The 1200 sow and 2400 sow units have the same change in this case because investment costs were assumed to be a percent mark-up compared to the base stall barn. With the retrofit or ESF specific costs per sow were included causing non-proportional changes.

[c] The base stall barns differ because in the case of ESF, the respective contractors for the trickle and ESF barns provided their own stall barn estimates as well. This allowed for a better comparison in the changes from stall to their type of system assuming same material suppliers, labor, etc.

[d] ESF impacts include a 75% increase in equipment maintenance costs which is why this value is higher relative to trickle feed options in this case.

Result 3: Industry Level Total Impact

Scenario	Capital Cost Plus 2 Year Productivity Loss Total Industry Cost	Percent Decrease in Industry NPV
Total Average Cost to Retrofit Barns to Trickle Feed	**$ 1,867,892,023.74**	74%
Total Average Cost to Build New Trickle Feed	**$ 3,240,730,303.66**	129%
Total Average Cost to Build New ESF Feed	**$ 3,237,111,517.39**	97%

- **Absolute Best Case** = **~$ 101 million GAIN**
  - ESF at end of life and no productivity loss to industry
- **Absolute Worst Case** = **$8.05 billion loss**
  - ESF, High Maintenance, Ongoing Productivity Loss

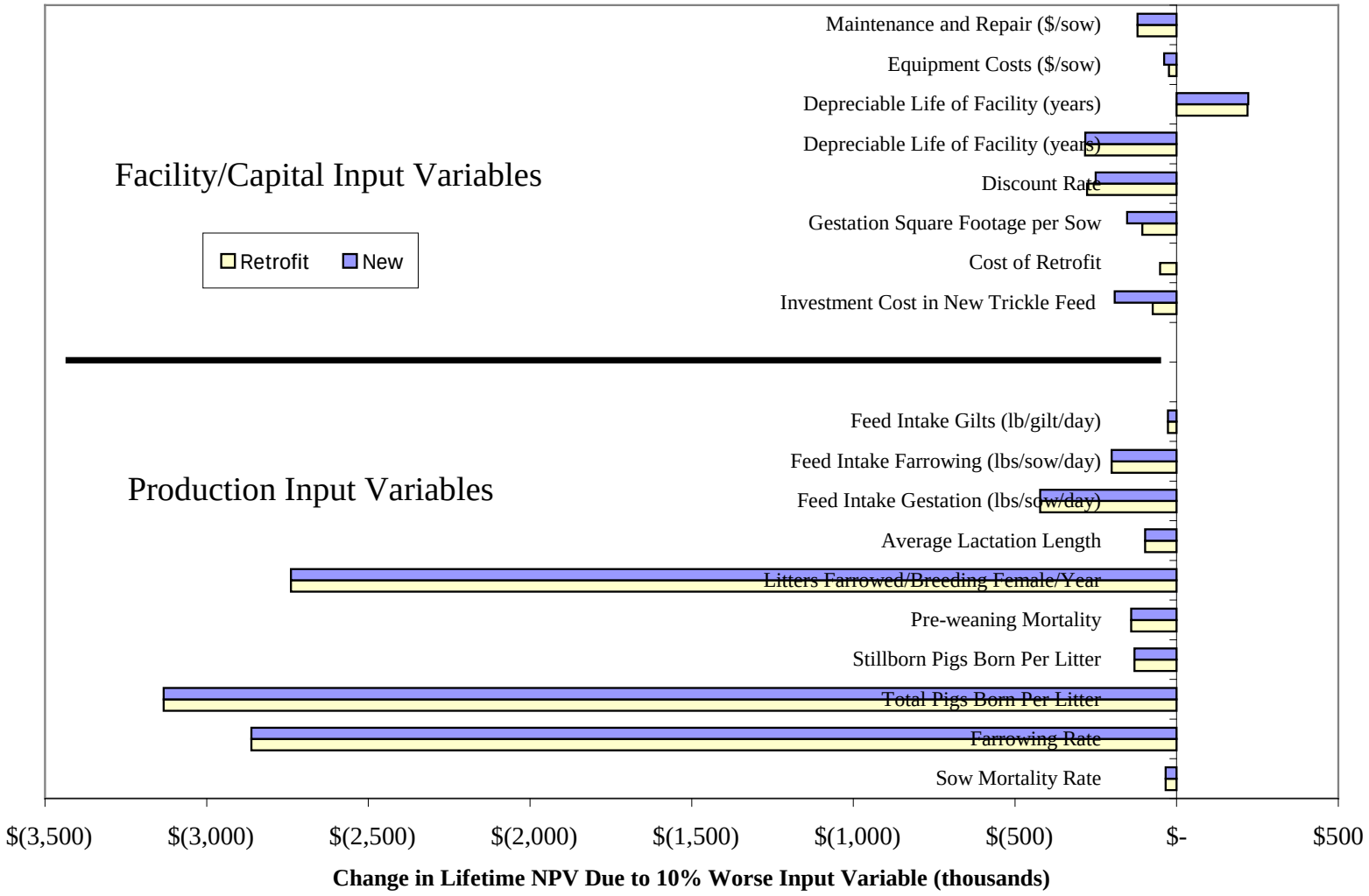
Result 4: Market Adjusted Impacts

Most Likely Impacts on Market Level Producer and Consumer Costs

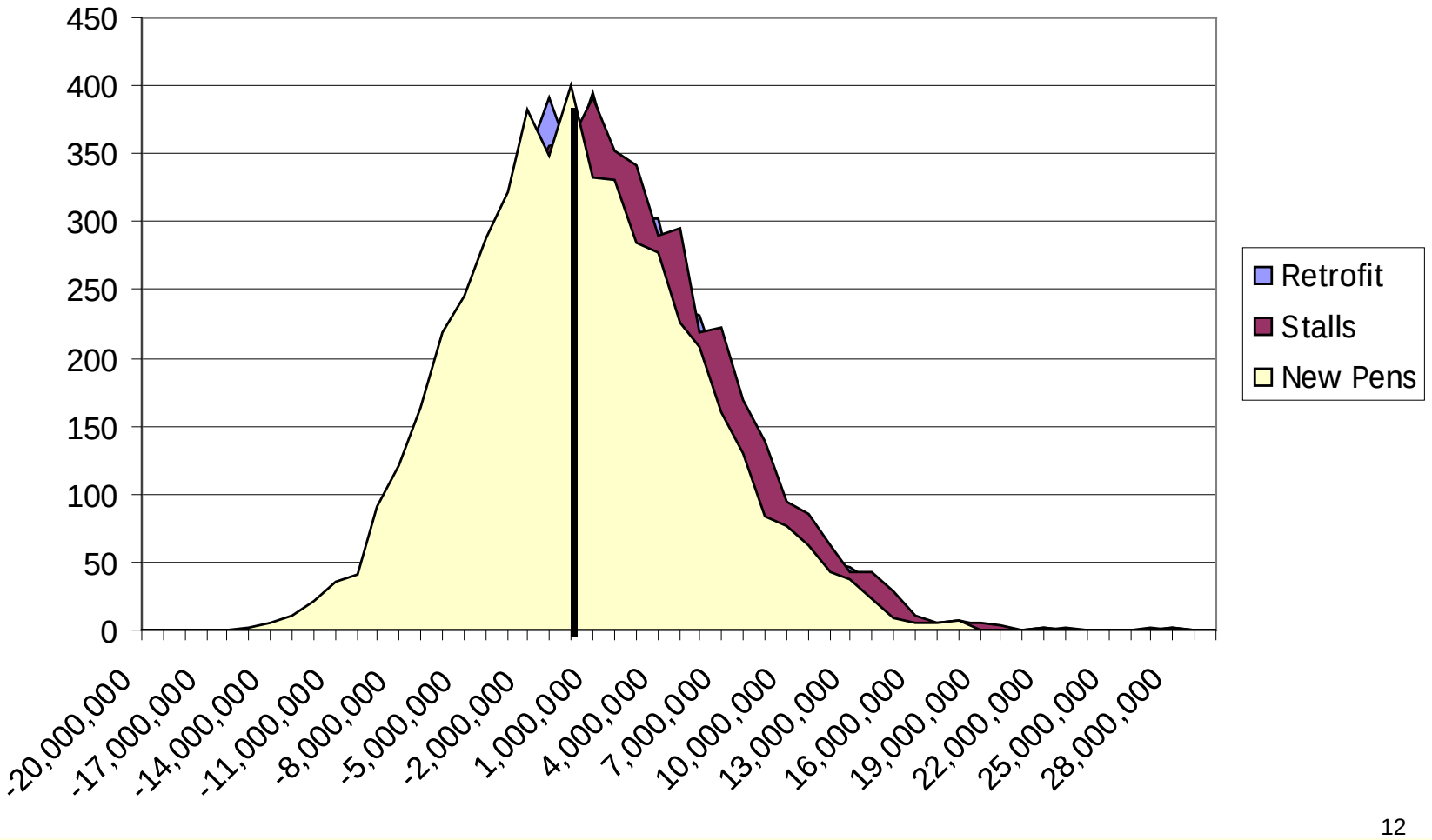
		ESF Productivity Impacts 2 year Transition
Variable		
Change in Producer Surplus (Net Impact)		
Pork Producer Surplus	Mill $	**-$1,491.30**
Beef Producer Surplus	Mill $	**$1,193.20**
Chicken Producer Surplus	Mill $	**$469.23**
Change in Consumer Surplus		
Pork Consumer Surplus	Mill $	**-$2,714.12**
Beef Consumer Surplus	Mill $	**-$1,698.46**
Chicken Consumer Surplus	Mill $	**-$576.34**
Total Consumer Surplus	Mill $	**-$4,988.92**

- Competitive loss to other meats and trade
- **Consumers** must be **willing to pay 25% more** for pork raised in group pen facilities.
- Maximum Producer Loss = $4 billion, consumer = $8 billion

Which Assumptions Have Greatest Impact on Results? Sensitivity



Potential “Risk” of Non-Uniformity in Adaptation – Concern About Need for Better Management



Other Key Issues

- **Relative Competitiveness by Age of Facilities.**
  - Regional Impact
  - Firm Impact
- **Multi-Facility Firms Have Major R&D Advantage**
  - Many alternatives likely one will dominate.
- **Rather than mandates, allow for labeling or other voluntary information provision.**
  - If mandate, consumers who don't have preference are taxed.
- **What Really Improves Sow Welfare?**
  - Which system maximizes productivity and welfare?
  - What does HSUS really want? Is there a welfare treadmill?

Gestation Crates are One Example of a Market that is Increasingly Driven by **"Externality"** Attributes – **No Direct Benefit or Cost to Consumer**

- **Externality** - Actions You Take That Affect Others.

- Traditional Agricultural Externalities:

  - Fertilizer Run-off – Hypoxia in the Gulf
  - Row cropping – soil erosion
  - Antibiotics in Livestock – Potential Resistance
  - Manure – Odor, Phosphorus, Nitrogen

Sustainable/Organic Agriculture Is Offshoot from Externality Driven Agriculture.

Key Point:
Potential Reduction
Of REAL Input Externality.

Beginning of Subtle Shift – Is there a Direct Benefit to Consumers?

Organic food is no healthier, study finds

Wed Jul 29, 2009 12:29pm EDT

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1 of 1 Full Size

LONDON (Reuters) - Organic food has no nutritional or health benefits over ordinary food, according to a major study published Wednesday.

Researchers from the London School of Hygiene & Tropical Medicine said consumers were paying higher prices for organic food because of its perceived health benefits, creating a global organic market worth an estimated $48 billion in 2007.

Now leading to another subtle change to "perceived or "ethical" externalities.

What is the externality of a gestation crate?

- On the Sow?
- On the Consumer?

What is the Externality of Business Organization?

- Size of Firms
- Business Organization
- Methods of Production
- Do these really directly affect consumer?
- Stops Story At Production
  - What about demand?

A Great Grey Area of Real, Perceived and Ethical Externalities: Which Is It?

FOR IMMEDIATE RELEASE

Contact:
Haven Bourque, Straus Communications
(415) 777-1170 x303, Haven@StrausCom.com

An Inconvenient Tooth:
New "Low Carbo

Issue Brief:

The Impact of Ethanol Production on Food, Feed and Fuel

Summer 2007 — A Publication of Ethanol Across America

For more than three decades, critics have tried to cast ethanol as a "food versus fuel" argument. The marketplace is a better indicator of grain supply and demand—and statistics simply don't bear out the dire predictions of those who say we must choose between fueling our cars and feeding people. We can do both—and we are.

By ROD SMITH

COMPASSION In World Farming (CIWF) has called on consumers to begin paying "an honest price" for meat, urging consumers to choose meat "that has been produced ethically to higher animal welfare standards" and "to look beyond price alone."

CIWF, an animal welfare organization in Europe that advocates decreasing meat consumption, said the "cheap

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November 2007

14/09/2006 - **America's dairy processors are increasingly seeking rBST-free dairy supplies, as the demand for additive-free foods begins to exert its influence on the market.**

DÖHLER
DRINKING YOGHURT

An Ignored Externality: The Economic Externality – Cost of Food Example

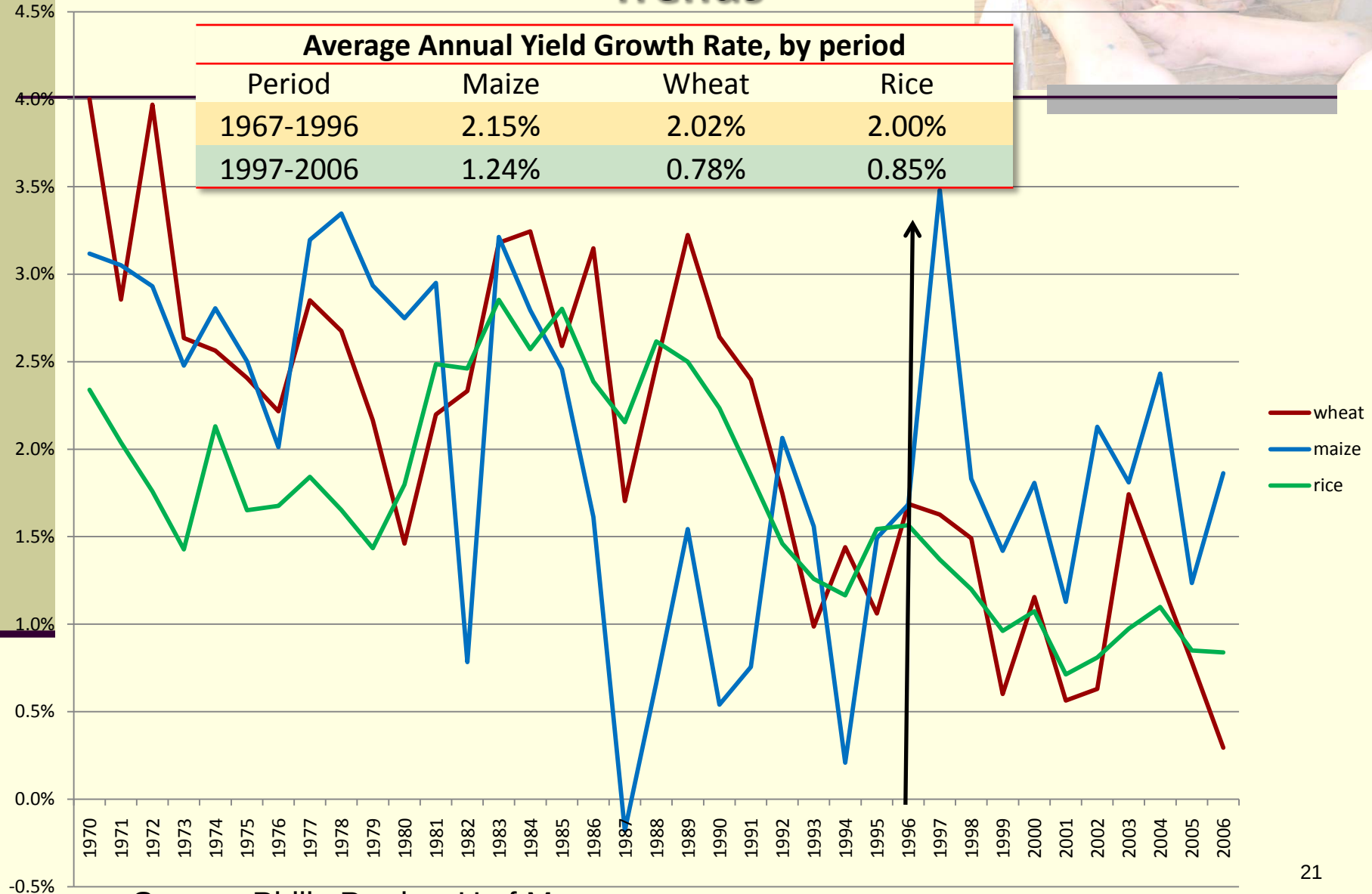
- Sow housing load = $3.1 billion (Buhr)
- Ban antibiotics load = $1.04 billion (Hayes et al.)
- COOL load = $179 million - $1.7 billion (Brester et al. and Lusk et al.)

Total policy load = $5.5 billion in pork from what amount to issues that have no physical consumer externality.

- How do you determine the “value” to the consumer of these perceptive externalities?

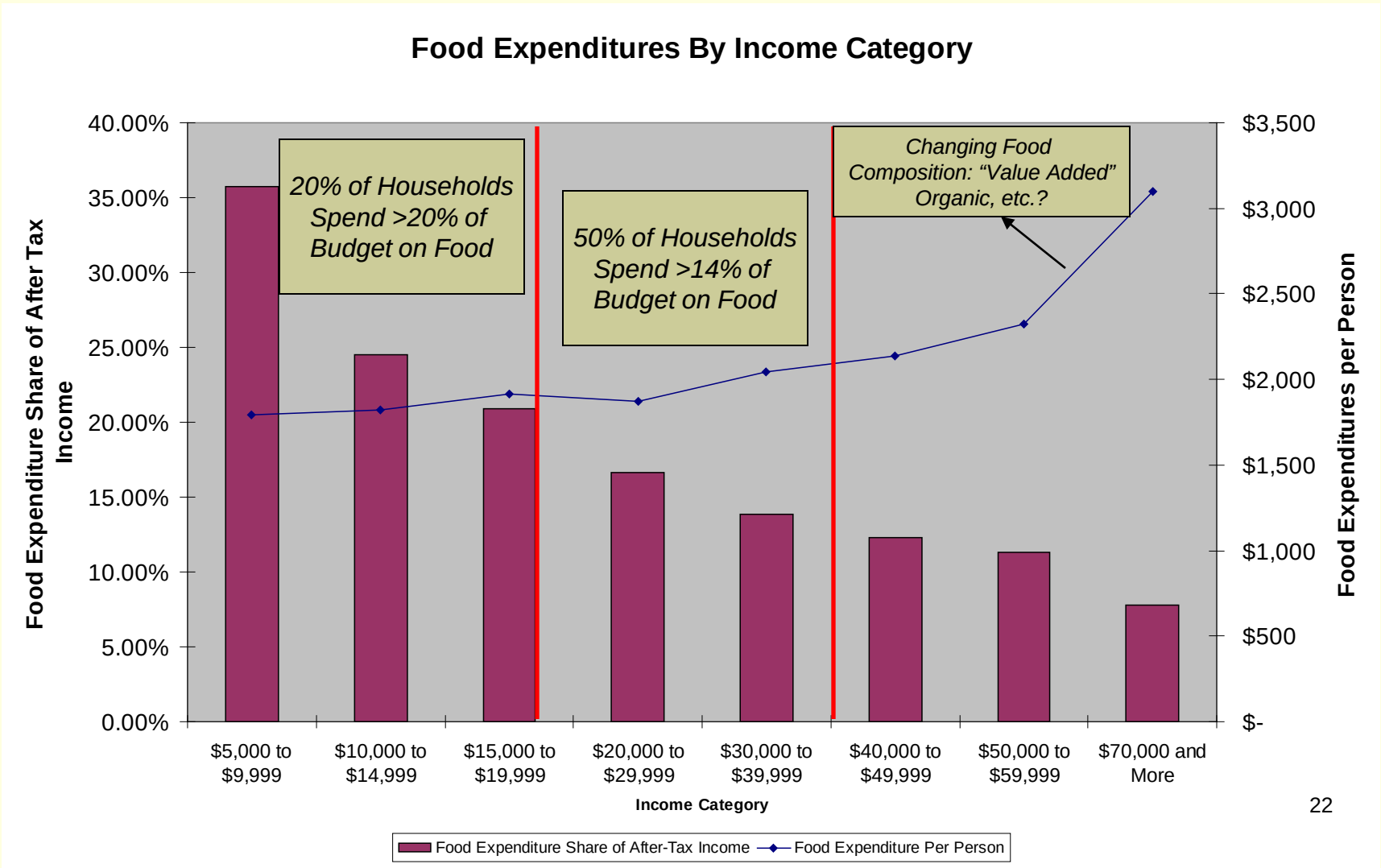
An Experiment in GMO Bans: Corn, Wheat and Yield Trends

Average Annual Yield Growth Rate, by period			
Period	Maize	Wheat	Rice
1967-1996	2.15%	2.02%	2.00%
1997-2006	1.24%	0.78%	0.85%



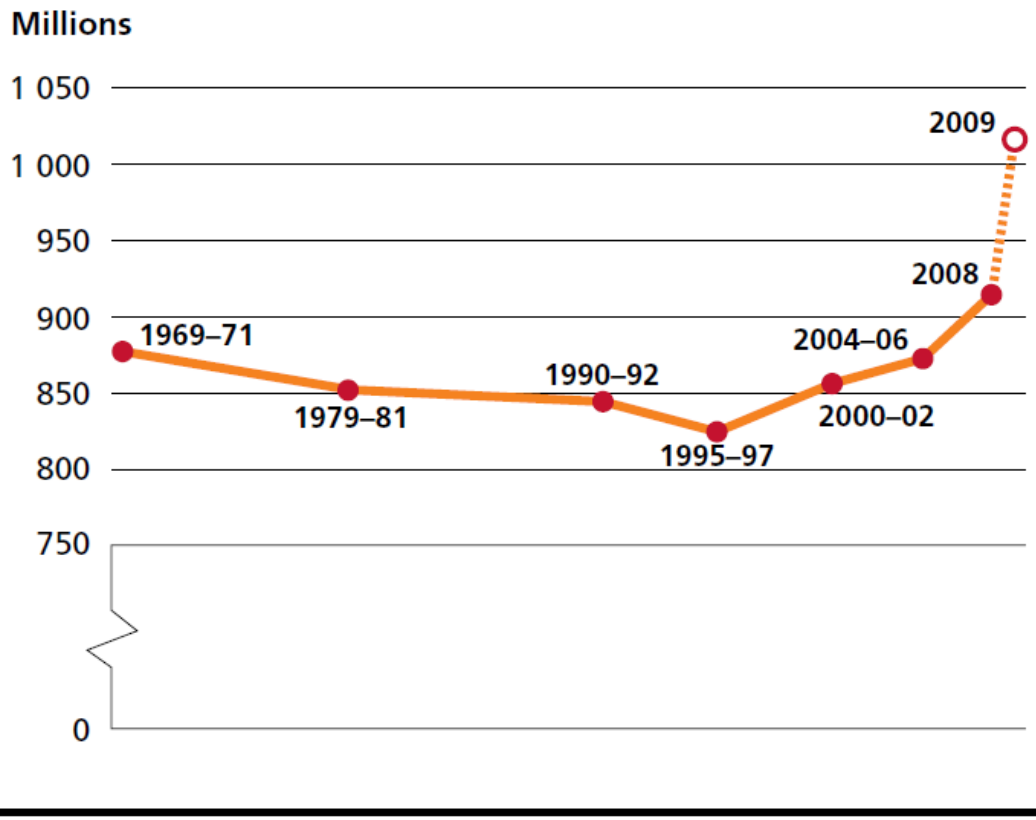
Source: Philip Pardey, U of M

Food Cost Increases Imposed By Preferences or Ethics are Very Regressive On Poor and Real



Cost Externalities Impact 1/6 of the World's Consumers

Learning from the past: number of undernourished in the world, 1969–71 to 2009



Source: FAO.

- "The State of Food Insecurity in the World, FAO 2009.
  - ftp://ftp.fao.org/docrep/fao/012/i0876e/i0876e.pdf

The Ethics of Efficiency: Egalitarian Food

- All People Have Equal Access to Safe, Nutritious Food.
- New Policies Driven by Small Vocal Minority and Appealing to Wealthy– Leveraging Retailers
- 'Voluntary' Food Price Increases are a Regressive Tax:
  - 10% Increase Food Cost → 3.5% tax on low income →0.8% tax on high income
- Hidden Tax – If you don't support policy you pay for higher food costs anyway. Consumer Choice?
  - E.g., WTP pST free (Buhr, *JARE):* 50-86% of respondents no WTP.

What Does This Mean?

- The new battle over food and hunger is not being waged on science/policy issues but rather ETHICS.
- The agricultural community is not effectively engaging in this discussion but activists are.
- Agricultural community typically engages the cost efficiency and science arguments which are often self serving. (e.g., sows must be in gestation crates…)
- YOU must begin to clearly articulate the ETHICS of food production methods and if agriculture finds ethical conflicts it must articulate them and address them.

Conclusion: The Three "**E's**"

- Externalities – Actions Indirectly Affecting Others.
- Ethics – REAL values of individuals not just preferences.
- Egalitarian Foods – Assuring Safe, Ethical, Nutritious and Accessible Foods.

Thank You

Questions?

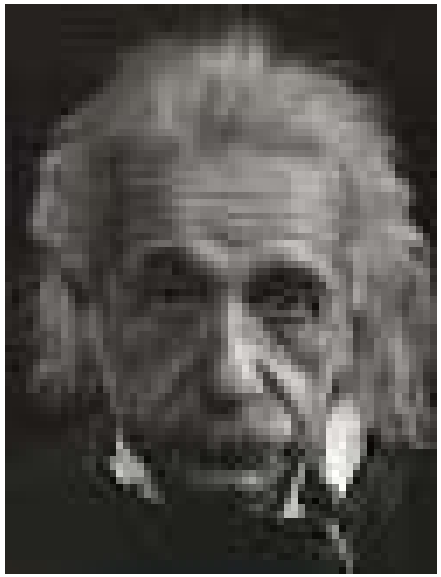
Future welfare of farmers and their animals

John Deen
University of Minnesota


1
COMPLAINT DEPT.
TAKE A NUMBER

Future Welfare of Farmers and Their Animals or: One World One Health One Welfare?

John Deen
University of Minnesota

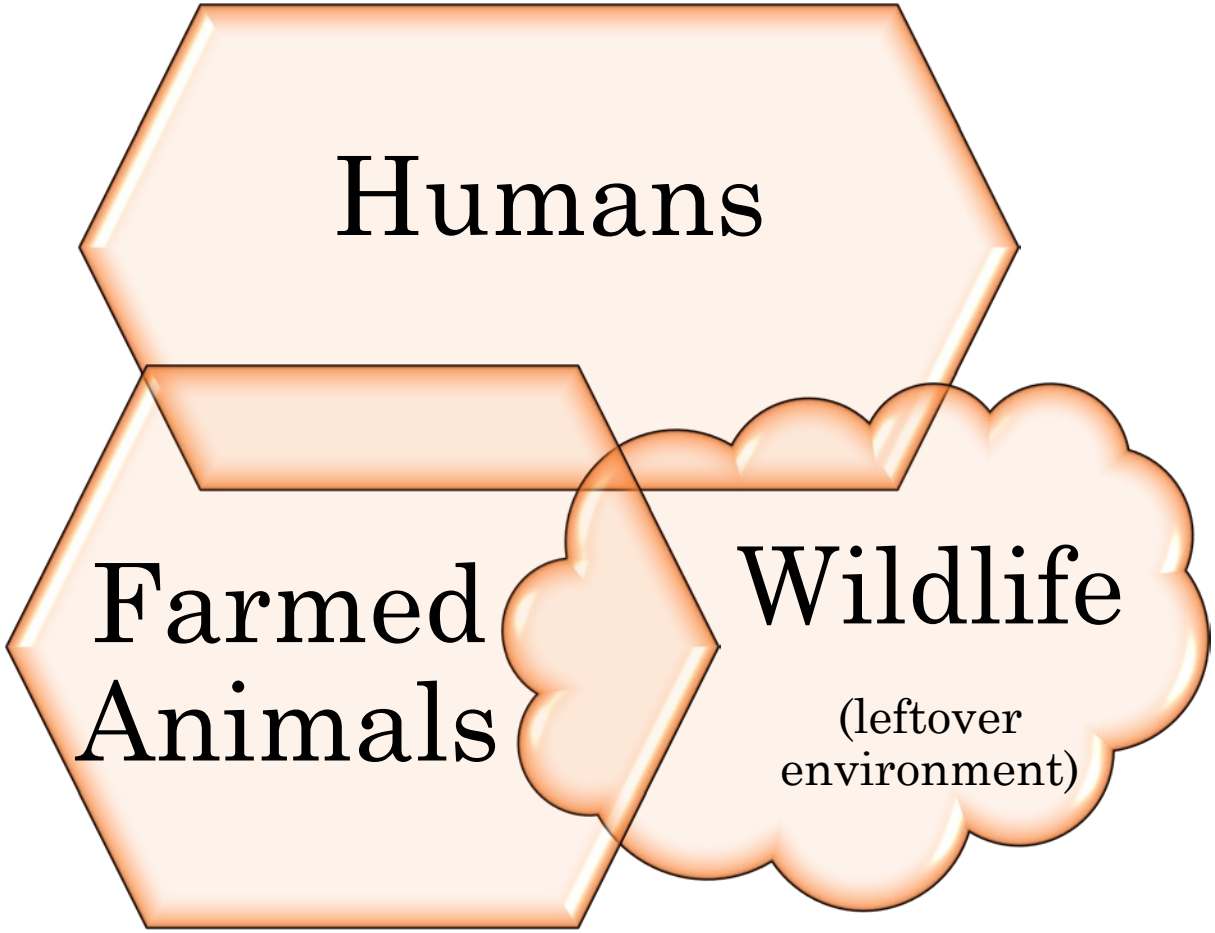


I think that only daring speculation can lead us further and not accumulation of facts.

Welfare policy

- The efficient allocation of scarce resources to a population
  - Implicitly some or all desired outcomes will not be maximized
  - Usually modeled across a homogeneous population
  - Heterologous populations and needs create a difficult (or wicked) problem to solve
  - Much of the information is in shadow values

Three Solitudes



Competition and Conflict

- Welfare
- Food (quantity and security)
- Water (quantity and quality)
- Space (built and leftover)
- Wealth (direct and indirect)
- Power (political and relational)
- Infectious disease (within and across species)
- Quantity of life
- Net relative benefit

- Are objectives always in conflict or can they be concomitantly beneficial?

Stan Curtis:

- An "adaptagent" may be an adverse thermal impingement, poor-quality air, social tension, vaccination, light quality or quantity, abusive or neglectful stockmanship . . . and the list goes on
- The animal's "adaptate(s)" come(s) in "homeokinetic response" to the "adaptagent" and is/are what collaterally/inadvertently result(s) in the performance decrement(s) and inter-individual variation therein upon which we focus in terms of the performance axiom

Curtis, The Professional Animal Scientist 23 (2007):573–583

Optimal Use of Limited Resources

- Land base
- Inputs, especially energy
- Transport costs
- Labor
- Storage
- Preparation
- Societal effects

- *What is the objective function?*
  - *Which are to be optimized and which are constraints?*
  - *Is welfare an objective or a constraints?*

Percentage of Disposable Income Spent on Food (Worldwide)

United States	7.2%
U.K.	10.2%
Canada	10.4%
Japan	15.9%
France	17.7%
Mexico	24.0%
India	48.4%

USDA, 2007

Utilitarianism

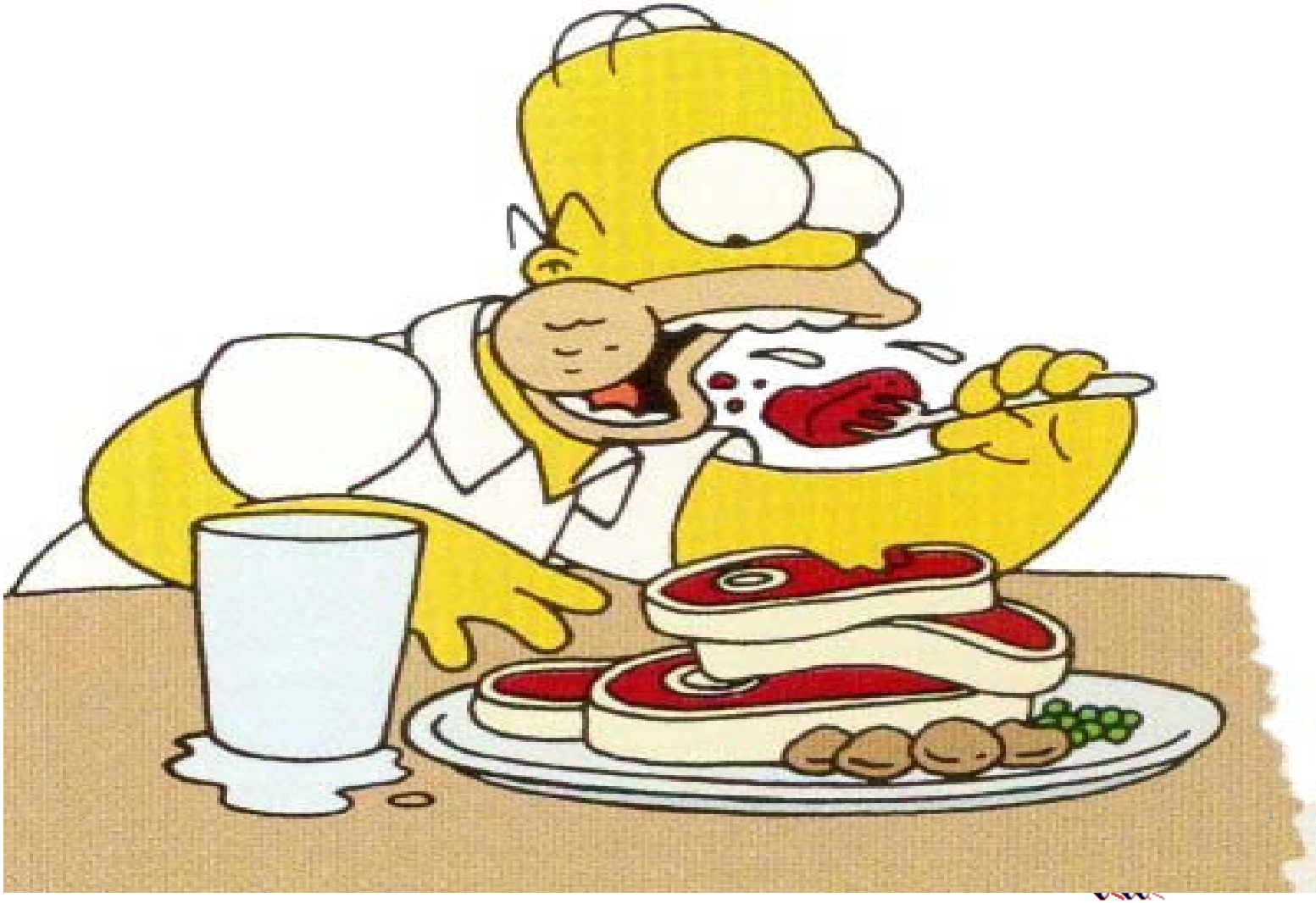
1. The right action to perform is always the action that results in the greatest overall increase in aggregate good.
2. We are morally obligated to perform right actions.

Is this an optimal food?

A GOOD FOOD:

- Corn
- Soy
- Vitamins and minerals
- Formulated through extensive monogastric studies
- Restricted allocation
- Clean water
- Delivered in bulk
- Delivered RTE

Ethical Human Feeding?



Quotation

Whenever people say “We mustn’t be sentimental,” you can take it they are about to do something cruel. And if they add “We must be realistic,” they mean they are going to make money out if it.

Brigid Brophy

Reaction to:

"In animal agriculture, every natural death is a failure. Our aim is to kill our stock at an economically optimal point or, when failing that, the well-being of the animal cannot be sustained"

Mind teaser:

- If a human life is worth more than an animal life:

- Three possible conditions:
  - 1 human life = ∞
  - 1 animal life = 0

  0r 1 human life = n animal lives

But what about the baby in the burning barn?

Proposed Criteria for Moral Standing (resource allocation?)

- *Citizenship*
- Personhood
- Potential personhood
- Rationality
- Linguistic capacity
- Sentience
- Being alive
- Being an integral part of an ecosystem
- Being an ecosystem

Is there a hierarchy of responsibility?

- Omission vs commission
- Knowledge
- Power
- Culture
- Ownership
- Legality
- Proximity
- Immediacy

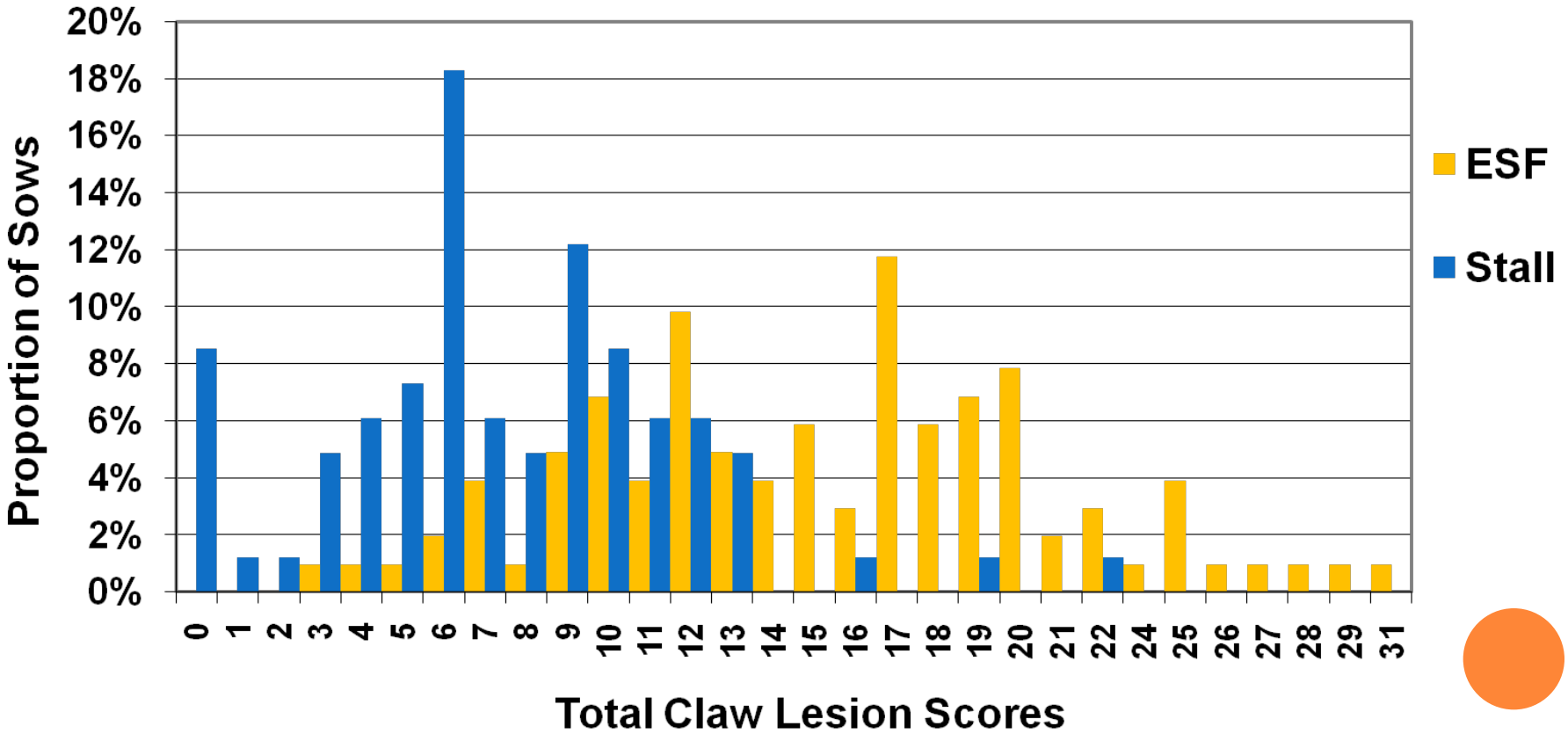
My precious

Certified Big Red Apple

For Large Animal Enrichment

Scented for swine and stall animals' pleasure

Claw lesion scores in pens and stalls



The challenges

- The burden of proof
- The portrayal of intent (care)
- The use of production records
- The restrictions of economics and its portrayal
- Mean vs. outlier analysis
  - Audits are outlier identifications

Aristotle: A good narrative

- *Logos* is appeal based on logic or reason.
- *Ethos* is appeal based on the character of the speaker.
- *Pathos* is appeal based on emotion.

- HL Green: The three types of persuasion, if you are a classically trained orator, are ethos, pathos, and logos. If your training was obtained in modern times, you have an additional tool-statistics.

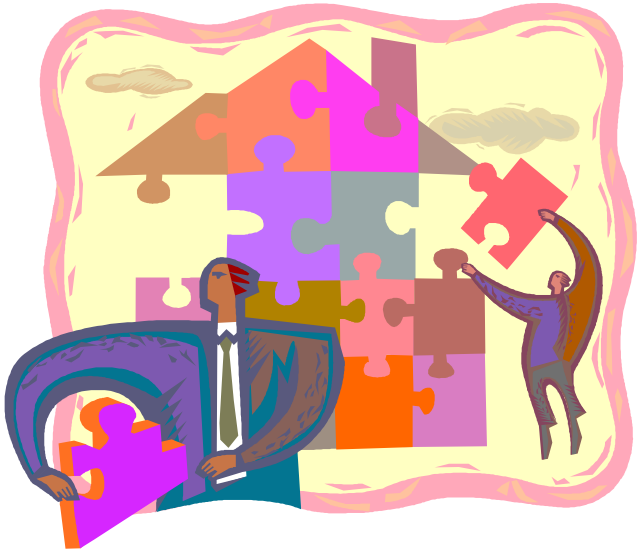
Choices

- Accept and magnify duality
  - Cultural warfare model
- Stick to mechanistic descriptions and maintain neutrality
  - Centrality of science
    - Quantify
    - Evaluate
- Create a narrative

Suggested Narrative

- Intent
  - Role of farmers
  - Animals
  - Consumption
  - Care
- Failings
  - Ineffective resource allocation
  - Ignorance
  - Abuse
  - Uncontrollable conditions
- Redemption
  - Monitor
  - Improve
  - Prevent

How do we gain trust?



- Show up
- Highlight caregivers
- Focus on intent
- Illustrate experience
- Admit failures
- Offer your expertise
  - Fairs, tours, interpretive centers, debates

Time Saving
Truth from
Falsehood and Envy

François Lemoyne

Panel: Comprehensive analysis of certification and regulatory programs: What is the future?

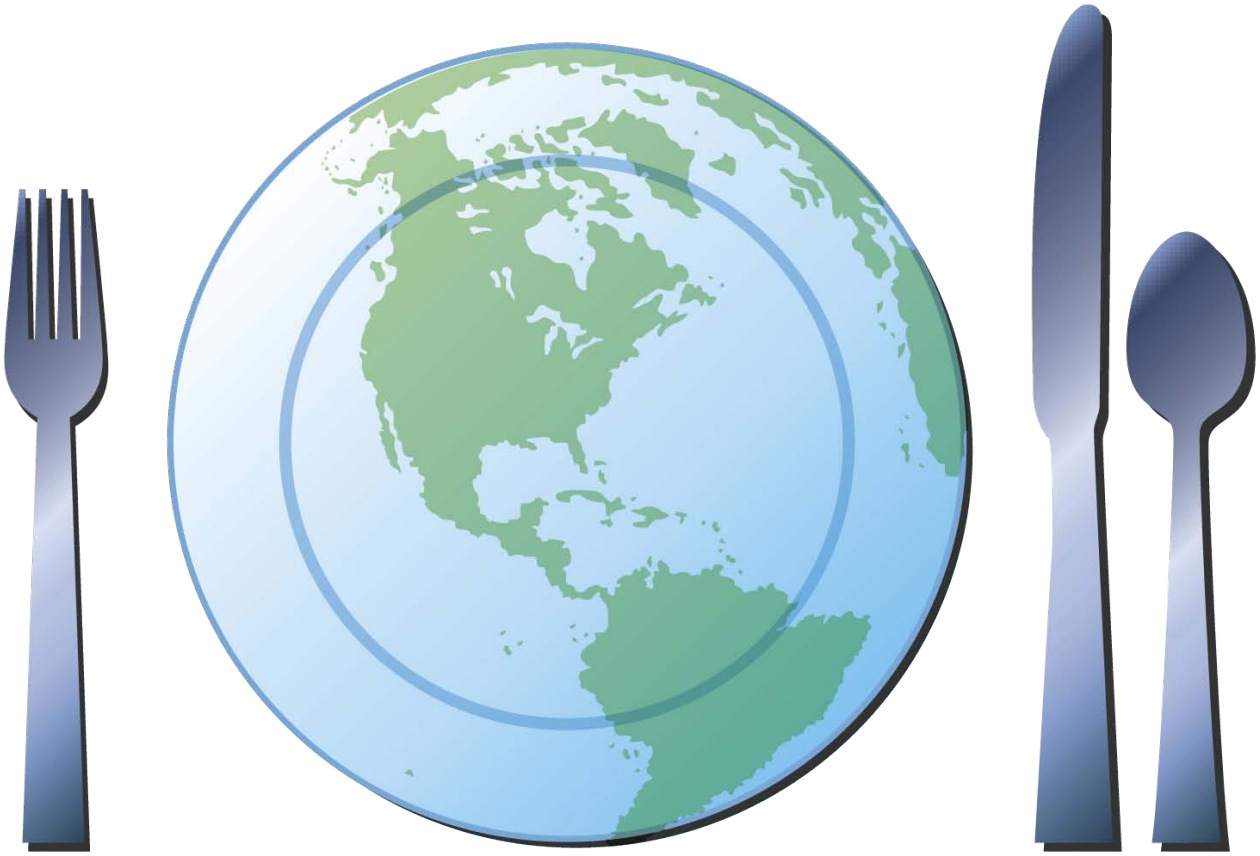
Yvonne Vizzier Thaxton
Mississippi State University (Poultry Industry)

World and U.S. population growth: How can we feed everyone?

William Weldon
Elanco Animal Health

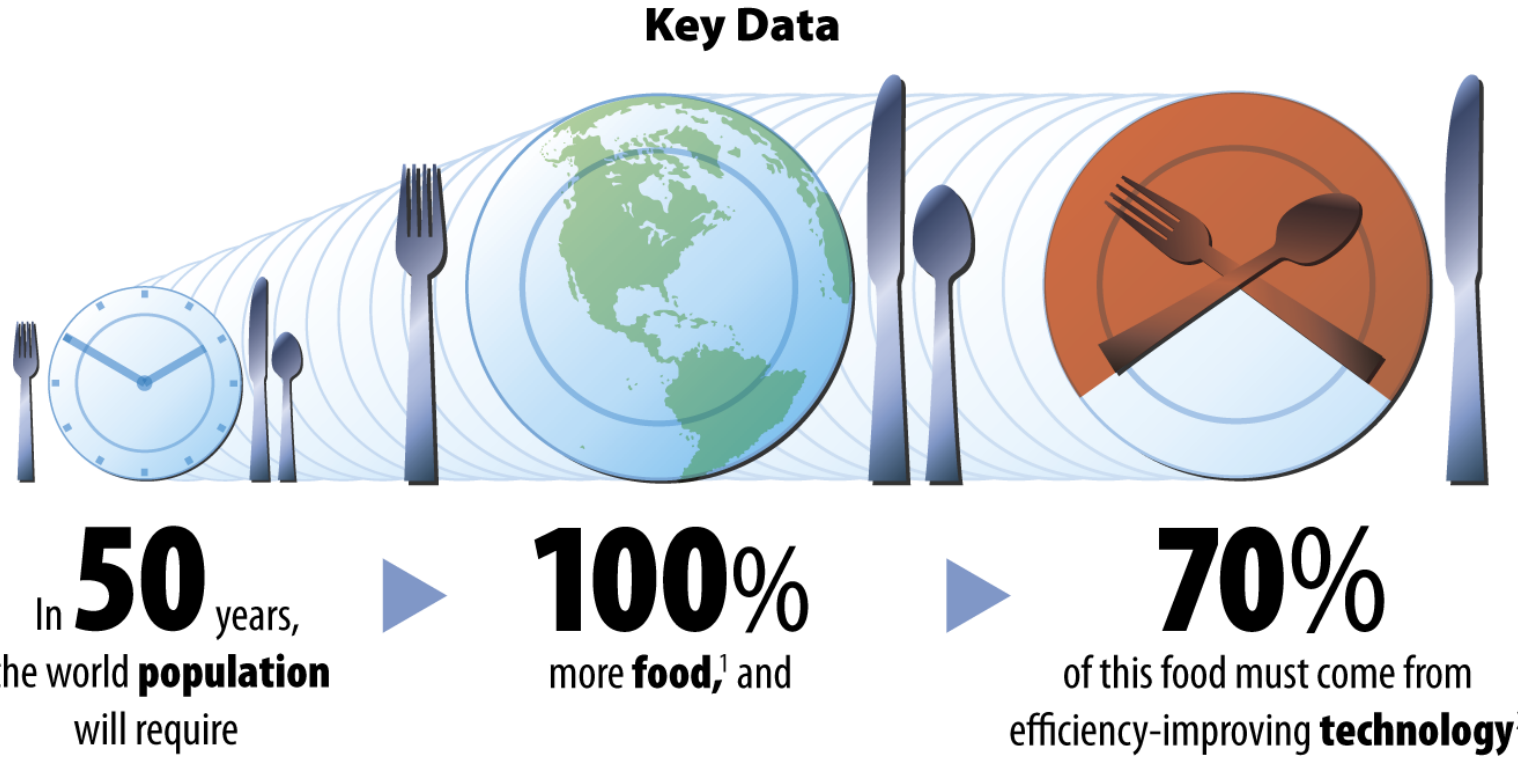
Food Economics and Consumer Choice

Why agriculture needs technology to help meet a growing demand for safe, nutritious and affordable food



Food Economics and Consumer Choice

An overview of the challenge ahead



[1] Green, R. et al. January 2005. “Farming and the Fate of Wild Nature.” Science 307.5709: 550-555; and Tilman, D. et al. August 2002. “Agricultural sustainability and intensive production practices.” Nature 418.6898: 671-677.

[2] “World Agriculture: toward 2015/2030.” 2002. United Nations Food and Agriculture Organization, Rome. Accessed 12/8/08. <ftp://ftp.fao.org/docrep/fao/004/y3557e/y3557e.pdf>.

Food Economics and Consumer Choice

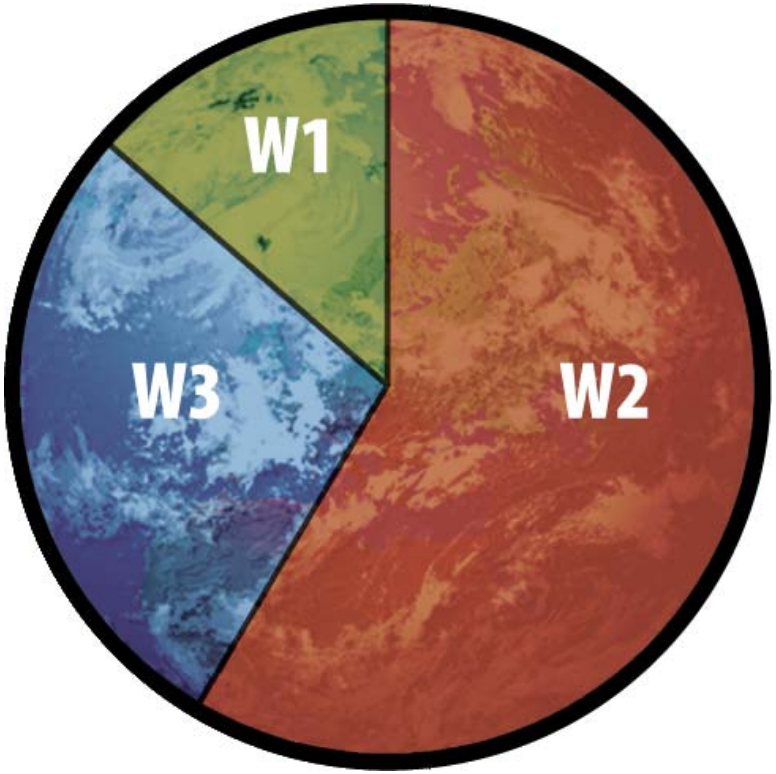
Working together, we can achieve an "ultimate win"

- Consequences of failing to use science-based technologies/innovations will be disastrous
- We all share responsibility to ensure new & proven agricultural technologies are available
- Driven by food production efficiency, agriculture can achieve the "ultimate win" for consumers:
  - Affordability
  - Abundant supply
  - Food safety
  - Sustainability
  - Ample grain for biofuels

Food Economics and Consumer Choice

Will population growth outpace the global food supply?

- **First World (W1)**
  Total estimated population, 2008: <1 billion
- **Second World (W2)**
  Total estimated population, 2008: 3-4 billion
- **Third World (W3)**
  Total estimated population, 2008: 1-2 billion



Hines, A. July-August 2008. "Consumer Trends in Three Different 'Worlds.'" The Futurist.

Agricultural technology: past, present & future

- In the 20th century, ag productivity in industrialized nations expanded at a phenomenal rate
- USDA cites ag technologies (advances in genetics, nutrition, disease/pest control & livestock management) as important factors for this increased productivity[1,2]
- Refining these technologies & discovering new ones will be critical to expanding productivity improvements in this century

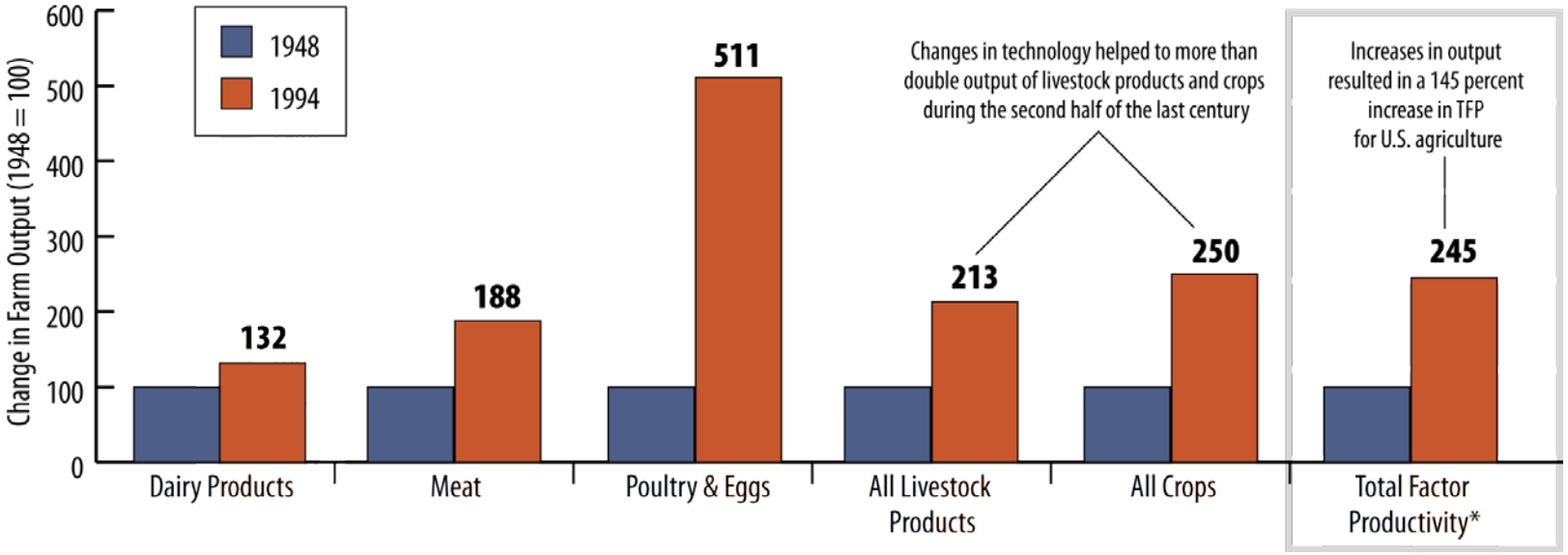
[1] Fuglie, K., MacDonald, J., Ball, E. September 2007. "Productivity Growth in U.S. Agriculture." United States Department of Agriculture Economic Research Service. Economic Brief No. 9.
[2] Ahearn, M., Yee, J. et al. January 1998. "Agricultural Productivity in the United States." United States Department of Agriculture Economic Research Service. Agriculture Information Bulletin No. 740.

20th-Century technology improved ag productivity[1]

Figure 1

U.S. Farm Output & Productivity: 1948 -1994

(USDA Economic Research Service Data)



[1] Ahearn, M., Yee, J. et al. January 1998. "Agricultural Productivity in the United States." United States Department of Agriculture Economic Research Service. Agriculture Information Bulletin No. 740.

Food Economics and Consumer Choice

The consumer perspective

- Only 7% worry about agricultural production methods[1]
- Only 1% cite biotechnology as a top-of-mind concern[1]
- Most assume the meat/poultry they buy is safe[2]
- Only 17% in 2008 were interested in knowing about food animal production (~60% had little/no interest)[2]
- Primary food concern in 2008: **affordability**[3]

[1] "2008 Food Biotechnology: A Study of U.S. Consumer Trends." August 2008. International Food Information council.
[2] Studies sponsored by the animal health industry in partnership with Elanco Animal Health. 2001 study conducted by Ipsos Reid; 2004 study conducted by Forward Research; 2008 study conducted by Ipsos Forward Research.
[3] "Research Study: Consumer Trust in the Food System." October 2008. The Center for Food Integrity.

The consumer perspective *(continued)*

Figure 2

Consumer Agreement That Today's Food Supply Is Safer Than It Was During Their Childhood

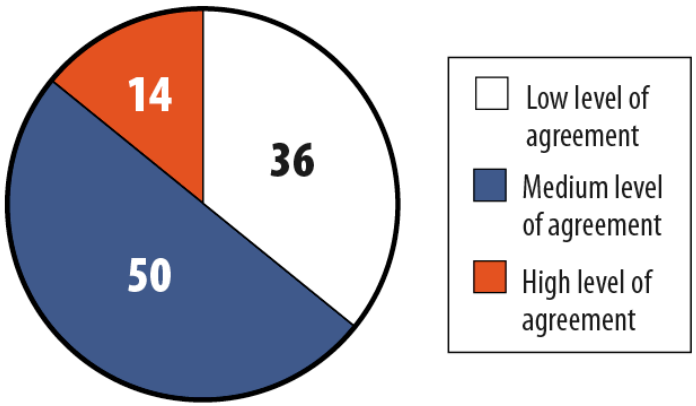
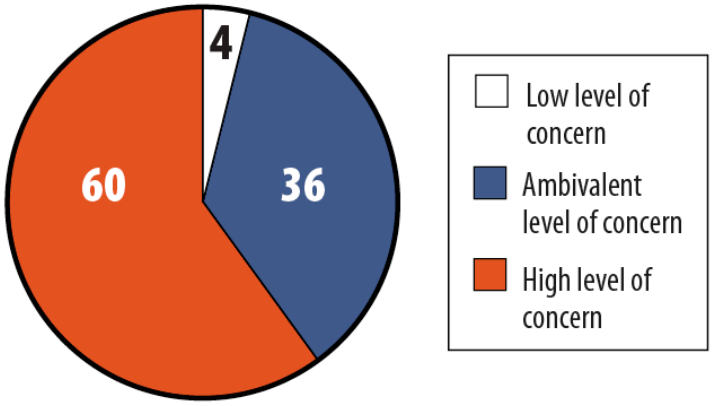


Figure 3

Consumer Concern About Food Prices



Sixty-four percent of Americans believe today's food supply is even safer than it was when they were young, though 60 percent express a high level of concern about food prices.[1]

[1] "Research Study: Consumer Trust in the Food System." October 2008. The Center for Food Integrity.

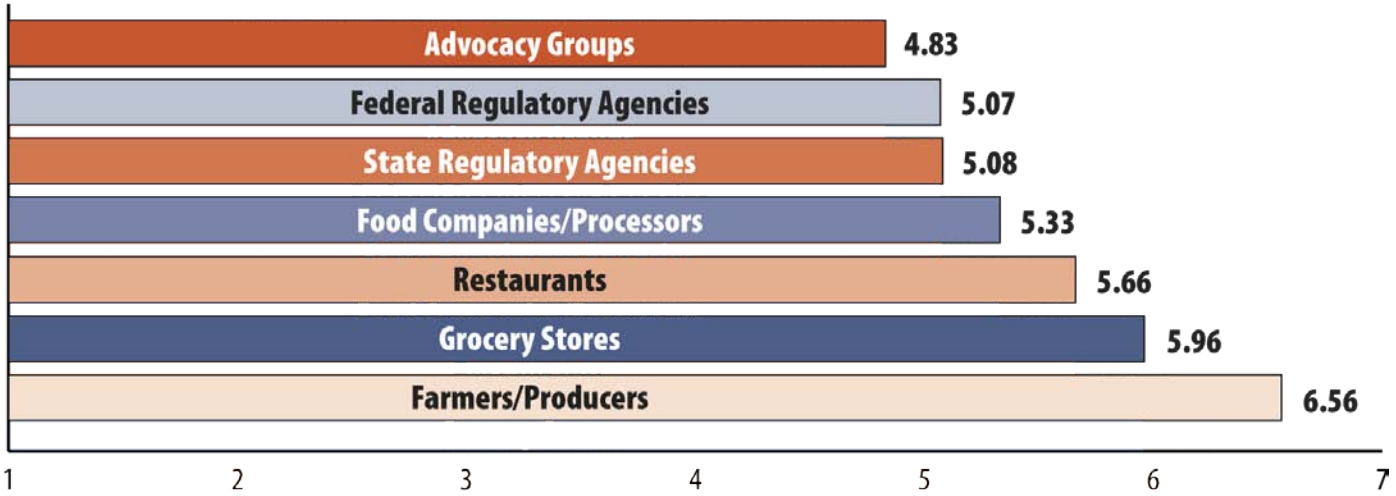
The consumer perspective *(continued)*

- Consumers trust farmers most to ensure food safety[1]

Figure 4

Whom Do Consumers Trust to Ensure Food Safety?

(1 = Trust Least, 10 = Trust Most)



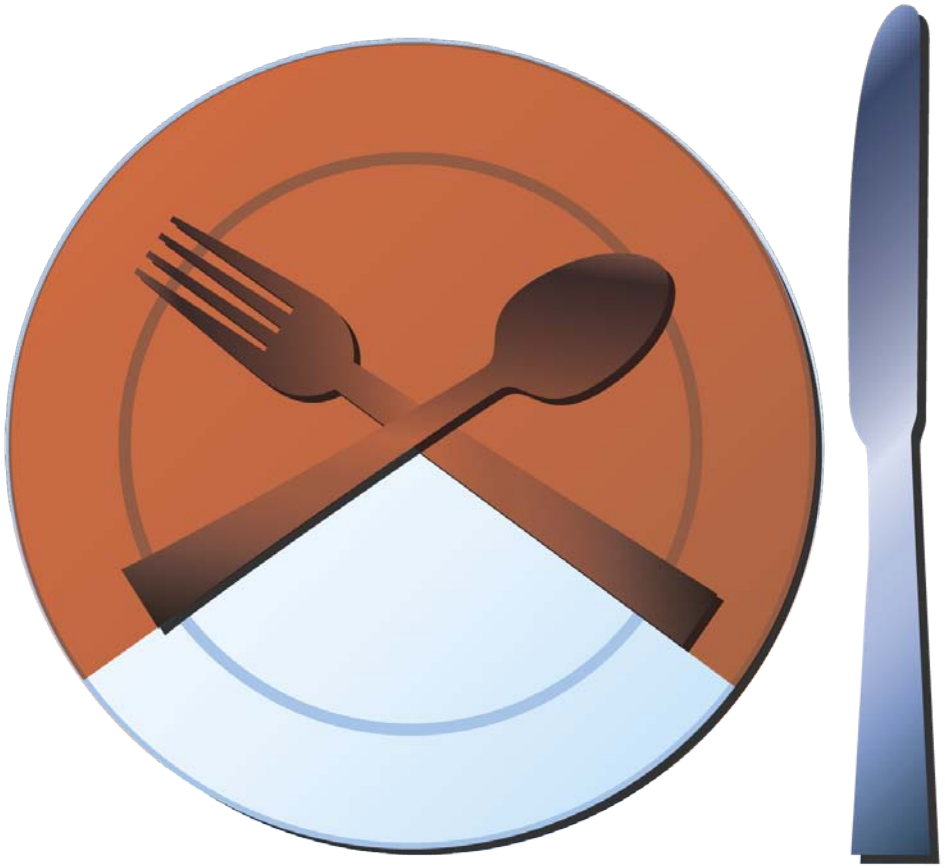
[1] "Research Study: Consumer Trust in the Food System." October 2008. The Center for Food Integrity.

The consumer perspective *(continued)*

- Consumers also want choice
- Those who prefer organic foods deserve that choice
- 75% of the world's population can't afford organic foods
- All consumer preferences can & should be protected

Food Economics and Consumer Choice

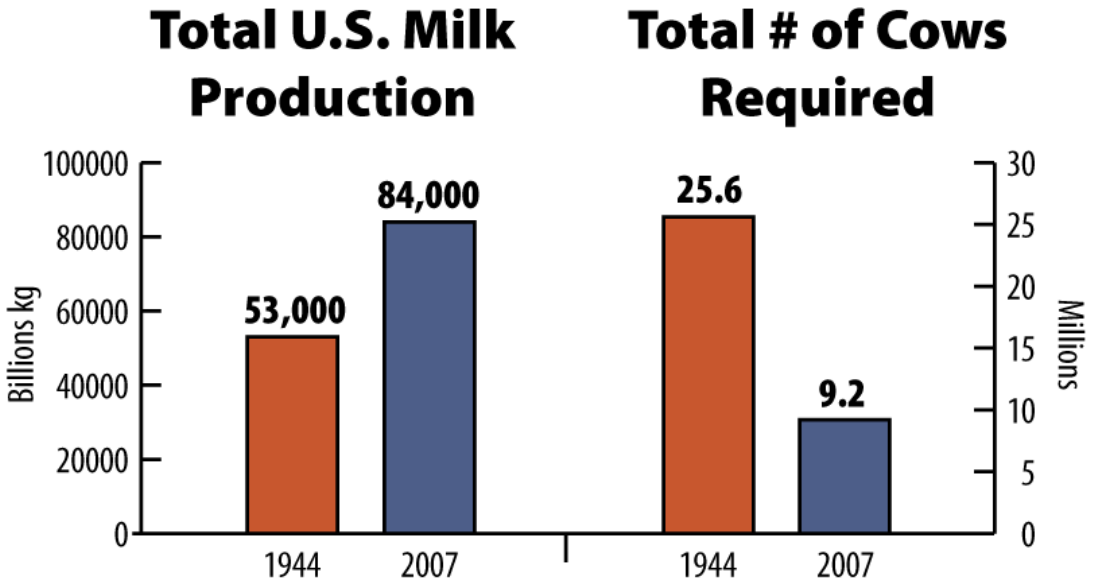
Why is technology so important for meeting the global demand for food and consumer choice?



Food Economics and Consumer Choice

Technology helps food producers provide more high-quality grains & protein sources using fewer resources

Figure 5



Historical, "all natural" farming techniques were actually highly inefficient. Using proven agricultural technologies and modern management methods, we can now produce 58 percent more milk from 64 percent fewer cows.[1]

[1] Capper JL, et al. July 2008. "Comparing the environmental impact of dairy production in 1944 to 2007." Abstract. J. Anim. Sci. Vol. 86, E-Suppl. 2/J. Dairy Sci. Vol. 91, E-Suppl. 1.

Food Economics and Consumer Choice

Technology can optimize affordability & consumer choice — especially in developing nations

- USDA reports price premiums for organic foods:[1,2]
  - 100%+ for vegetables
  - 200% for chicken
  - ~300% for eggs
- Organic agriculture may be “a realistic alternative” in 30 years, but only on a local level[3]
- Efforts to maximize choice & production efficiencies (& lower costs) for all foods—including organics—deserve support throughout the global food chain

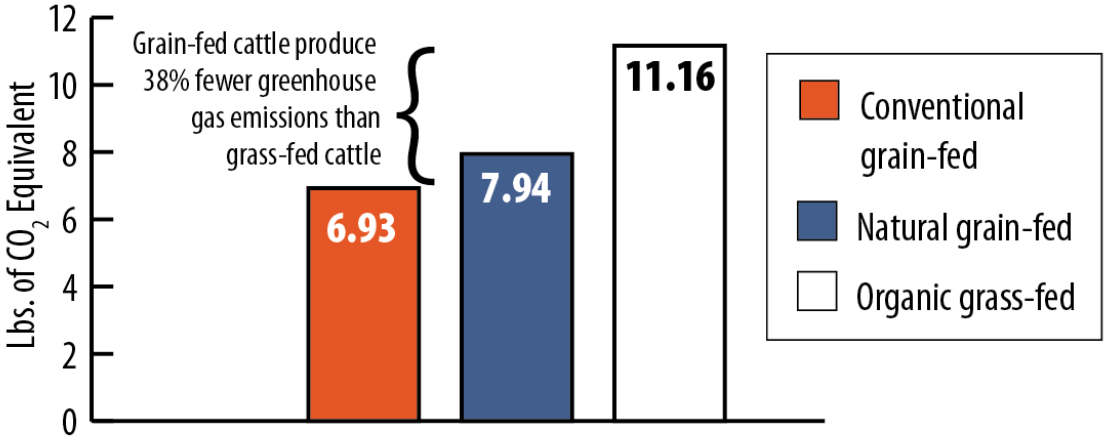
[1] Oberholtzer, L., Dimitri, C. and Greene, C. 2005. “Price Premiums Hold on as U.S. Organic Produce Market Expands.” United States Department of Agriculture Economic Research Service. VGS-308-01.
[2] Oberholtzer, L., Greene, C., and Lopez, E. 2006. “Organic Poultry and Eggs Capture High Price Premiums and Growing Share of Specialty Markets.” United States Department of Agriculture Economic Research Service. lDP-M-150-01.
[3] World Agriculture: toward 2015/2030. 2002. United Nations Food and Agriculture Organization, Rome. <ftp://ftp.fao.org/docrep/fao/004/y3557e/y3557e.pdf>.

Food Economics and Consumer Choice

Technology helps minimize global environmental impact of increased food production

Figure 6

Total Greenhouse Gas Emissions per Lb. of Beef (excludes NOx)



Today's conventional production methods help reduce total greenhouse gas emissions compared to organic methods.[1]

[1] Avery AA and Avery DA. 2007. "The Environmental Safety and Benefits of Growth Enhancing Pharmaceutical Technologies in Beef Production." Hudson Institute. Washington, D.C.

Conclusions

1. The global food industry needs technology
2. Consumers deserve the widest possible variety of safe & affordable food choices
3. The food production system can mitigate the food economics challenge & achieve an “ultimate win”:
   - Improving the affordability of food
   - Increasing the food supply
   - Ensuring food safety
   - Increasing sustainability
   - Producing more biofuels w/no negative effect on food supply

Food Economics and Consumer Choice

Pathways to success:

- **Collaboration**
- **Choice**
- **Technology**

Should there be biotechnology in the future of animal agriculture?

L. Val Giddings
PrometheusAB, Inc.

Sustaining Animal Agriculture: Balancing Bioethical, Economic, and Social Issues

CAST Food & Animal Agriculture Symposium

10 June 2010

Jefferson Auditorium USDA Ag South Building

Washington, DC

prometheusAB

Advanced Expertise in US and Global Biotechnology Policy™

Should there be Biotechnology in our Future?

L. Val Giddings, Ph.D.
President, PrometheusAB, Inc.
Advanced Expertise in US & Global Biotechnology


D'OH!

What a silly question...

Let’s review, briefly:

What IS biotechnology, anyway?

- Fermentation
- Tissue culture
- Embryo rescue
- Somatic cell transplantation
- Marker assisted breeding
- Genome sequencing
- Transgenics
- Etc.

Society has already answered the question:

--unequivocal “YES”

The Real question is --

how BEST to use biotechnology?

along with all the other tools
we will need in the 21st century...

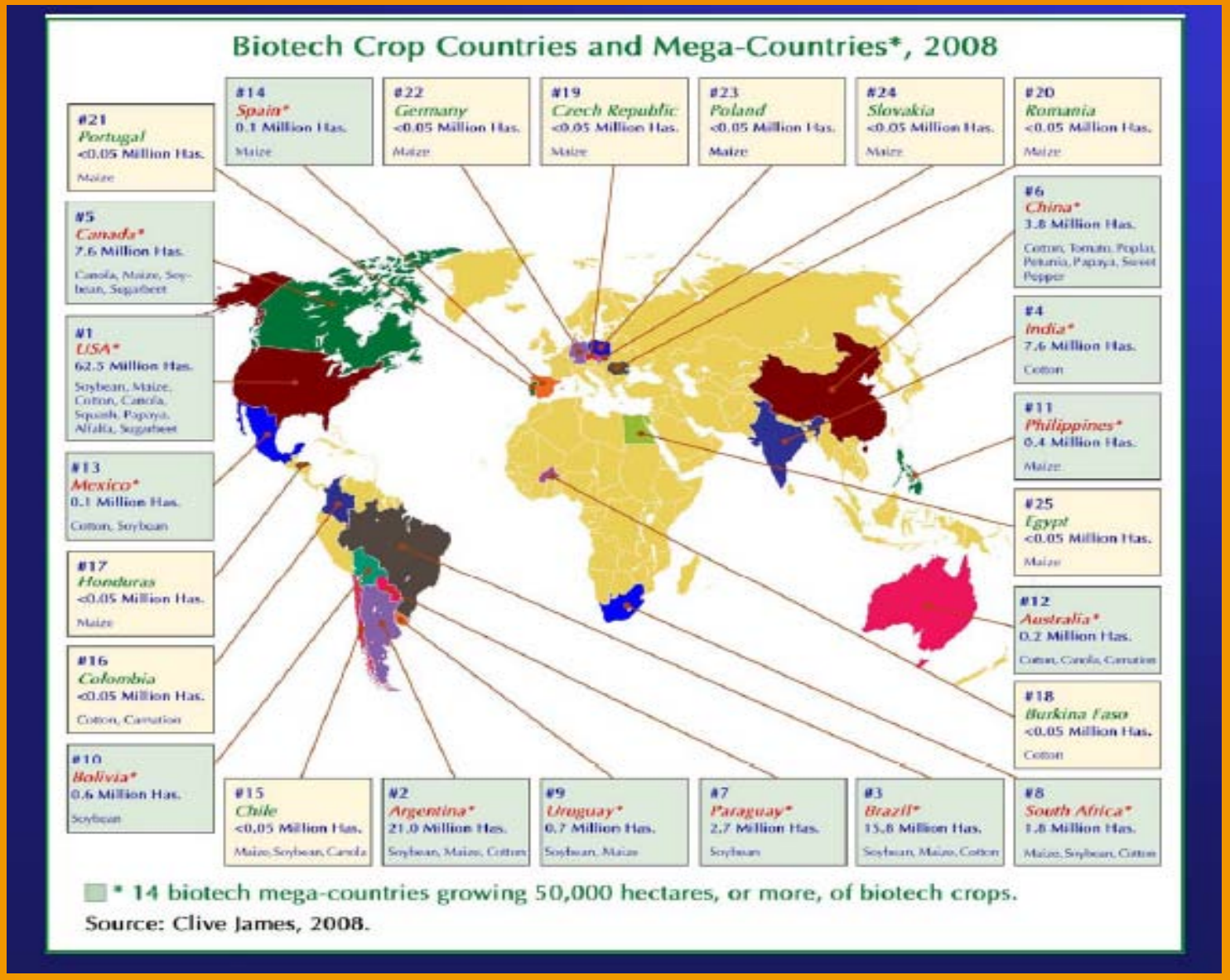
Crop Biotech has been adopted at historically unprecedented rates

- Similarly transforming events:
- Plowing ~Hundreds/thousands of years
- Hybrid seed (maize) ~ decades/thousands
- Biotech improved varieties -- handful of years until biotech = conventional

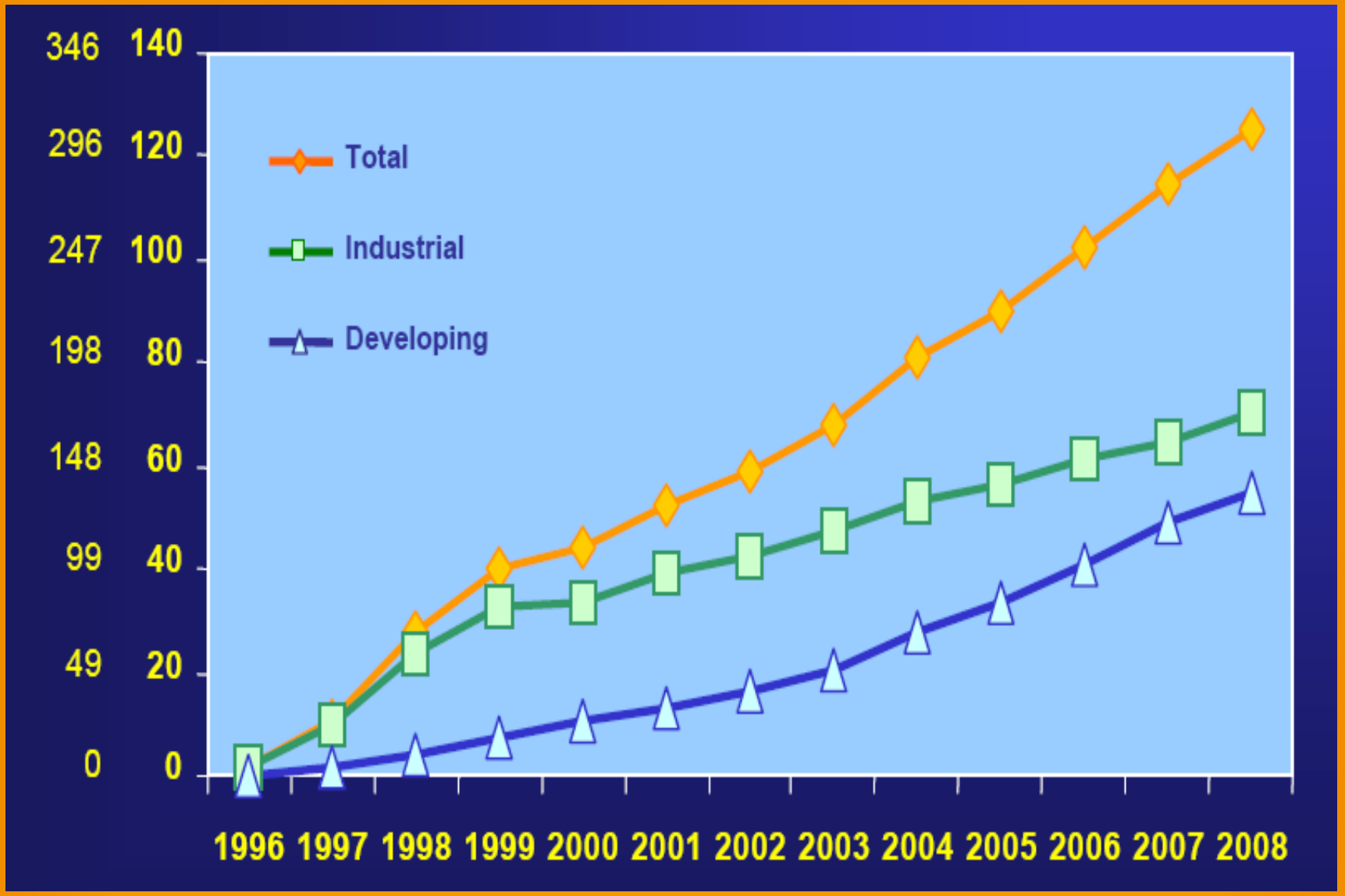
Why?

Because biotech delivers...

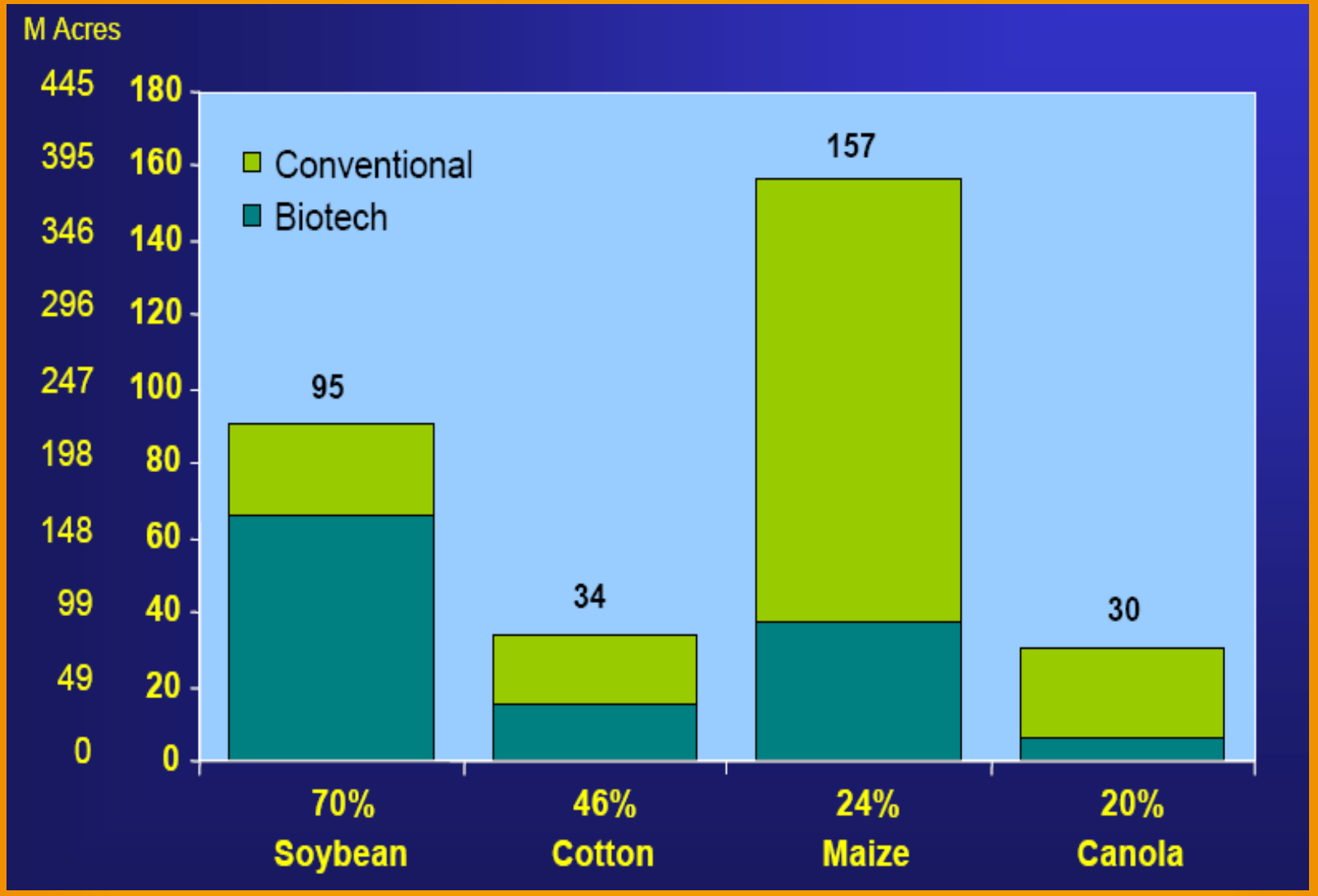
- Higher yields per hectare
- Lower input costs
- Solutions to farmers' problems (weeds, pests, disease, environmental constraints)
- Less farmer labor
- Higher farmer profits
- Higher quality/safer harvests/foods



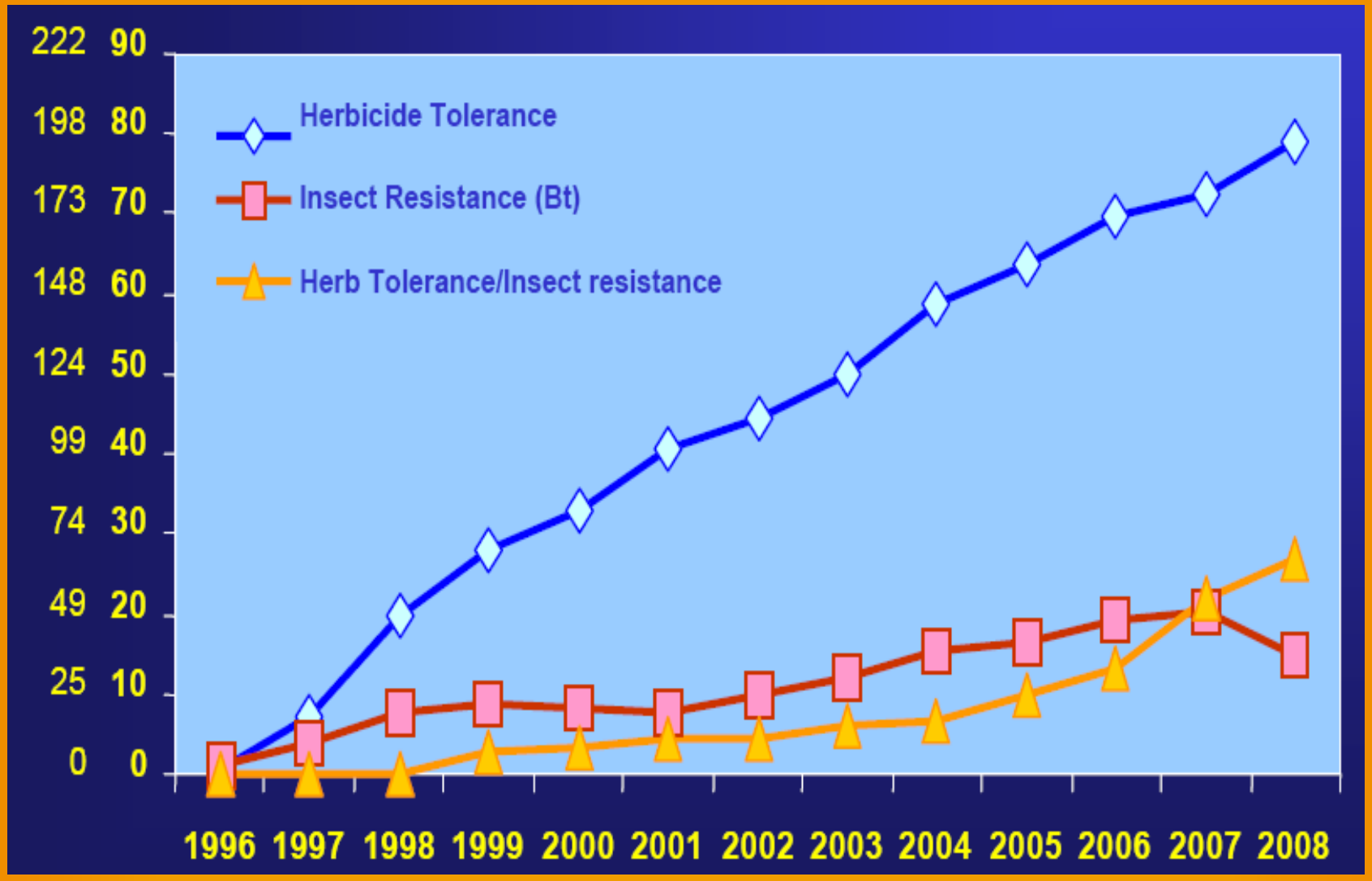
2008 Summary data on biotech crop area by country for the top 25 countries(James, 2009).



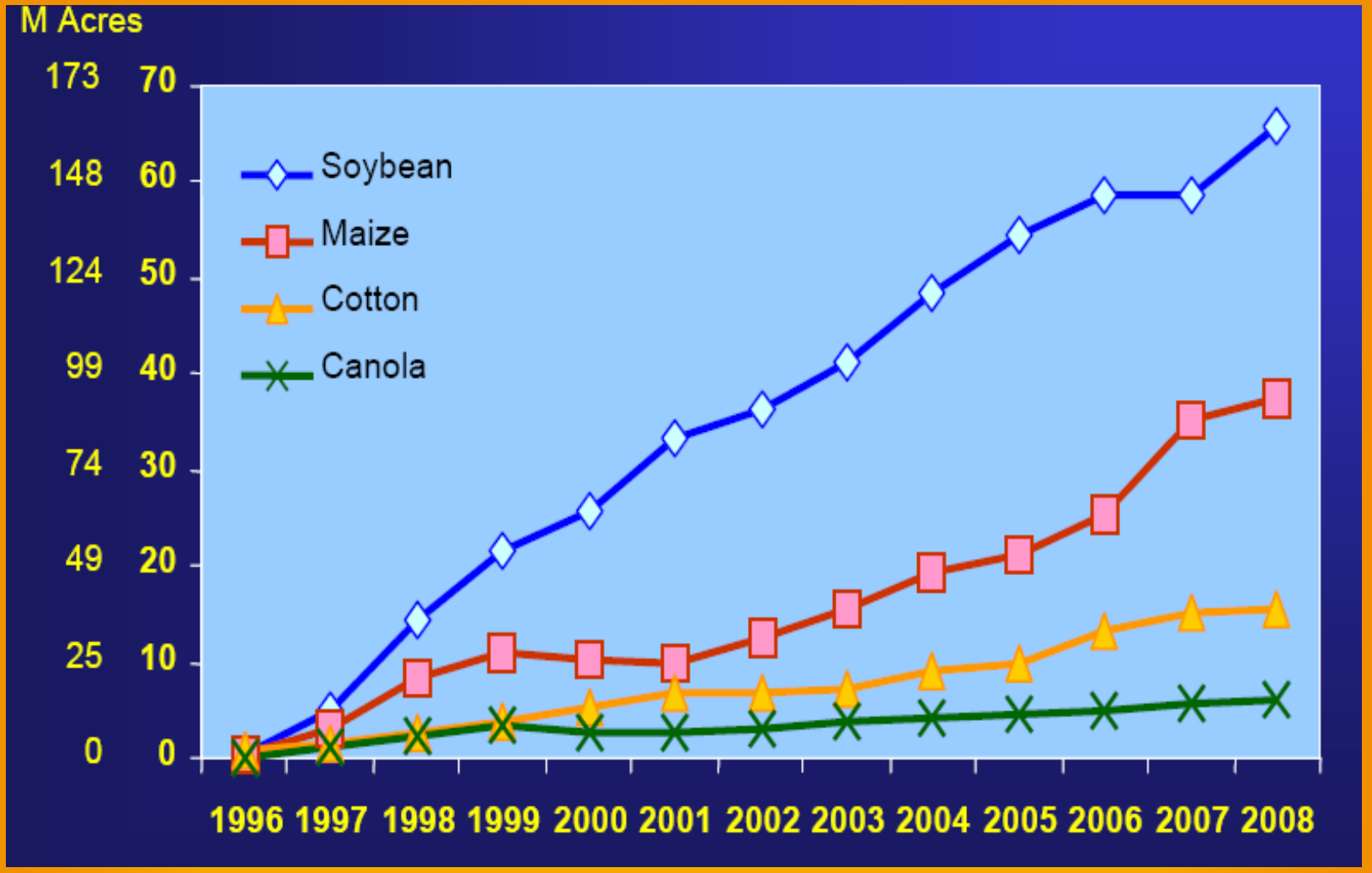
Global area of biotech crops (in acres and hectares) per year (James, 2009).



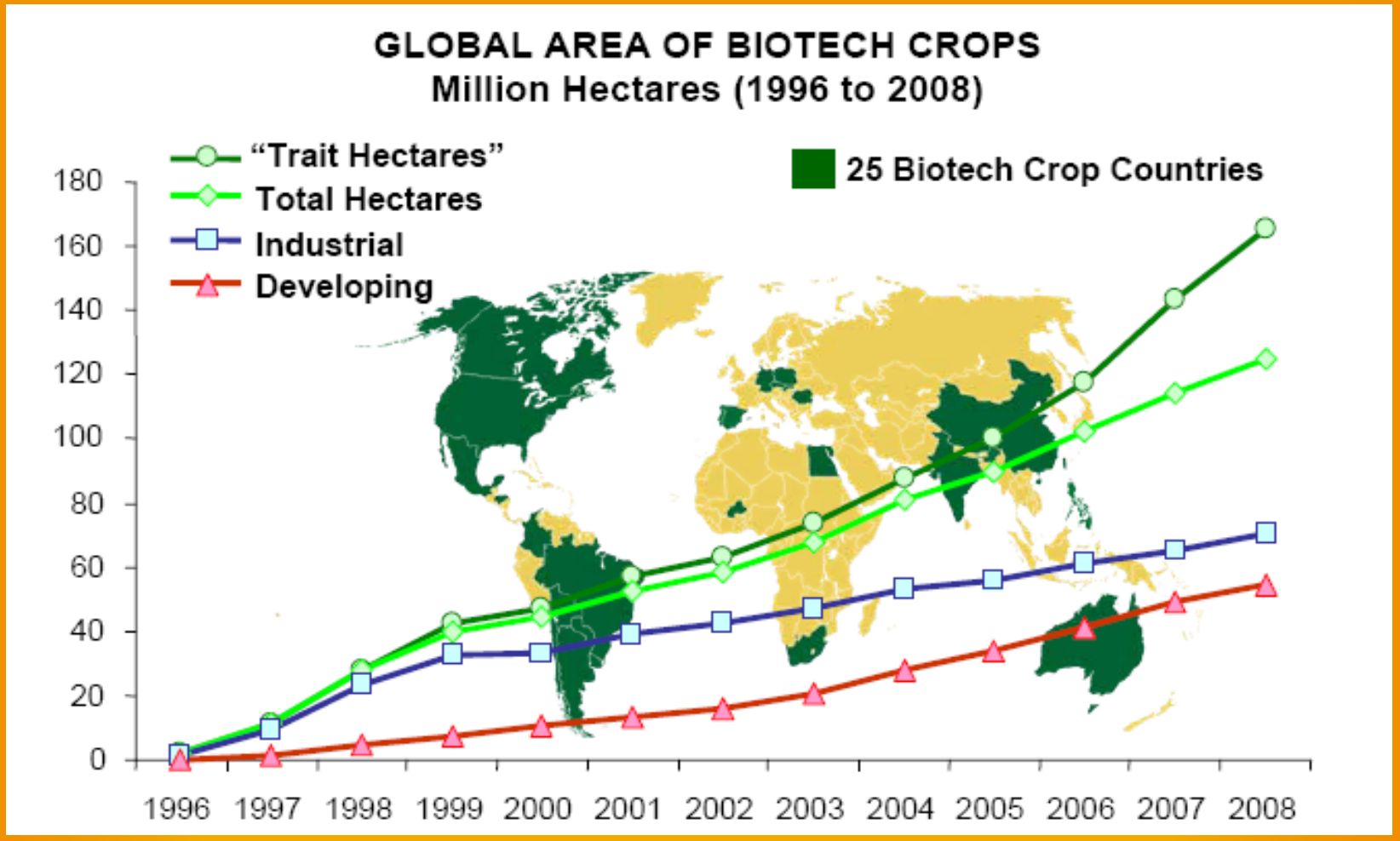
2008 global data showing quantity and proportion
of biotech vs conventional area for the top four crops(James, 2009) .



Annual growth and area of leading biotech traits (James, 2009).



Annual growth and area for biotech varieties of the top four crops(James, 2009) .



Global area (hectares) of biotech crops and traits per year, superimposed on a map showing the top 25 countries (James, 2009).

IMPACT ANALYSES IN THE PEER-REVIEWED LITERATURE

- Brookes et al. 2010 & Brookes & Barfoot, 2010 -- full reports available on www.pgeconomics.co.uk
- Peer reviewed journal: AgBioForum (2010) 13 (1) 25-52 & AgBioForum 13 (1) 76-94; also at www.agbioforum.org
- Cumulative impacts: 1996-2008
- Farm income & productivity impacts: focuses on farm income, yield, production
- Environmental impact analysis covering pesticide spray changes & associated environmental impact
- Environmental impact analysis: greenhouse gas emissions

Ag Biotech Impacts to date:

source = http://www.pgeconomics.co.uk/

- Greenhouse gas reductions in 2008 = 15.6 B kg CO_2 (6.9 M cars for 1 year)
- 352 M kg reduction in pesticide AI sprays 1996-2008 ~120% EU use in 1 year
- 58% of income gains to LDC farmers in 2007; 50% from 1996-2007
- +79.7 M tons corn, +74 M tons soy, +8.6 M t cotton & 4.8 M t canola since 1996

Ag Biotech Impacts (cont.):

source = http://www.pgeconomics.co.uk/

- Average yield gains (1996-2007) corn = 6%; cotton = 13%.
- Highest yield gains by developing country farmers.
- Added production (1996-2007) energy savings enough to feed 402 M people for 1 year; in 2007 88 M (Philippines)
- Without biotech would have taken additional 4.6 M ha soya, 3.5M ha maize, 2.2 M ha cotton; ~ 21% of arable land in Brasil, 6% of US

Yield gains versus cost savings

- 43% ($14.54 billion) of total farm income gain due to yield gains 1996-2006
- Balance due to cost savings
- Yield gains mainly from IR technology
- Cost savings mainly from HT technology
- Yield gains greatest in developing countries
- Cost savings mainly in developed countries
- HT technology also facilitated no tillage systems – allowed second crops (soy) in the same season in S America

Additional global production on areas planted to biotech crops in 2006

- Soybeans: +20%
- Corn: +7%
- Cotton: +15%
- Canola: +3%

Impact on pesticide use

- Significant reduction in global environmental impact of production agriculture
- Since 1996 use of pesticides down by 352 m kg (-8.4%) & associated environmental impact - 16.3% - equivalent to total EU pesticide active ingredient use on arable crops in one year!
- Largest environmental gains from IR cotton: savings of 5.6 million kg insecticide use & 25% reduction in associated environmental impact of insecticides

Reduced GHG emissions: 1996-2006

- less fuel use = 5.8 billion kg CO_2 emission saving (2.6 m cars off the road)
- additional soil carbon sequestration = 63.9 billion kg CO_2 saving if land retained in permanent no tillage. BUT only a proportion remains in continuous no till so real figure is lower (lack of data means not possible to calculate)

How do we know
this stuff is safe?

Fact:

- Crops improved through biotechnology have been subjected to more scrutiny, in advance, in depth and detail, than any other crops in human history.
- The safety record is without blemish. (there have been a few compliance issues)
- Suggestions to the contrary are inaccurate.

Indeed, the use of more precise technology and the greater regulatory scrutiny probably make [GM foods] even safer than conventional plants and foods;...
...the benefits of these plants and products for human health and the environment become increasingly clear.

--European Commission, Press Release of 8 October 2001, announcing the release of 15 year study incl 81 projects/70M euros, 400 teams (http://ec.europa.eu/research/fp5/eag-gmo.html and http://ec.europa.eu/research/fp5/pdf/eag-gmo.pdf)

Food from GM Maize is more healthy than from conventionally grown maize... samples with the highest fumonisin concentrations are found in products labeled “organic.”

--Commission on Green Biotechnology, Union of the German Academies of Science & Humanities, at www.abic2004.org/download/reportongmohazards.pdf

The fact is, arguments that we do not have enough information to assess the risks grow weaker by the year. Tens of billions of meals with GM foods have been eaten. This real-world experiment, Australian Academy of Science president Jim Peacock observes, has had no documented ill effects on human health.

--The Age (Australia), 20 Feb 2006

The risks GE crops pose for the environment, and especially biodiversity, have been extensively assessed worldwide during the past ten years of commercial cultivation. Consequently, substantial scientific data on environmental effects of the currently commercialized GE crops is available today.... **The data available so far provide no scientific evidence that the commercial cultivation of GE crops has caused environmental harm.**

-- Olivier Sanvido. Michele Stark, Jorg Romeis & Franz Bigler. Ecological impacts of genetically engineered crops: Ten years of field research and commercial cultivation. ISB News Report, December 2006, pp. 6-9. www.isb.vt.edu.

Anti-GM campaigns have focused on possible environmental and food safety concerns associated with GM crops and food products. **The likely position is, in fact, the complete opposite. GM crops offer potentially significant health and environmental benefits.** For example, adoption of GM varieties has transformed the Australian cotton industry's environmental performance, reducing insecticide use by 70 per cent over the past decade.

Agriculture and Food Policy Reference Group, Government of Australia. 2006. in a report titled Creating our Future: Agriculture and Food policy for the Next Generation. At http://www.agfoodgroup.gov.au/next_generation.html

Mariann Fischer Boel
EU Commissioner of Agriculture

- The EU is lagging behind the rest of the world over genetically modified food and imports are being blocked because the authorisation process is so slow, according to the EU's agriculture chief.
- this is not because evidence of risk has been found. Instead, it is because the political decision is being "knocked around like a ball in a slow-motion tennis match“

16 October 2009. *EU chief calls for path of GM imports to be eased.* FoodBizDaily.com. http://foodbizdaily.com/articles/93321-eu-chief-calls-for-path-of-gm-imports-to.aspx.

"Month after month, GMOs receive a clean bill of health from EFSA but then get stuck because member states cannot get a qualified majority, in favour or against, when it comes to the proposal on authorisation…ludicrous“

– Mariann Fischer Boel, EU Commissioner of Agriculture; 20 October, 2009.
  - http://www.independent.ie/farming/fischer-boel-slams-irish-stance-on-gm-1918260.html.

So...

...what about animals?

"The greatest challenge of the 21st century: feeding 9 billion people with a sustainable agricultural production system."

--Chrispeels, 2000

GLOBAL DEMOGRAPHY

- 1999 -- 70% of people grow what they eat
- 2025 -- 50% will live in cities, will need to be fed through market channels.

FAO Projections...

- “...prices above historic equilibrium levels during the next ten years...”
- higher costs for animal feed
- Demand increase 100% over 40y
- By 2020 animal ag will produce 50% of ag production value
- Be responsible for 20% global GHG emissions...

How can we
increase production
by 100% in 40 years?

What’s the first thing a society does under economic uplift?

Increases protein consumption

FAO – SOFIA (State of World Fisheries & Aquaculture 2008)

- ALL fisheries at or exceeding sustainable yields; too many have already collapsed
- Future demands will double
- Aquaculture essential
- Environmental impacts non trivial – disease, pollution, feed conversion

Closed-circuit production = partial answer

- Tilapia
- Trout
- Salmon

To double production
FAO estimates
gains will come from:

- additional farmlands 20%
- increased intensity 10%
- innovative technologies 70%

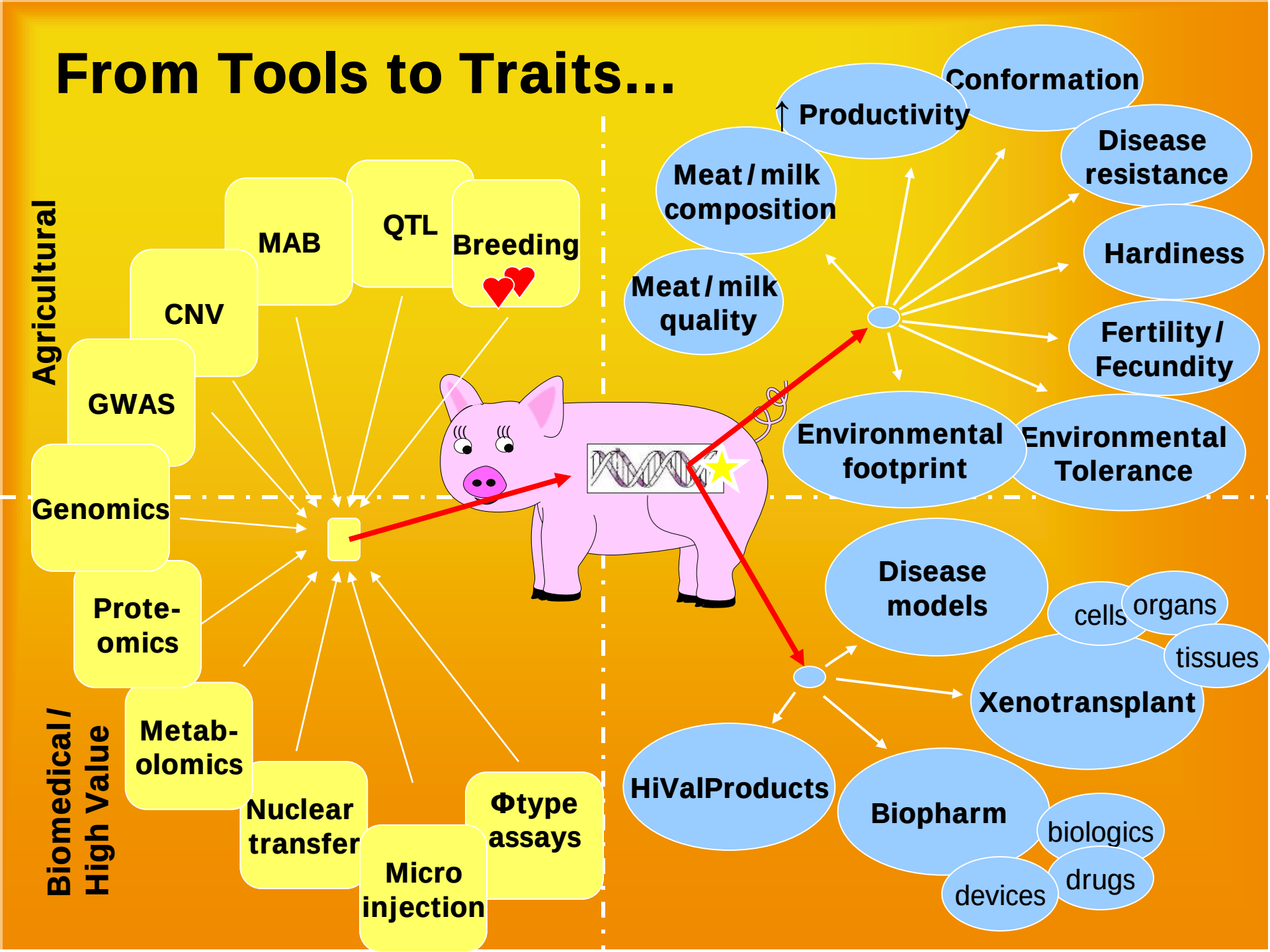
biotechnology

Where can biotechnology help?

virtually every livestock production or quality constraint can be mitigated or overcome through biotechnology

many biomedical applications as well

From Tools to Traits...



"...Societies initially lacking an advantage either acquire it from societies possessing it or (if they fail to do so) are replaced by those other societies."

--Jared Diamond

in *Guns, Germs and Steel*;

W.W. Norton, 1998, p. 407

"Instead of rejecting the solutions offered by science, we should change policies to assure that the solutions benefit the poor... Condemning biotechnology for its potential risks without considering the alternative risks of prolonging the human misery caused by hunger, malnutrition and child death is unwise and unethical."

-- Per Pinstrup-Andersen,
Director General, International
Food Policy Research Institute (IFPRI)

Further information:

- The Future of Animal Agriculture 2030: Future Trends in Animal Agriculture, USDA 2 December 2009 http://www.nal.usda.gov/awic/pubs/FTAAProceedings/FTAA_2009.pdf
- Ethical Implications of Animal Biotechnology: CAST Issue Paper 46/June 2010 http://www.cast-science.org/displayProductDetails.asp?idProduct=169
- Impact of Genetically Engineered Crops on Farm Sustainability in the United States. 13 April 2010. http://www8.nationalacademies.org/onpinews/newsitem.aspx?RecordID=12804

THANKS!

- USDA
- CAST
- Dr. Barb Glenn, BIO/CLA
- Dr. Larisa Rudenko, USFDA
- Clive James/ISAAA
- Graham Brookes, Peter Barfoot, colleagues/PG Economics

Agricultural Productivity Strategies for the Future

Gale Buchanan
Former USDA Under Secretary

Council for Agricultural Science and Technology

John M. Bonner, Ph.D.
Executive Vice President, CEO

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The CAST Mission

CAST assembles, interprets, and communicates credible, science-based information regionally, nationally, and internationally to legislators, regulators, policymakers, the media, the private sector, and the public

- **CAST is a nonprofit organization composed of scientific societies and many individual, student, company, nonprofit, and associate society members**
- **CAST uses volunteer key scientific authors and reviewers**
- **CAST provides credible, understandable science-based information to your staff and to the public**

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Primary Objective

- The primary work of CAST is the publication of task force reports, commentary papers, and issue papers written by scientists from many disciplines

- The wide distribution of CAST publications to nonscientists enhances the education and understanding of the general public

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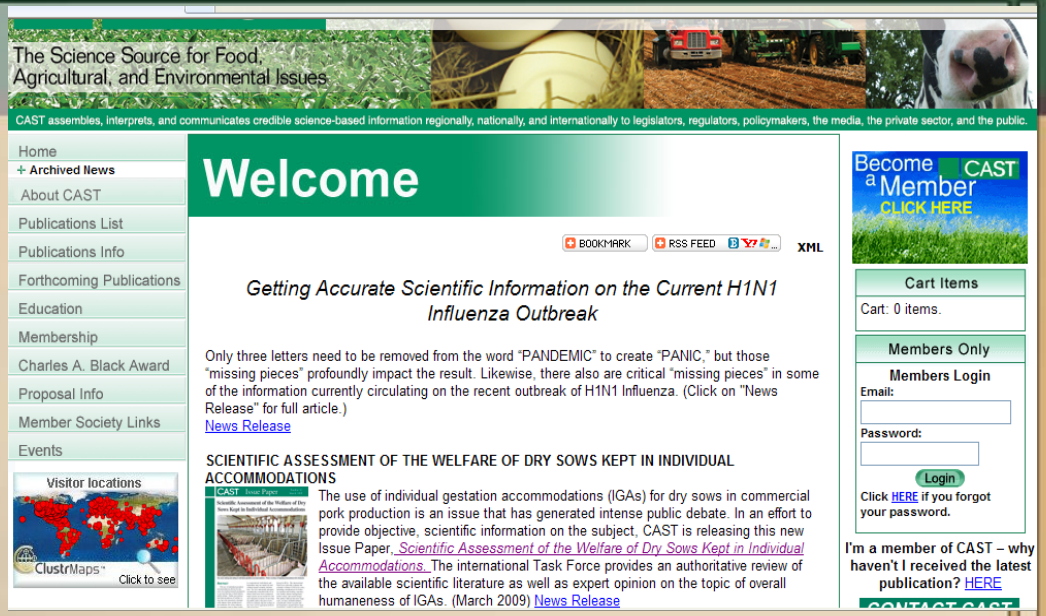

The above map depicts: **26,311 visits** from 17 Jan 2008 to 17 Jan 2009

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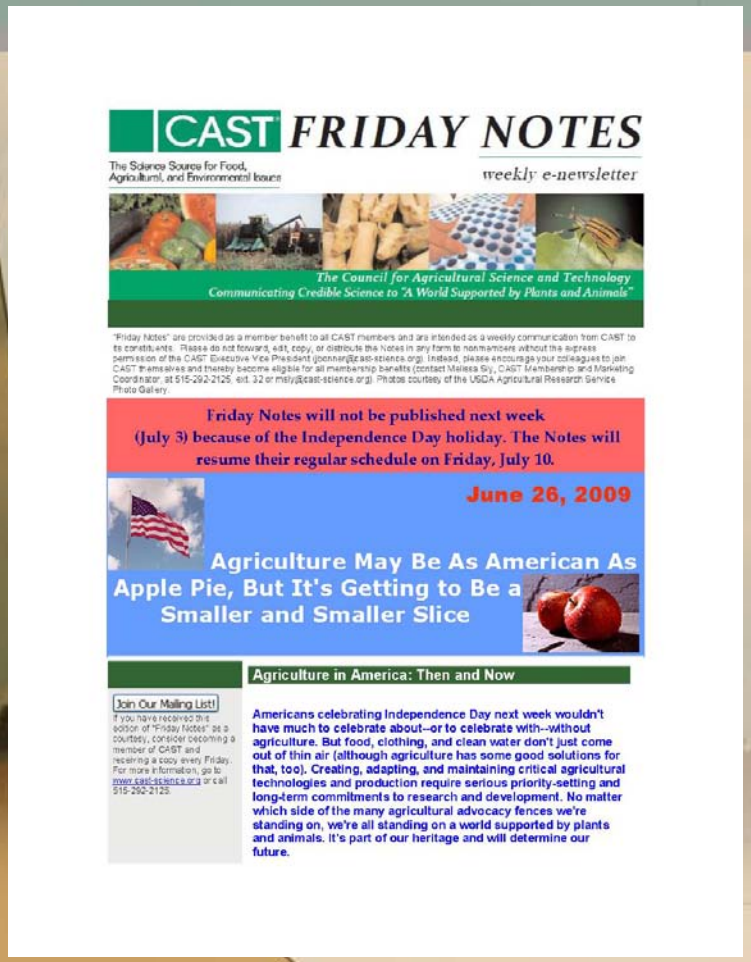
Friday Notes



CAST FRIDAY NOTES

The Science Source for Food, Agricultural, and Environmental Issues

weekly e-newsletter

The Council for Agricultural Science and Technology

Communicating Credible Science to "A World Supported by Plants and Animals"

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Friday Notes will not be published next week (July 3) because of the Independence Day holiday. The Notes will resume their regular schedule on Friday, July 10.

June 26, 2009

Agriculture May Be As American As Apple Pie, But It's Getting to Be a Smaller and Smaller Slice

Join Our Mailing List!

If you have received this edition of "Friday Notes" as a courtesy, consider becoming a member of CAST and receiving a copy every Friday. For more information, go to www.cast-science.org or call 515-292-2125.

Agriculture in America: Then and Now

Americans celebrating Independence Day next week wouldn't have much to celebrate about--or to celebrate with--without agriculture. But food, clothing, and clean water don't just come out of thin air (although agriculture has some good solutions for that, too). Creating, adapting, and maintaining critical agricultural technologies and production require serious priority-setting and long-term commitments to research and development. No matter which side of the many agricultural advocacy fences we're standing on, we're all standing on a world supported by plants and animals. It's part of our heritage and will determine our future.

- Published 48 times each year
- More than 60 current agricultural news items-- gleaned from 100+ sources
- News articles are categorized in areas of emphasis that parallel the three CAST work groups, and the "page 1" stories often feature CAST activities
- Washington, D.C. congressional updates from Meyers and Associates

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Agricultural Productivity Strategies for the Future: Addressing U.S. and Global Challenges

West view of the U.S. Capitol Building in Washington D.C. (Photo courtesy of the Architect of the Capitol.)

CAST Issue Paper 45

January 2010

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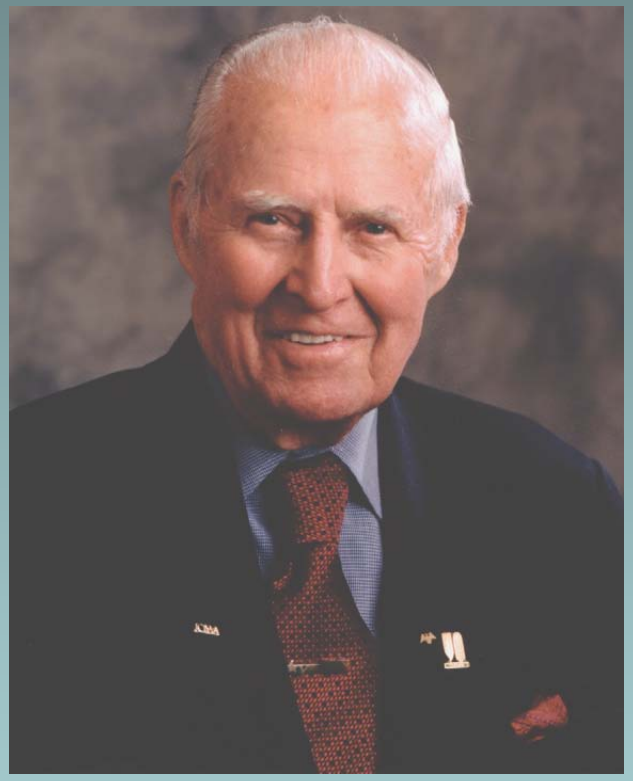

Dr. Norman E. Borlaug
1914 - 2009

Agricultural Science and the Public. 1973. CAST Paper No. 1

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Introduction

- Success of agriculture
- Issues this paper addresses
- Issues not addressed
- Correcting pathologies in the U.S. economy
- Future role of agriculture in meeting the energy and climate control challenge
- Future success of agriculture through enhanced productivity

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Future Demands Facing Agriculture

- **Principal drivers of global demand for agricultural output**
- **One billion people who today rarely get enough to eat**
- **Projections show 2025 demand for farm products will be 143% of 2000 demand**

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Bioenergy and Bioproducts Bring About a New Paradigm for Agriculture

- **We can visualize, if not see, the end of cheap petroleum**
- **Harvesting the sun's energy is one approach to meeting the energy challenge**
- **Competition for resources will require hard choices**
- **Unfolding of this process will mean an almost limitless demand for agricultural output**

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Emerging Constraints on Future Agricultural Productivity in the U.S.

- **We are aware of present constraints; others are emerging**
- **It is prudent to plan for all**

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Soil, Water and Crop Issues

- **Soil erosion is a long-term problem**
- **Water quality and quantity are affected by farming and irrigation practices**
- **Bioengineered crops offer benefits to agriculture but raise concerns in some countries**

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Animal Welfare Issues

- **Most people recognize that animal agriculture is “under fire” in some areas**
- **Society as a whole will largely determine and set social and moral standards in animal agriculture**
- **Certain production practices, if implemented, will place further demands on agriculture**

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Challenges in Animal Agriculture

- **Reduction of green house gas (GHG) emissions**
- **Balancing types of confinement with free range systems**
- **Developing alternatives to antibiotics and addressing antibiotic resistance**
- **Identifying more effective means of handling animal waste**
- **Enabling the public to gain a better understanding and appreciation for the importance of animal agriculture**
- **Developing better animal health products**
- **Food security**
- **Capturing the power of biotechnology**

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Endangered Species Act

- **Preserving diversity comes at a price**
- **We must weigh costs vs. benefits**

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Fertilizer Resources

- **Sustainability of agriculture requires a sustainable source of plant nutrients**
  - **Nitrogen**
  - **Potassium**
  - **Phosphorus**

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Global Warming

- Global warming will have an influence on agriculture by affecting the demand for natural resources
  - the crops we grow
  - the location of crop production
  - the availability of water: some areas too much, other areas too little

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Major Issues Facing Agricultural Productivity Outside the U.S.

- **Must consider agriculture from a global perspective**
  - **China: expected growing demand for food has not affected global ecosystem in past decade**
  - **India: great potential for increased production**
  - **Brazil: continued growth of agriculture is possible, but there are environmental concerns**
  - **Sub-Saharan Africa: recent increases in agricultural GDP, but significant challenges remain**

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Strategies to Meet Future Agriculture Needs for Agricultural Output

- **Success requires a supportive institutional structure**
- **Generally, this support must come from the public sector**

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Assist Less-Developed Countries (LDC)

- **Approaches**
  - **Provide food and medical support**
  - **Help build institutional and intellectual capacity**
  - **Develop international agreements and trade**
- **Must be greater commitment for sustained support for research**

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The “Next Green Revolution”

- **Strong commitment to science is necessary to meet future challenges**
- **Remember Dr. Borlaug’s challenge**
- **How do we go about making the Next Green Revolution happen?**

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Commitment of ALL branches of Science

- **Basic science**
- **Applied science**
- **Classical genetics**
- **Biotechnology**
- **Other areas such as nanotechnology**

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A Few Ideas That We Suggest Should Be Considered

- Enabling C_3 plants to utilize the C_4 photosynthetic pathway
- Nitrogen fixation in non-legumes
- Incorporating the process of apomixis into crop plants
- Improving pest resistance in plants
- Improving energy efficiency of plants
- Effectively and efficiently capturing all animal waste
- Eliminating all respiratory diseases of livestock
- Utilizing the power of genomics and biotechnology to improve food animals

What is the Commitment to Agricultural Research to Bring about Another Green Revolution?

- **Few signs the nations of the world are making the commitment to the research needed to bring about a second Green Revolution**
- **Linkage between agricultural research and productivity is unquestioned**
- **Bottom line: "We (all nations) must strengthen our commitment to research!"**

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Conclusions

- **Challenges are real**
- **Agriculture's challenge is food, feed, fiber, flowers, and now fuel or energy**
- **Convergence of so many challenges at one time is unprecedented – "The Perfect Storm"**

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Strategies for Meeting the Challenges

- **Meeting the challenges of maintaining and enhancing agricultural productivity requires broad-based support**
- **It will require constant public commitment to acquire adequate funding for agricultural research and education**
- **Greatest concern felt by the authors**
- **Remain hopeful and confident**

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Thank you for your attention!

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Questions/Discussion

CAST® Issue Paper

Number 45
January 2010

Agricultural Productivity Strategies for the Future: Addressing U.S. and Global Challenges

West view of the U.S. Capitol Building in Washington, D.C. (Photo courtesy of the Architect of the Capitol.)

Dedication

This Issue Paper is dedicated to Dr. Norman E. Borlaug who wrote the paper's preface before his death September 12, 2009, and to his myriad accomplishments. Dr. Borlaug—credited by *The Economist* with saving hundreds of millions of lives, more than any other person who has ever lived—was recipient of the 1970 Nobel Peace Prize, the Presidential Medal of Freedom, and the Congressional Gold Medal. Often called the "Father of the Green Revolution" for his pioneering work developing high-yielding wheats for areas with limited cultivated land and increasing population, Dr. Borlaug was a supporter and promoter of CAST since its inception.

Preface

By Dr. Norman E. Borlaug

Agricultural policy has played a key role in my career and will always be near and dear to my heart. I was pleased to be a featured speaker at a CAST–Industry meeting in 1973, and I was honored when CAST distributed those remarks as its first publication (CAST Paper No. 1, *Agricultural Science and the Public*, 1973). As I said in 1973: "CAST has both a tremendous responsibility and opportunity to present unbiased, scientific data so that wise policy and legislation will be enacted. I have faith that the correct decisions will be made if the facts are made known to the general public and to national and state legislative leaders" (Borlaug 2009).

Although modes of communication have changed in the 37 years since CAST was organized, agricultural policy still plays the key role in determining outcomes. Unfortunately, agricultural science—like many other areas of human endeavor—is subject to changing

This material is based upon work supported by the U.S. Department of Agriculture's (USDA) National Institute of Food and Agriculture (NIFA) Grant No. 2009-38902-20041, NIFA Grant No. 2008-38902-19327, and USDA's Agricultural Research Service (ARS) Agreement No. 59-0202-7-144. Any opinions, findings, conclusions, or recommendations expressed in this publication are those of the author(s) and do not necessarily reflect the views of USDA, NIFA, or ARS.

For a free download of the entire Issue Paper 45:

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Sustainability myths and musts—key issues for animal agriculture moving forward

Jason W. Clay
World Wildlife Fund-US

Sustainability Myths and Musts—

Key Issues for Animal Agriculture Moving Forward

Jason Clay, Ph.D

SVP, Market Transformation

WWF-US

June 3, 2010

“You can’t wake a person who’s pretending to sleep”

Oromo Proverb

population x consumption ≠ planet

We need to use less . . .

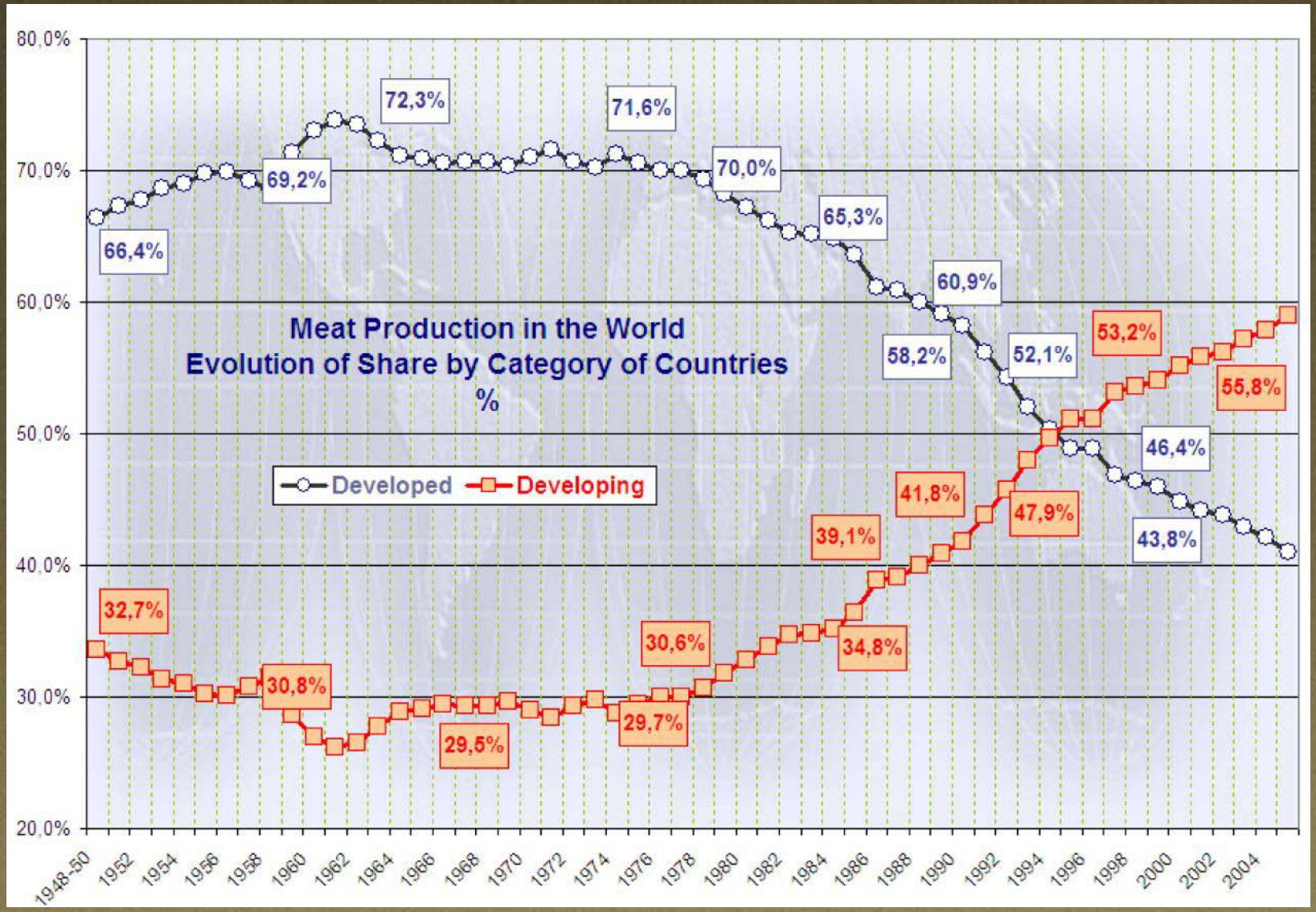
. . . to produce more from less.

Should consumers have a choice about sustainable products?

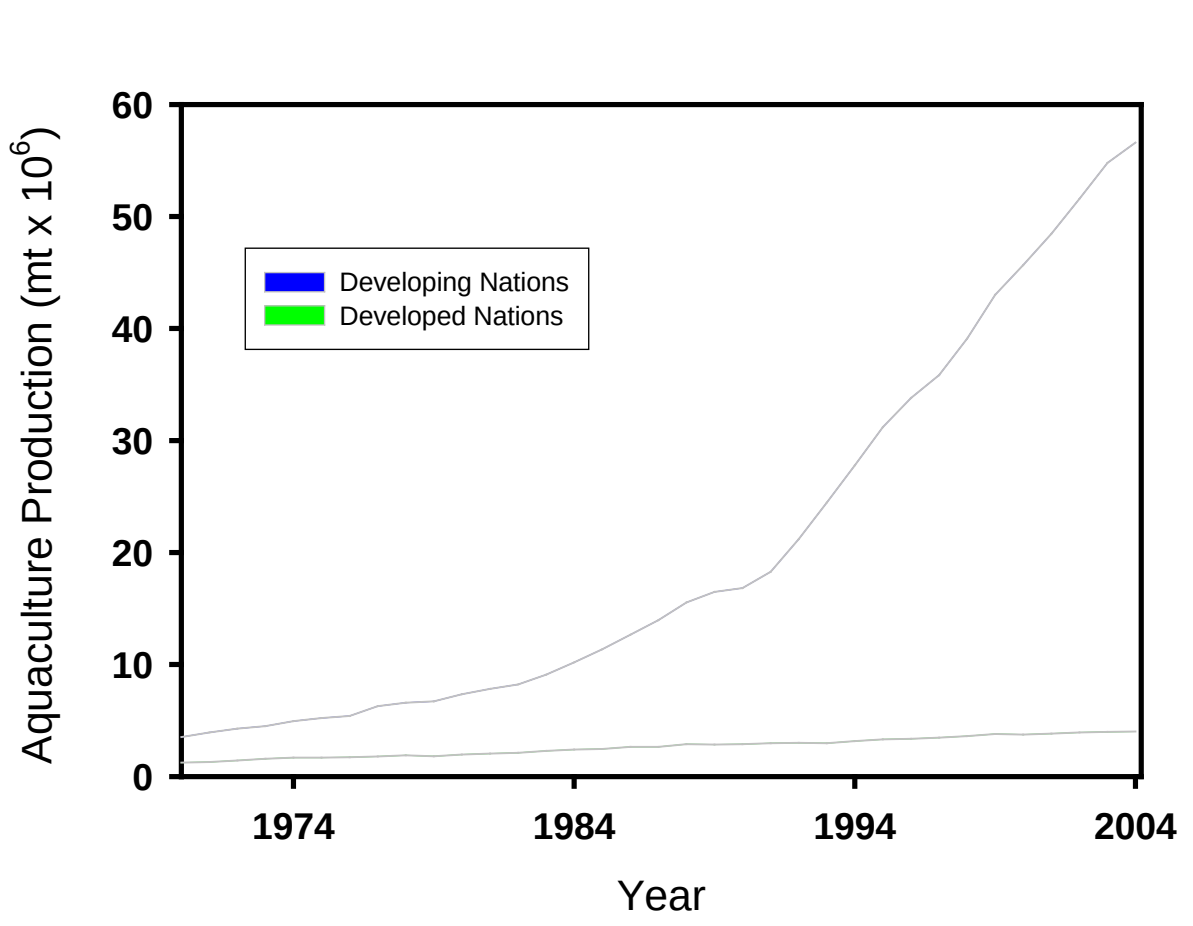
Myth 1—Most agricultural commodities are traded internationally

Myth 2—Most globally traded agriculture raw materials are produced in developing countries

However, World Meat Production Has Been Shifting to Developing Countries



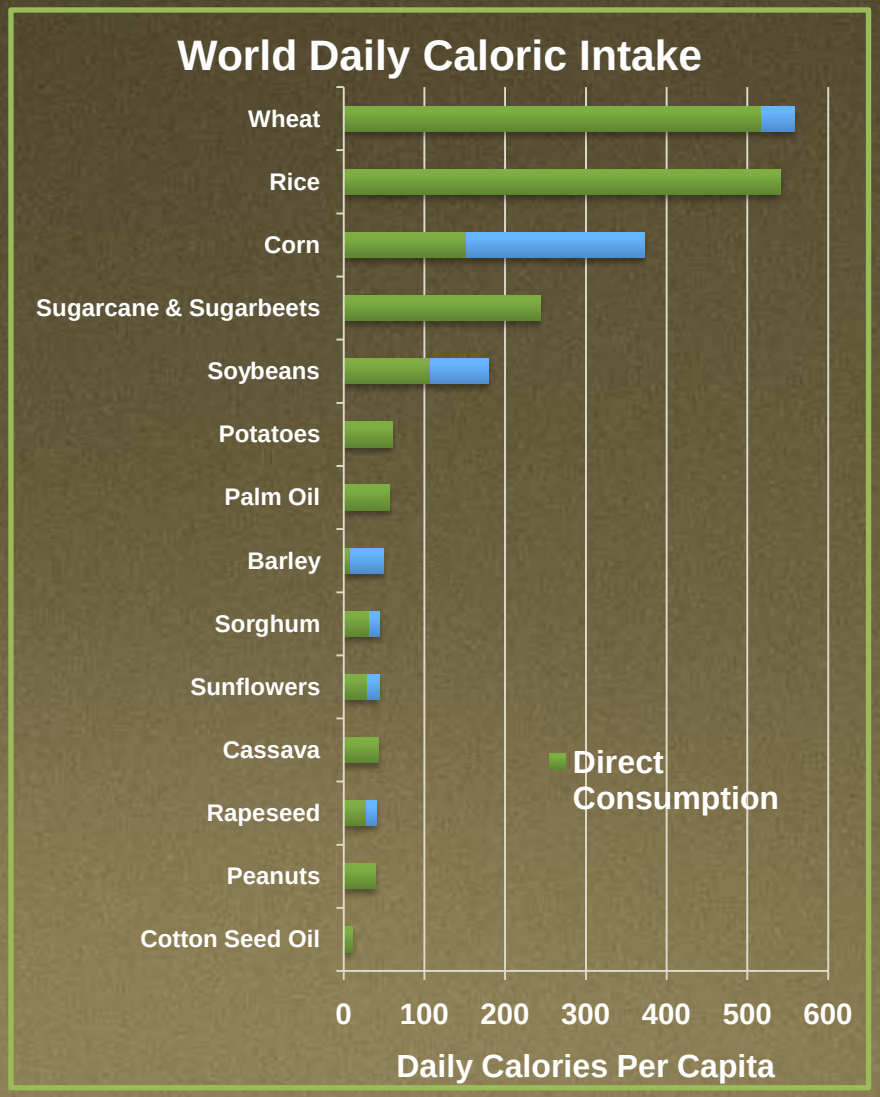
And most global aquaculture production is in developing countries



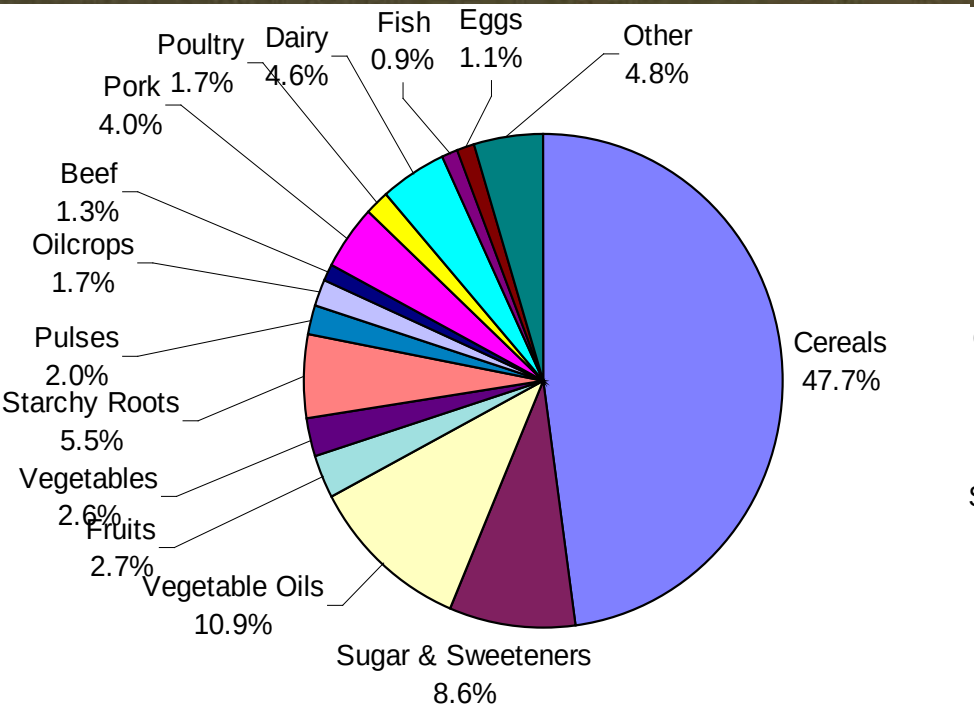
Myth 3—Most people eat a wide range of different foods

Ranking by Daily Caloric Intake

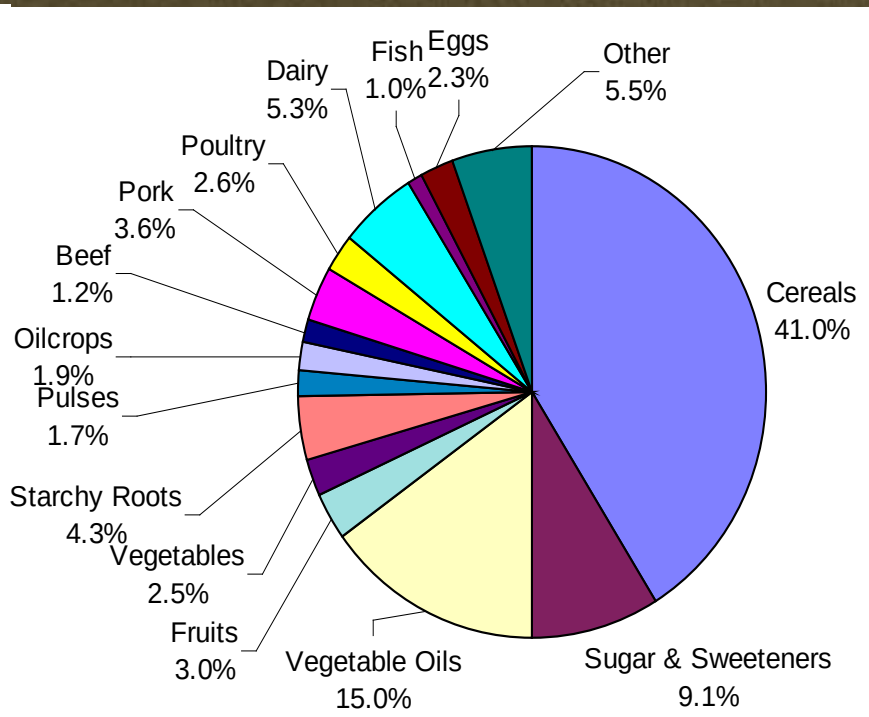
	Food Crop	Total Crop Calories (2003)	Direct Consumption	Indirect (Animal Protein) Consumption
1	Wheat	559	518	41
2	Rice	541	541	--
3	Corn	372	152	220
4	Sugarcane & Sugar beets	244	244	--
5	Soybeans	180	108	72
6	Potatoes	60	60	--
7	Palm Oil	57	57	--
8	Barley	49	8	41
9	Sorghum	45	32	13
10	Sunflowers	44	30	14
11	Cassava	43	43	--
12	Rapeseed	40	28	12
13	Peanuts	39	39	--
14	Cotton Seed Oil	11	--	--



World Projected Caloric Distribution Change



Total Calories Delivered Per Capita Per Day in 2000
World Average 2,712



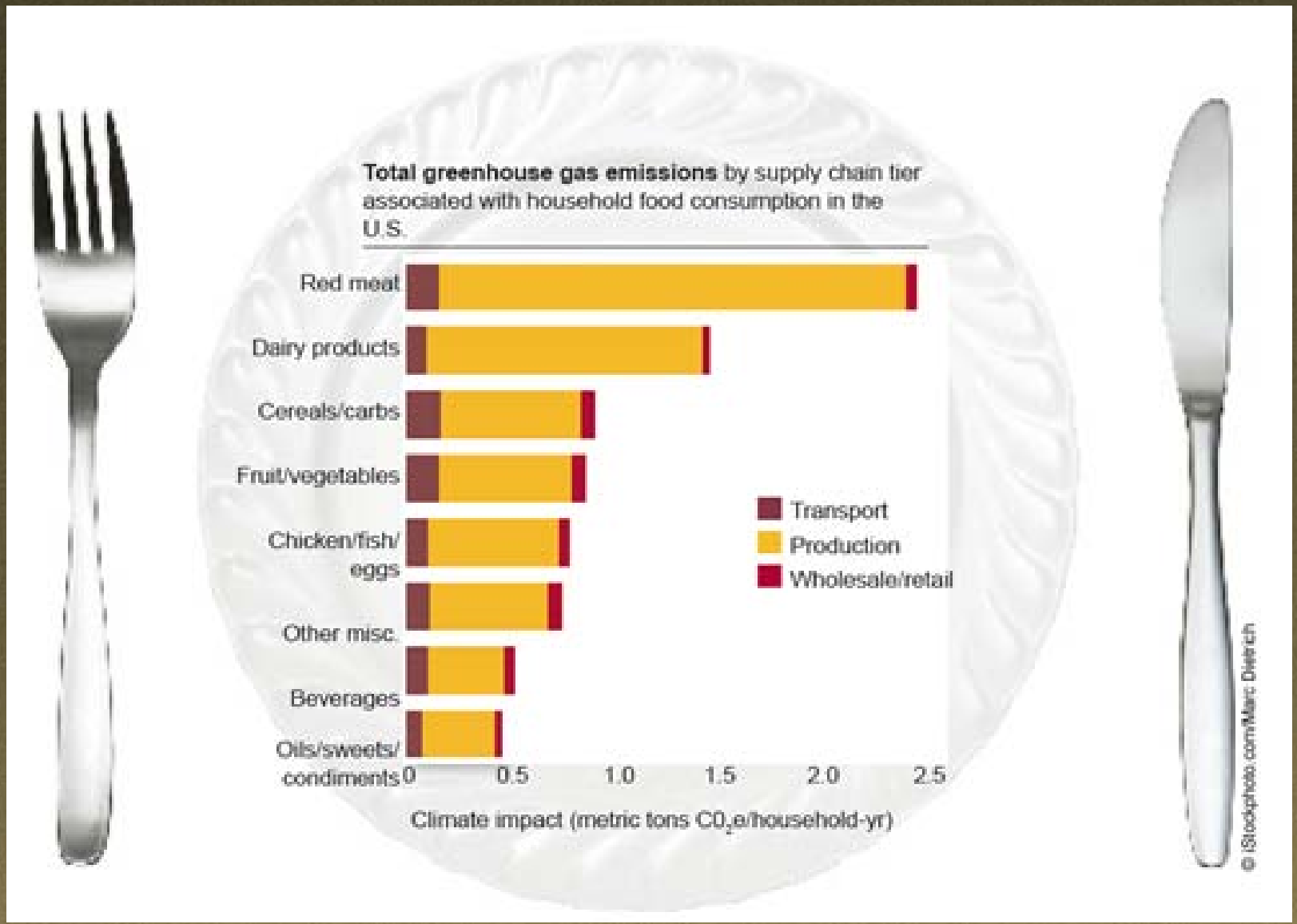
Total Calories Delivered Per Capita Per Day in 2050
World Average 3,226

Source: Calories in 2000 as reported by the Food and Agricultural Organization of the United Nations

Myth 4—Income from agriculture and food production is declining in most countries

Myth 5—Stocking density is the best indicator of animal welfare.

Myth 6—Buying locally is the most significant way to reduce GHGs from food production.



"The Problem of What to Eat" *Conservation.* Natasha Loder, Elizabeth Finkel, Craig Meisner, and Pamela Ronald. July-September 2008 9(3):31

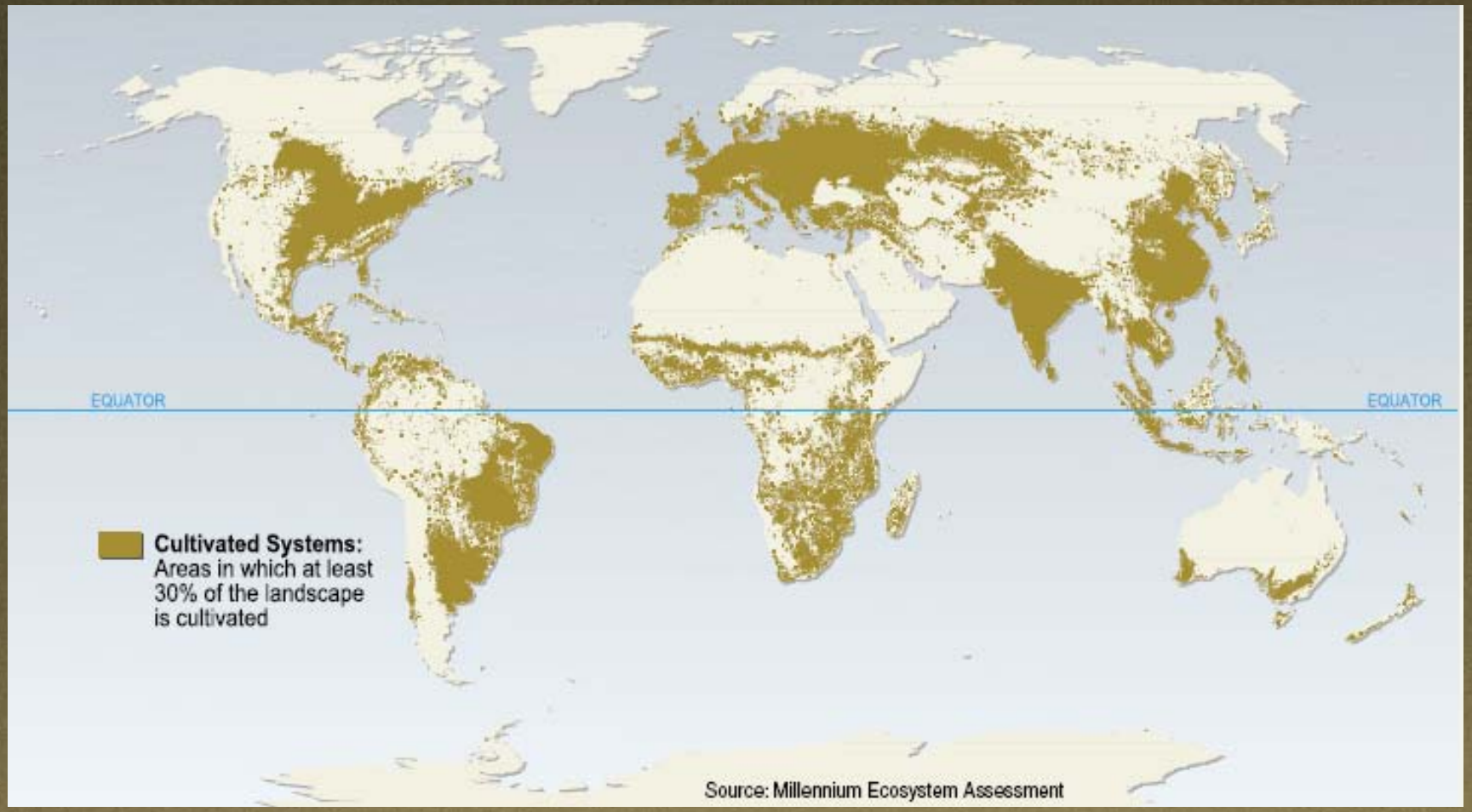
Myth 7—The price of food is increasing

Is Food Too Expensive?

Pacific Ethanol, Inc.

Myth 8—The price of food covers the cost of the resources used to produce it.

Agriculture's Global Footprint



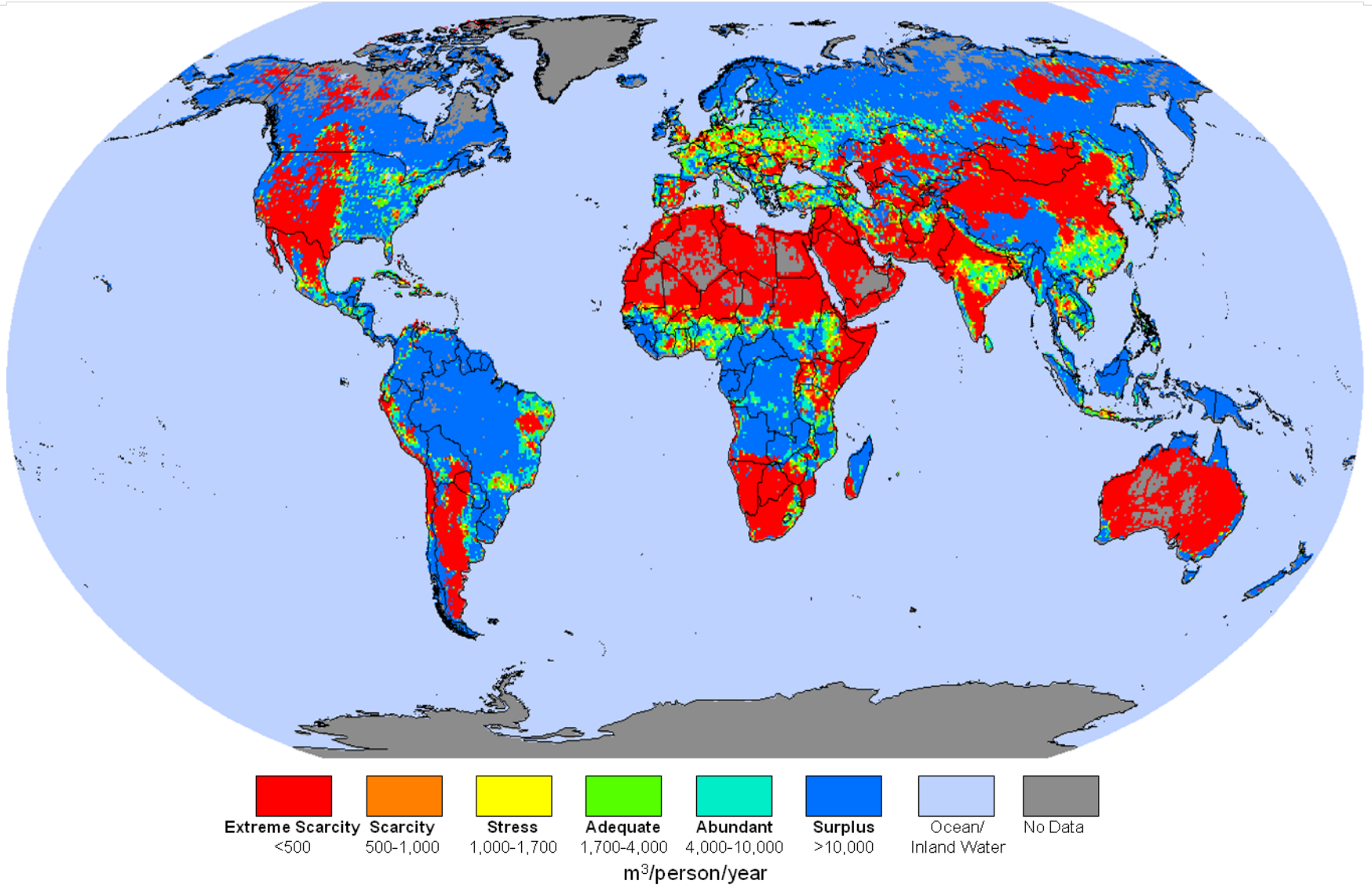
33% of Earth's surface in crops or grazing but 58% of habitable area

Beef is responsible for >60% of all land used by people for food production, but produces <2% of calories

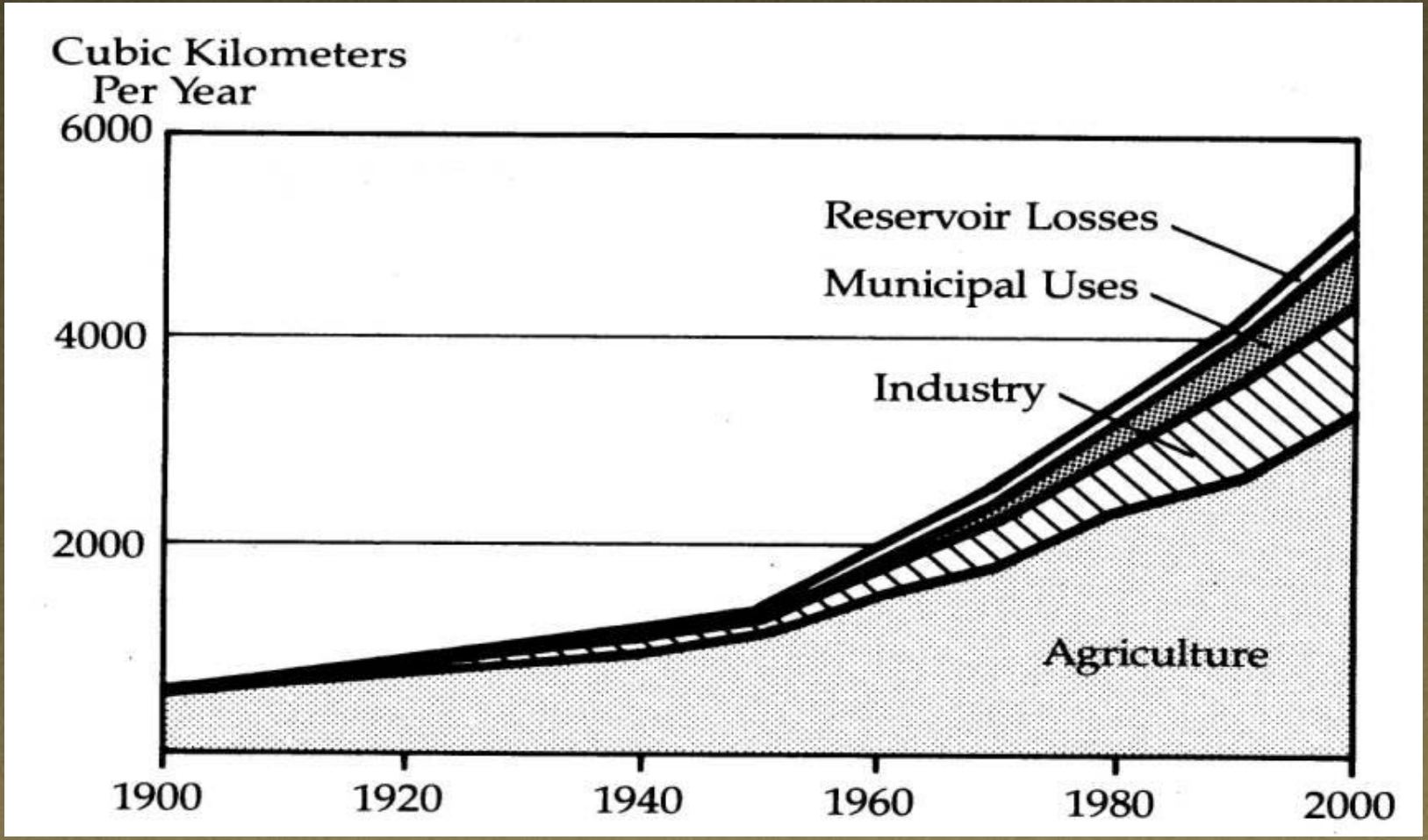
Not all impacts are direct
China and the EU import soy from Brazil

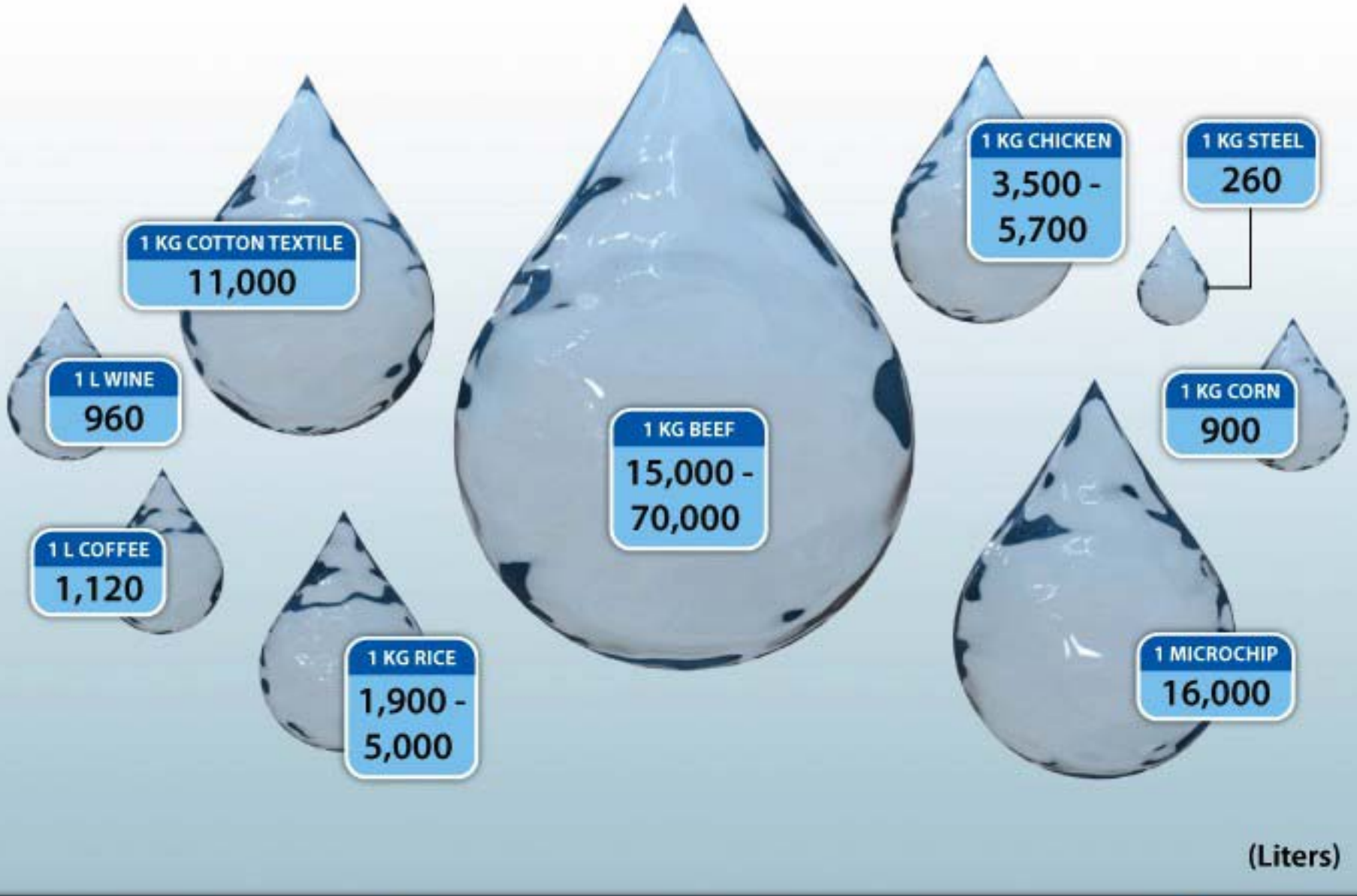
But are buying water, soil, and reduced pollution

Global Water Scarcity



Agriculture uses 70% of water used by humans





The Water Content of Things

Source: Peter Gleick, Pacific Institute
Graphic: Eric Daigh for Circle of Blue

circle of blue

Selected Products, Water Use and Farmer Income

	Raw material input	Water to produce input	Farm gate price
1 Cotton T-shirt	4 oz ginned	500 to 2,000 liters of water	US$0.20 (Aust.)
1 liter of soda	6 T sugar	175-250 liters of water	US$0.006 (Brazil)
1 oz. slice of cheese	6 oz milk	40 liters of water	US$0.03 (US)
1 double quarter-pounder	8 oz hamburger	3,000 to 15,000 liters of water	US$0.25 (US)

Global Trends by 2050

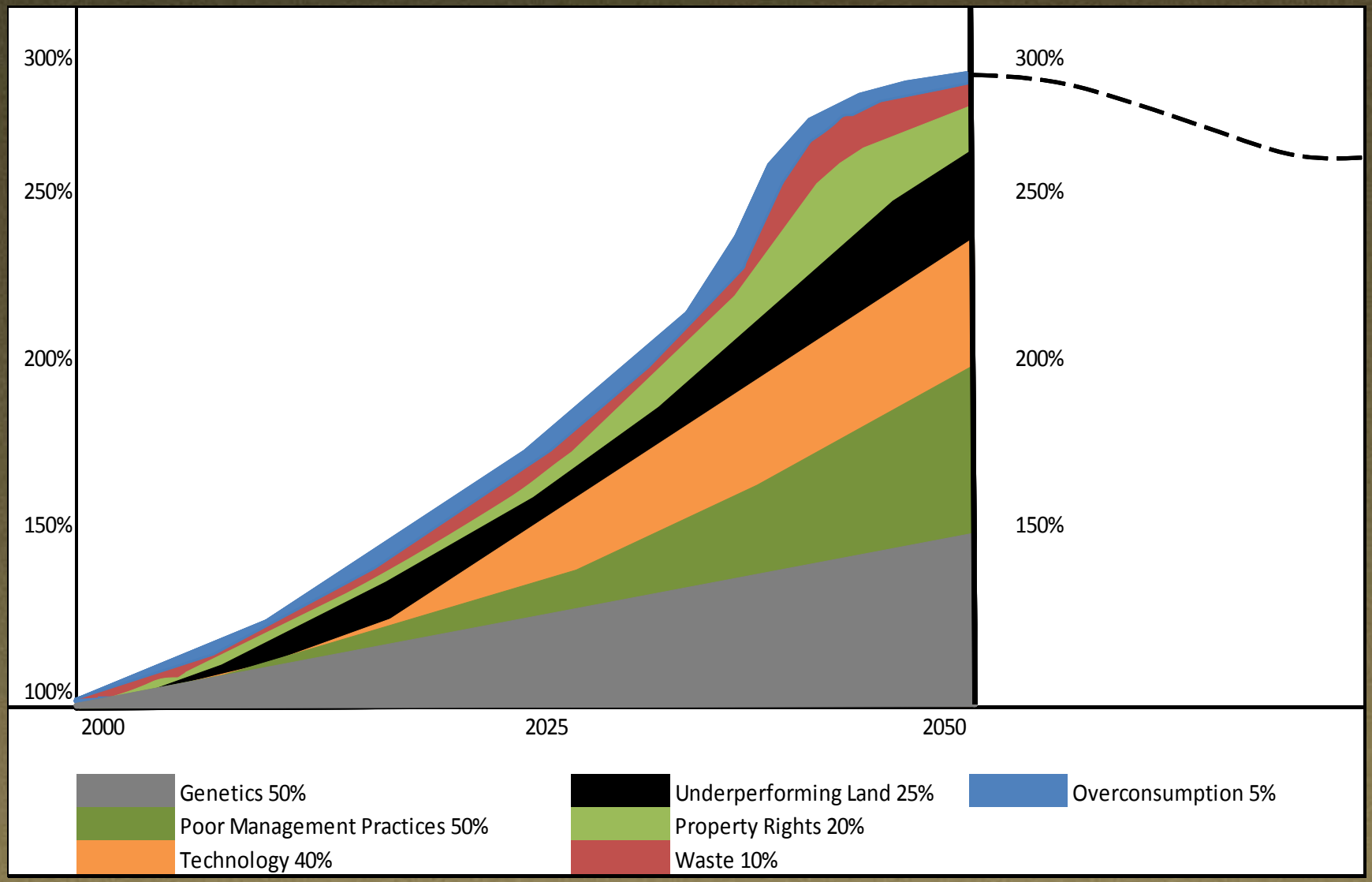
- Population—3 billion more
- Income will increase by 2.9 times
- Consumption will double
- 70% will live in cities—as many as are alive today

Impacts that are acceptable with 6.8 billion

Will not be with 9.4 billion people

Freezing the Footprint of Food

How to triple food production on the same amount of land by 2050



You manage what you measure.

But, producing anything has of impacts.

So, what should we measure?

What are the right metrics for animal agriculture?

Head per hectare land?

Kg per hectare of land?

Kg of produce per M3 of water?

Calories per hectare?

Grams of protein per hectare?

Cost of production per calorie of production?

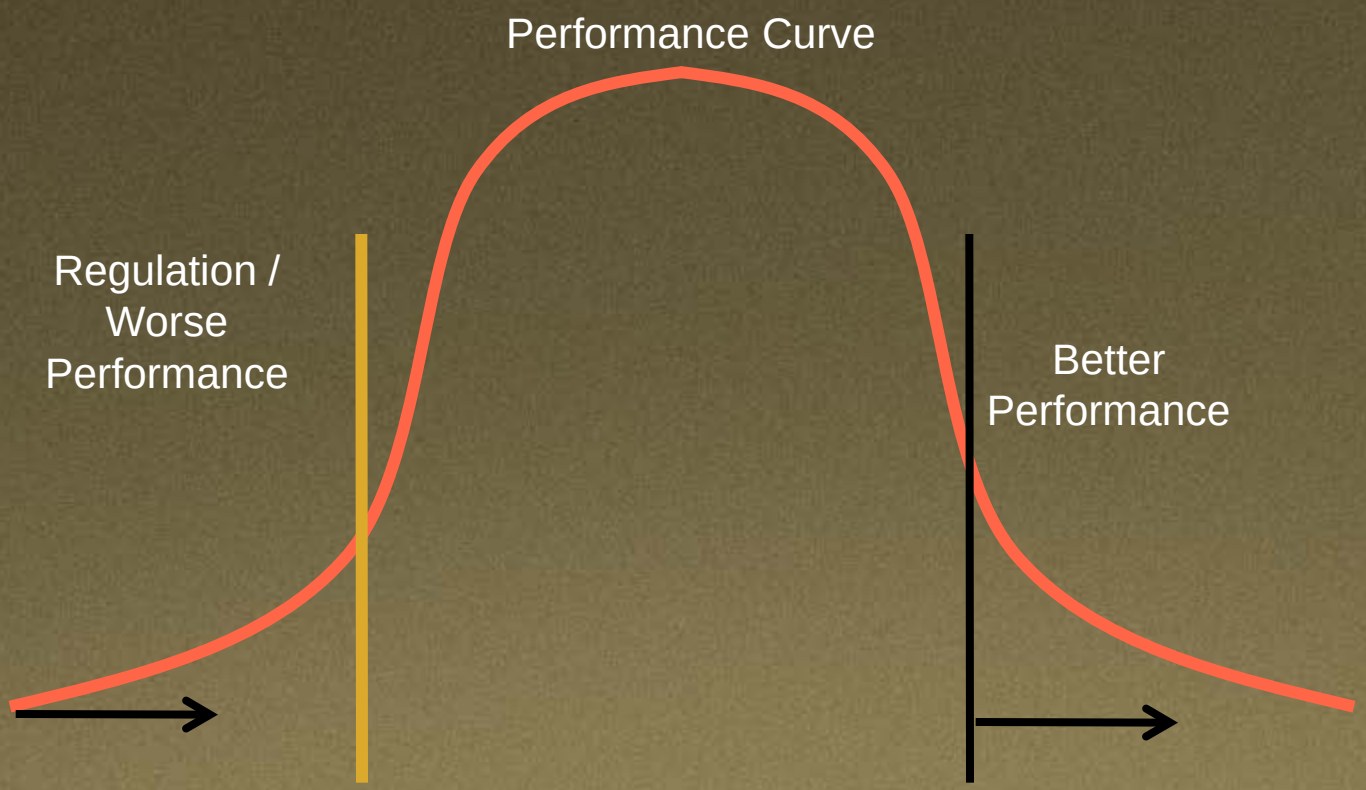
Kg of C avoided or sequestered /ha or /MT of production?

We must shift our thinking from trying to maximize any one variable

to optimizing the key ones

BMPs

Sustainability—Better Practices or Performance?



Producing Cattle—Better and Worse

- Same rainfall, soils and species
  - Same place (1 mile apart)
  - Pictures taken the same day
- 4 times more cattle and more wildlife

The only difference is management

efficiency—improve production

Poultry—Efficiency & Markets

CHICKEN – IMPROVEMENT EVOLUTION					
	1925	1945	1965	1985	2005
CONVERSION - KG FEED/KG LIVE	4,7	4,0	2,4	2,0	1,8
MORTALITY %	18%	10%	6%	5%	4%
AGE	112	84	63	49	42
LIVE COMMERCIAL WEIGHT - KG	1,0	1,4	1,6	1,9	2,4

Source: Dr.Paul Aho The World Chicken Meat Industry 1984 to 2004 - May 2004

animal welfare

Is stocking density is the best measure of animal welfare?

Some other possible indicators from aquaculture include:

- Feed conversion ratios (FCRs)
- Time to market
- Survival rates
- Disease outbreaks
- Medicines used per MT of product
- Water quality

Some Issues Moving Forward

On a finite planet, sustainability is a necessity

A precompetitive issue—need to work together, collude

Be strategic, focus on only a few impacts.

Understand the global performance baseline and range

Understand regional differences

Focus on results, not just BMPs or continuous improvement

Be technology neutral

Reinforcing Market Trends

Supply chains are longer than ever and have fewer players

Supply chains are moving from transactional to partnerships

Purchases are trending away from spot markets to more long term contracts

Don’t forget finance

Carbon (and water) will change the economics

“If you don’t know where you’re going any road will get you there.”


©
WWF®

Trade considerations and OIE guidelines

Phil Seng
US Meat and Export Federation

U.S. MEAT EXPORT FEDERATION

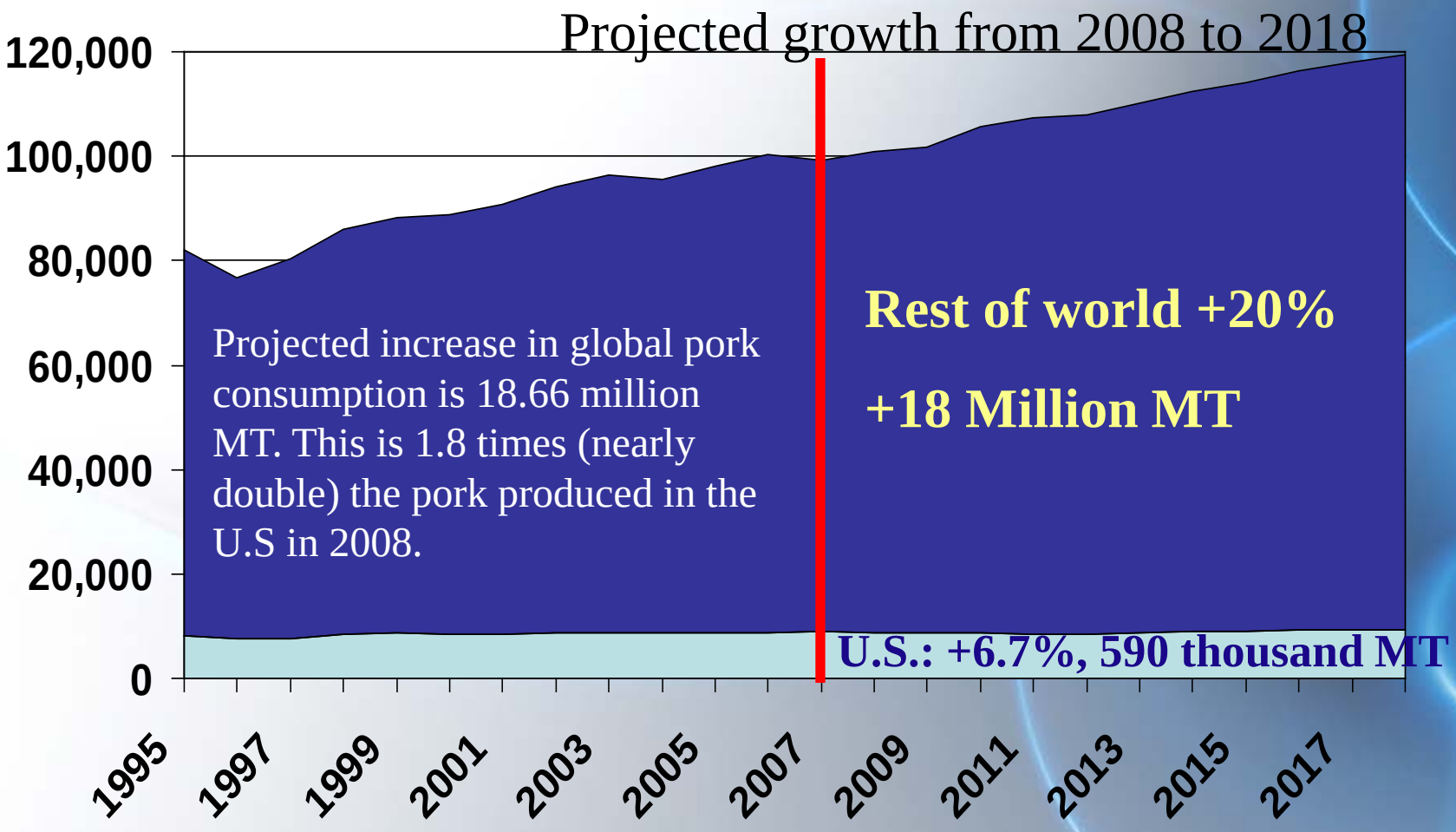
Putting U.S. Meat On The World's Table

Trade considerations and OIE guidelines

Philip Seng

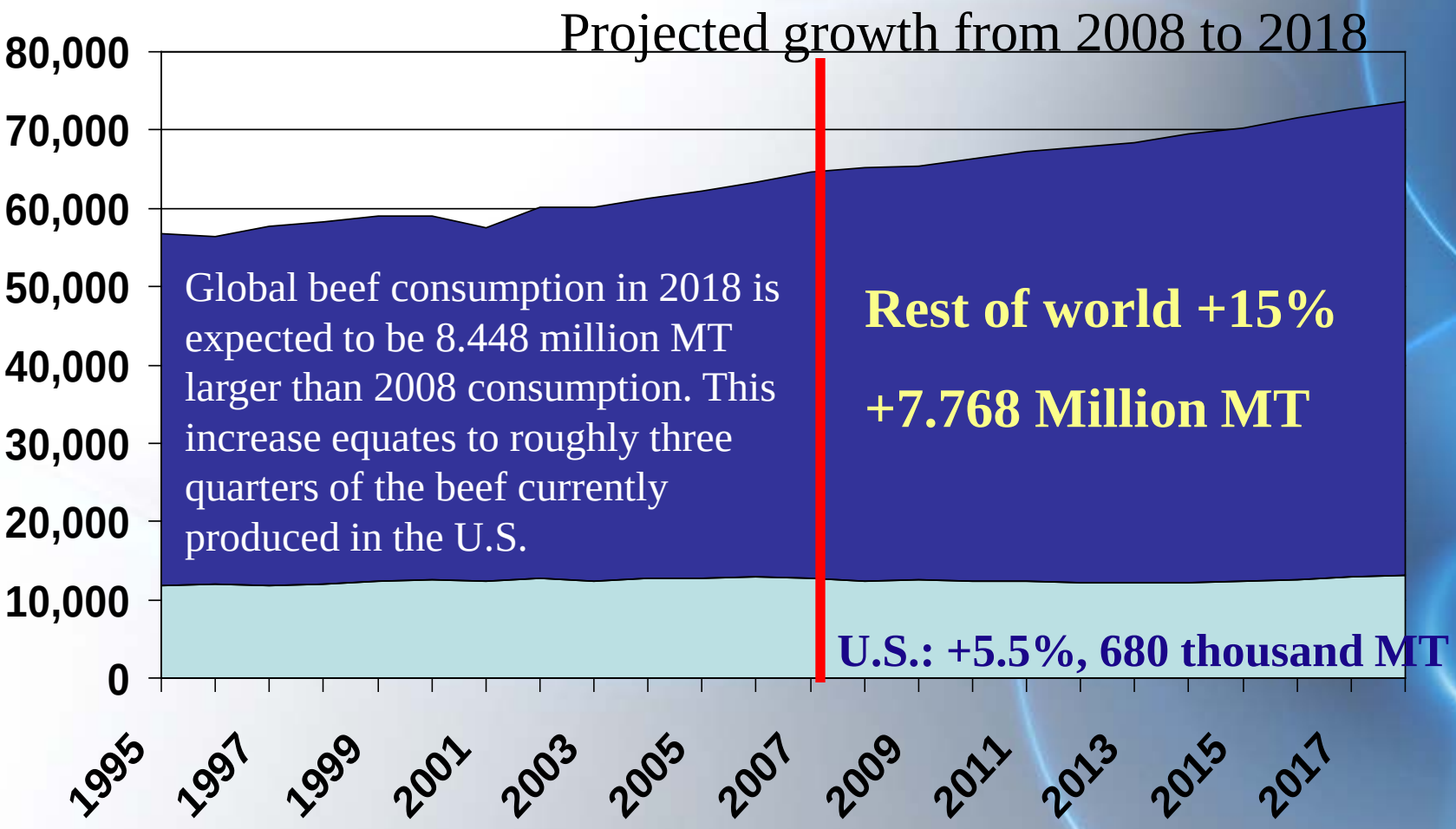
U.S. Meat Export Federation

Growth in pork consumption



Source: OECD/FAO; thousand MT

Growth in beef consumption

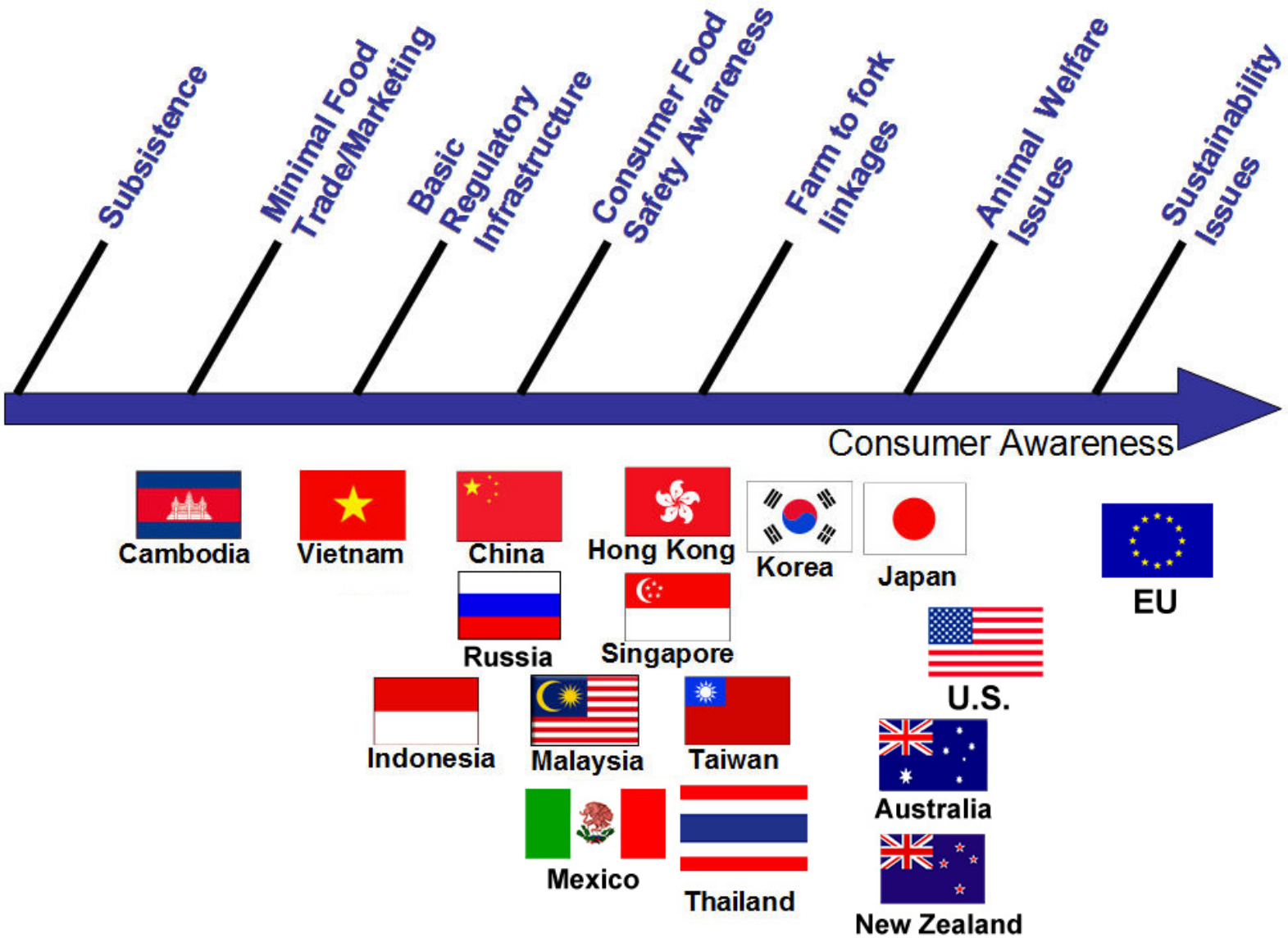


Source: OECD/FAO; thousand MT

The critical role of OIE

- **Development of internationally recognized standards for food safety and animal welfare**
  - 176 member countries and territories
- **Collect, analyze and disseminate veterinary scientific information**
- **Encourage international solidarity in approaching issues**

USMEF Food "Awareness" Spectrum



Role of livestock in sustainable agriculture

- **Balancing the need to feed a growing population with responsible animal agriculture practices**
  - 109% growth in meat production since 1980
  - Most growth from China (6-fold) and India (4-fold)
  - Globally, most growth achieved through more animals rather than increased productivity

Sustainable agriculture issues

- **Many governments link national/global food security objectives to sustainability concepts**
  - Livestock use 1/3 of cereals produced globally
  - Land for grazing and crops for feed equals about 80% of all agricultural land
  - 86% of water consumption for agriculture
- **Agriculture is a major contributor to greenhouse gas (GHG) emissions**
  - FAO estimates livestock production contributes 15-24% of GHG emissions

Critical issues

- **Private standards**
  - Differing views in established vs. developing countries
  - Potential for trade problems
- **Animal welfare**
  - Need for baseline for measurement
  - Lower priority in countries where hunger is an issue
- **Sustainability**
  - Lacking consistent definition, measurement

Private standards

- **Food Safety**
  - **62% believe private standards for sanitary safety may create significant benefits**
    - 87% of developed countries agree
    - 30% of developing countries agree
  - **82% agree these standards may create significant trade problems for their exports**
    - Compliance costs
    - Lack of basis in science
    - Lack of transparency


Are you crazy, too?
전국금속노동조합
또는 이치거나
전국금속노동조합

Korea Beef Traceability System (www.mtrace.go.kr): April 2009

1) 소 및 쇠고기 이력시스템 메인 홈페이지(http://www.mtrace.go.kr)
홈페이지 주소를 입력하여 쇠고기 이력제 홈페이지에 들어옵니다

2) 12자리 숫자를 띄어쓰기없이 입력하십시오
쇠고기 이력제 적용 판매장에서 이력추적제 적용 쇠고기인 경우 12자리 숫자로 되어있는 개체식별번호를 홈페이지 메인 개체식별번호 입력화면(2) 에 입력 후 SEARCH 버튼을 누릅니다

Japan: In-store Beef Traceability Kiosks

国内産牛肉
安心確認システム

安心への取り組み

生産地からお店まで
「履歴」がわかる
イオンのトレーサビリティー

イオンは、お客さまが安心して
牛肉をお買い求めいただけるよう、
「どこで生まれ、どこの、だれが、
どんな飼料を与えて育てた牛なのか」を
確認できるシステムに取り組んでいます。

履歴検索画面へ

イオンのトレーサビリティーの仕組み

トレーサビリティーとは、英語の「トレース」(足跡を追う)と、「アビリティー」(できること)を合わせた言葉で、「追跡可能性」(追跡ができること)と訳されます。イオンで取り扱う国内産牛肉は、全て生産から店頭までの履歴を追跡可能な牛肉ばかり。「国内産牛肉の安心確認システム」では、お客さまのご自宅からお買い求めいただいた牛肉の生産履歴をインターネットで検索いただけるサービスへの取組みを行っております。

Taiwan: Trial Traceability Coding

Home | Beef | Chicken | Milk | Potatoes | View the TV ad

Traceability

It's important for us to be able to trace our ingredients back to their source. We use 100% beef in our hamburgers, bought from farms accredited by nationally recognised Farm Assurance schemes. We can trace which farms the beef came from, know the farmers' names and how the animals were reared.

3 of 10

Traceability

We can trace which farm the beef came from, know the farmers' names and how the animals were reared.

Green

A Blog About Energy and the Environment

April 13, 2010, 3:49 PM

McDonald's Board Opposes Cage-Free Eggs for U.S.

By LEORA BROYDO VESTEL

The board of directors of McDonald's has recommended that the company's shareholders vote against a proposal to require that 5 percent of the eggs purchased for the chain's restaurants in the United States be the cage-free variety.

The proposal was advanced by the Humane Society of the United States.

Some major fast food companies, including Burger King, Subway and Wendy's, and the retailers Wal-Mart and Trader Joe's, have already made some level of commitment to purchasing or selling cage

But the McDonald's b
that the science was n
switch.

"As we have examine
there is no agreement
balance the advantage
said in a proxy statem

McDonald's says that its e
minimum of 72 square inches of floor space per hen. The Humane Society
counters that this is not enough space to allow a hen to fully spread its wing

"There's a big disparity between what McDonald's is doing in Europe and in the United States," HSUS said.

EU anti-cloning initiative

- EU Council of Ministers European Parliament's environmental committee votes not to authorize the entry of any food derived from cloned animals into the EU
  - Would ban products from clones, offspring or their produce
- New German (Testbiotech) report states that cloned foods could have adverse human health effects

Private standards

- **Animal welfare**
  - **64% say animal welfare private standards create benefits**
    - 89% of developed countries agree
    - 40% of developing countries disagree
  - **46% agree these standards may create significant trade problems for their exports**
    - Excluding the EU, 76% believe these private standards may create export problems (87% for developing countries)
      - Transportation & slaughter requirements

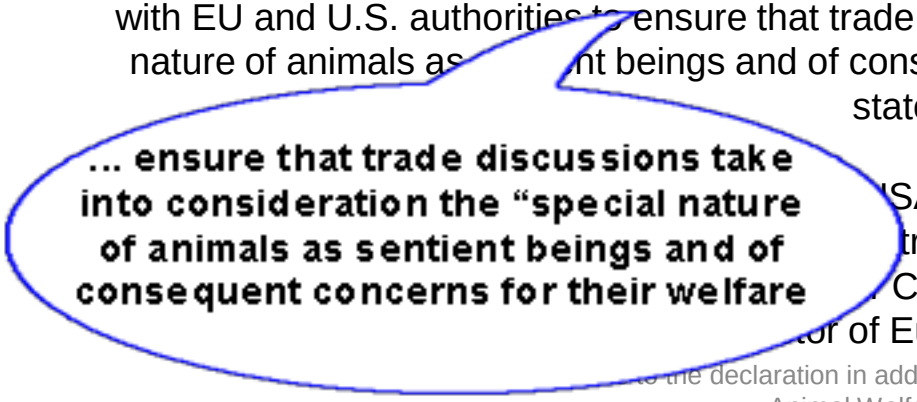
EU animal welfare regulations proposed for Jan. 1, 2013

- No more sow stalls
- No more caged laying hens
- Maximum transport time for cattle & hogs proposed at 8 hours
- EU requirements for conditions at slaughter to apply to imports

A European animal welfare group said late last week it signed a declaration uniting like organizations in the European Union and the United States in an effort to ensure that animal welfare standards are included in transatlantic trade.

The declaration signed by Eurogroup for Animals, which represents animal welfare organizations in all EU member states, creates the Transatlantic Animal Welfare Council (TAWC), the group said in a news release.

Formation of TAWC follows the creation in 2007 of the Transatlantic Economic Council (TEC), which aims to strengthening transatlantic cooperation in removing trade barriers. TAWC will work with EU and U.S. authorities to ensure that trade discussions take into consideration the "special nature of animals as sentient beings and of consequent concerns for their welfare," the release stated.



SA and EU member state governments integrate trade agreements in future and also urge private CSR and supply chain policies," said Sonja Van or of Eurogroup for Animals.

the declaration in addition to Eurogroup for Animals are:
Animal Welfare Institute
Compassion in World Farming
Global Animal Partnership
The Humane Society of the United States
Humane Society International
International Fund for Animal Welfare
Royal Society for the Protection of Animals
World Society for the Protection of Animals

PETA praises Burger King supply changes

Will increase use of eggs, pork from producers who don't use cages

Associated Press
updated 6:55 p.m. MT, Wed., March. 28, 2007

MIAMI - Animal rights advocates praised Burger King for its new commit ent to begin buying eggs and pork from supplie that do not keep their animals in cages or es.

"We certainly ho people will order the BK Veggie
Matt
Tr
K

"But the fact that Burger King has made positive changes for some of the animals killed for its restaurants will send a ripple effect through the fast food industry..."

UK retailer leads the way

- Morrisons becomes first top 4 UK retailer to use 100% British free-range eggs for its private label
  - 9 months ahead of forecast
  - 2 years ahead of EU-wide ban on battery cages

Make up your own mind

McDonald's crowned Food Business of the Year by British Free Range Egg Producers Association

McDonald's has been awarded the Food Business of the Year Award for the second year running at the British Free Range Egg Producers Association (BFREPA) annual conference.

Praised for the quantity of free range eggs that McDonald's uses each year, and the way it communicates that fact to its millions of customers, McDonald's was named leader in the Food Services Sector and was presented with its award on Thursday evening.

Presenting the award, Chairman of BFREPA, Tom Vesey said

"Back in 1997, McDonald's took the decision to switch to free range eggs. Initially they didn't make a fuss about it but I am delighted to say they do now.

"With communication across all of its restaurants and lorries spreading the free range message to the nation, it ranks amongst the most high-profile advertising our sector receives.

"In 2008, McDonald's plans to kick-off with big breakfast plans which are sure to boost free range egg usage beyond the 90 million eggs the restaurant chain already uses every year. For the second year running McDonald's is truly worthy of the Food Business of the Year title."

Collecting the award of behalf of McDonalds, Senior Agricultural Assurance Manager, David Thomas commented

"We are committed to using high quality ingredients and maintaining industry leading animal welfare standards with all of our menu items. It is for this reason that all of the eggs used in our breakfast menu and sauces are free range, coming from over 100 producers, 80% of which are independent farmers on small farms. All of our eggs conform to the Lion Mark code of practice and an independently audited free range Farm Assurance scheme, guaranteeing their quality.

"We are committed to using high quality ingredients and maintaining industry leading animal welfare standards with all of our menu items."

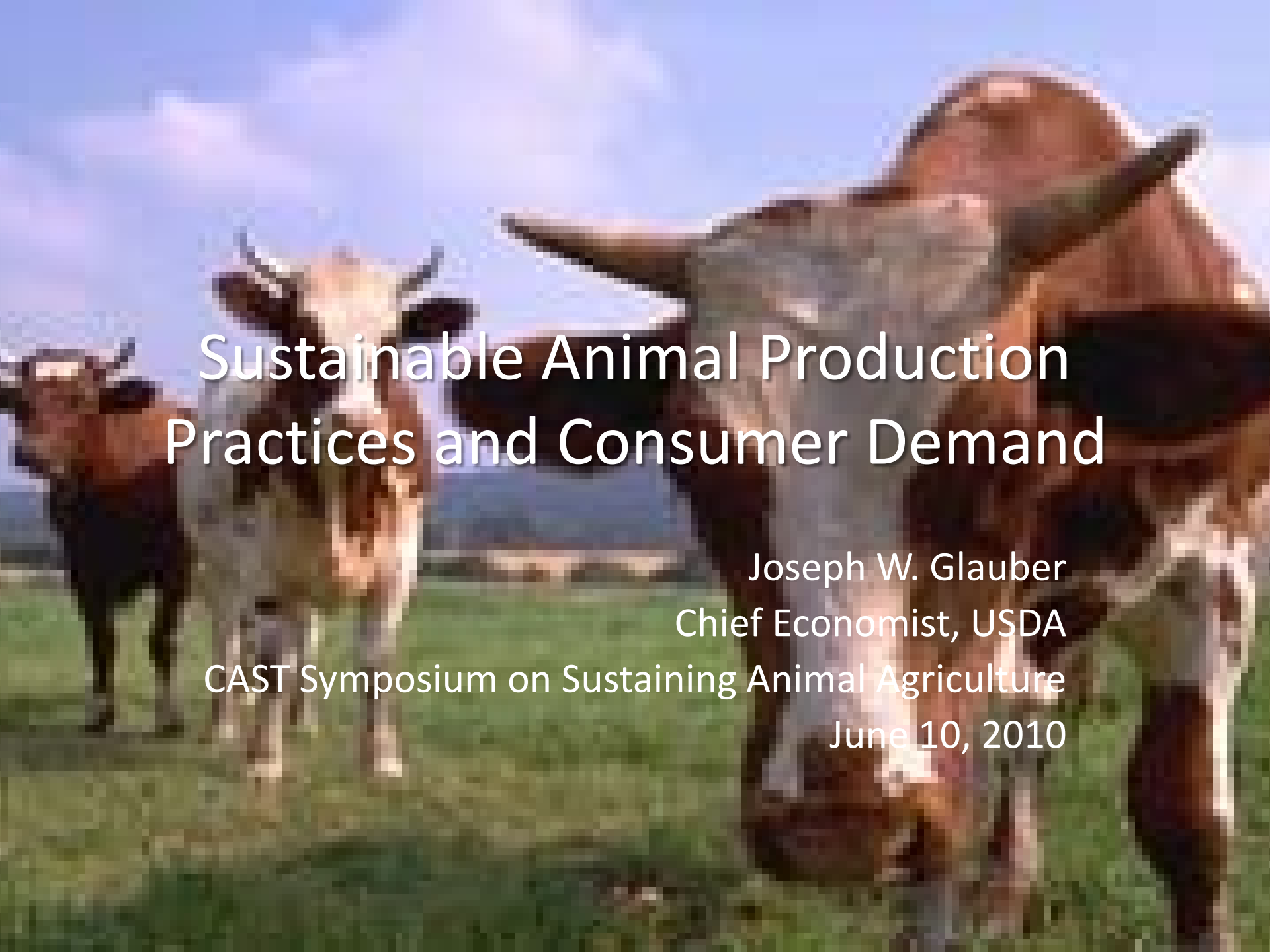

NO ABUSE
尊重生命
平等對待 無分貴賤
白狐制作

Conclusions

- Pressures on international trade in ag products are increasing
- Uniform approach is needed (OIE)
  - Others unfriendly to meat will fill the vacuum
  - Approach taken on BSE is good model

Are the poor a recognized stakeholder?

Joseph Glauber
USDA Chief Economist



Sustainable Animal Production Practices and Consumer Demand

Joseph W. Glauber
Chief Economist, USDA

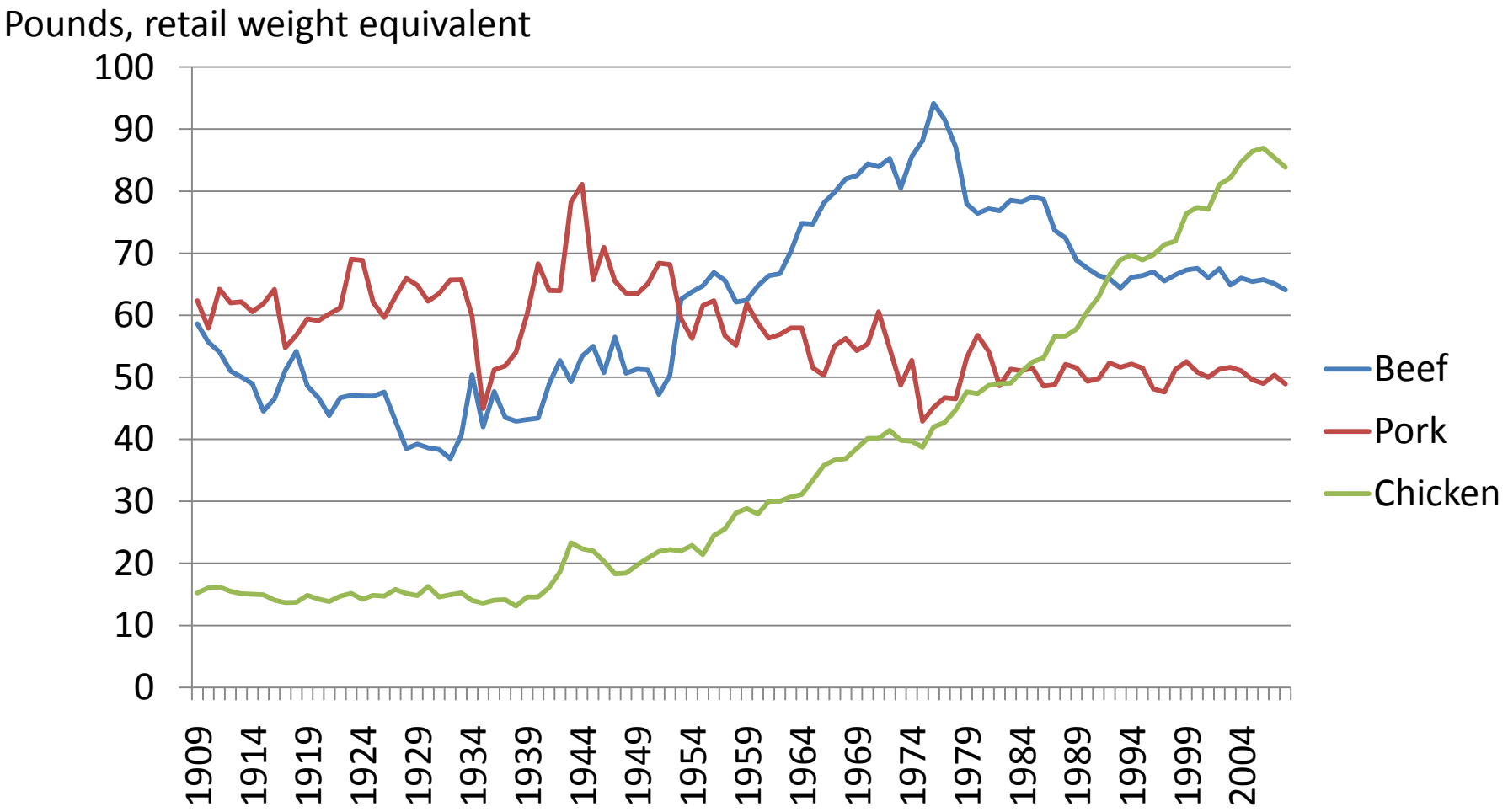
CAST Symposium on Sustaining Animal Agriculture

June 10, 2010

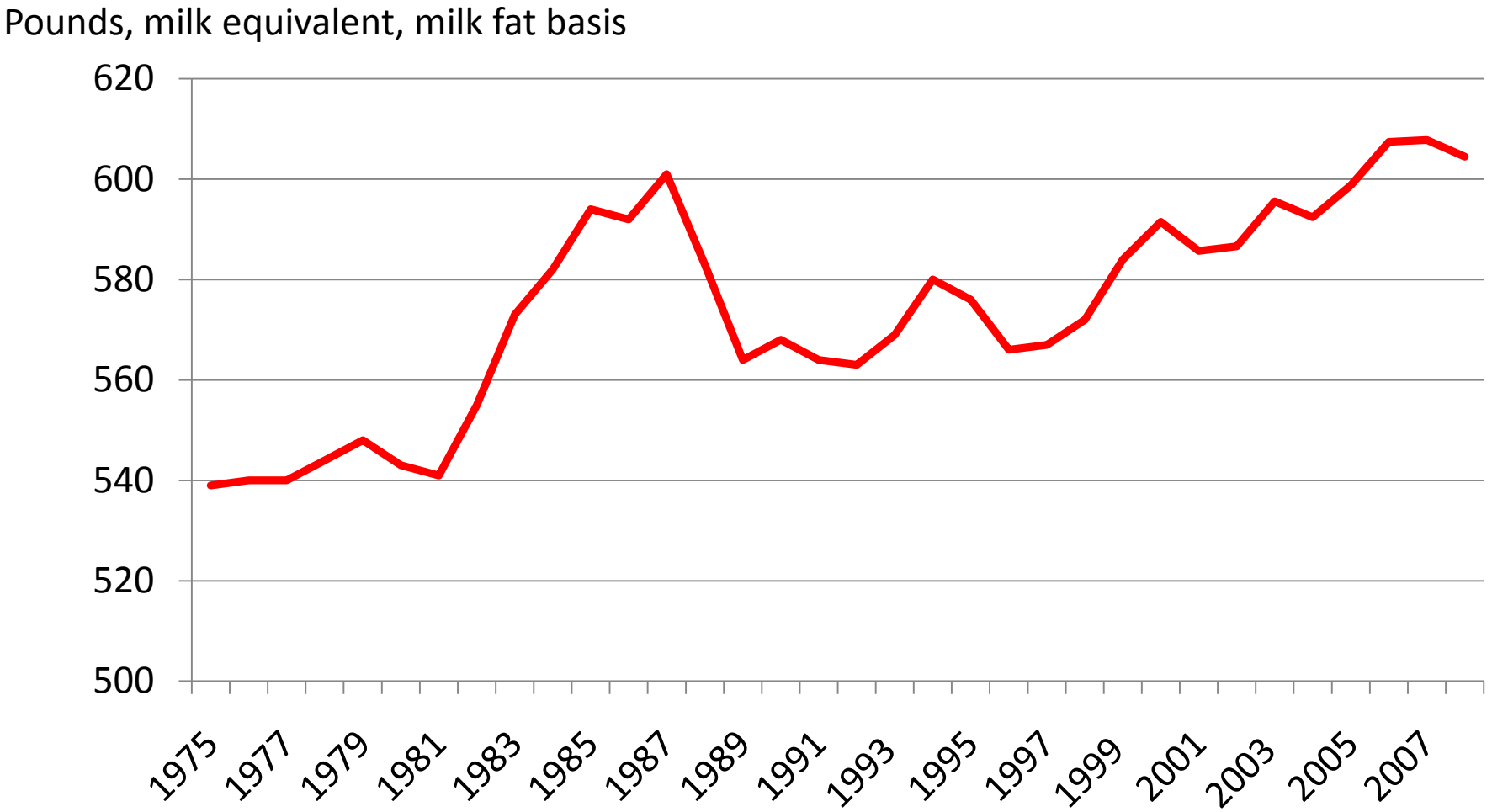
Outline

- Recent trends in per capita consumption of animal products
- Consumption by income levels
- Effects of price increases on demand by income level
- Consumer preference for sustainable animal production practices
- International implications

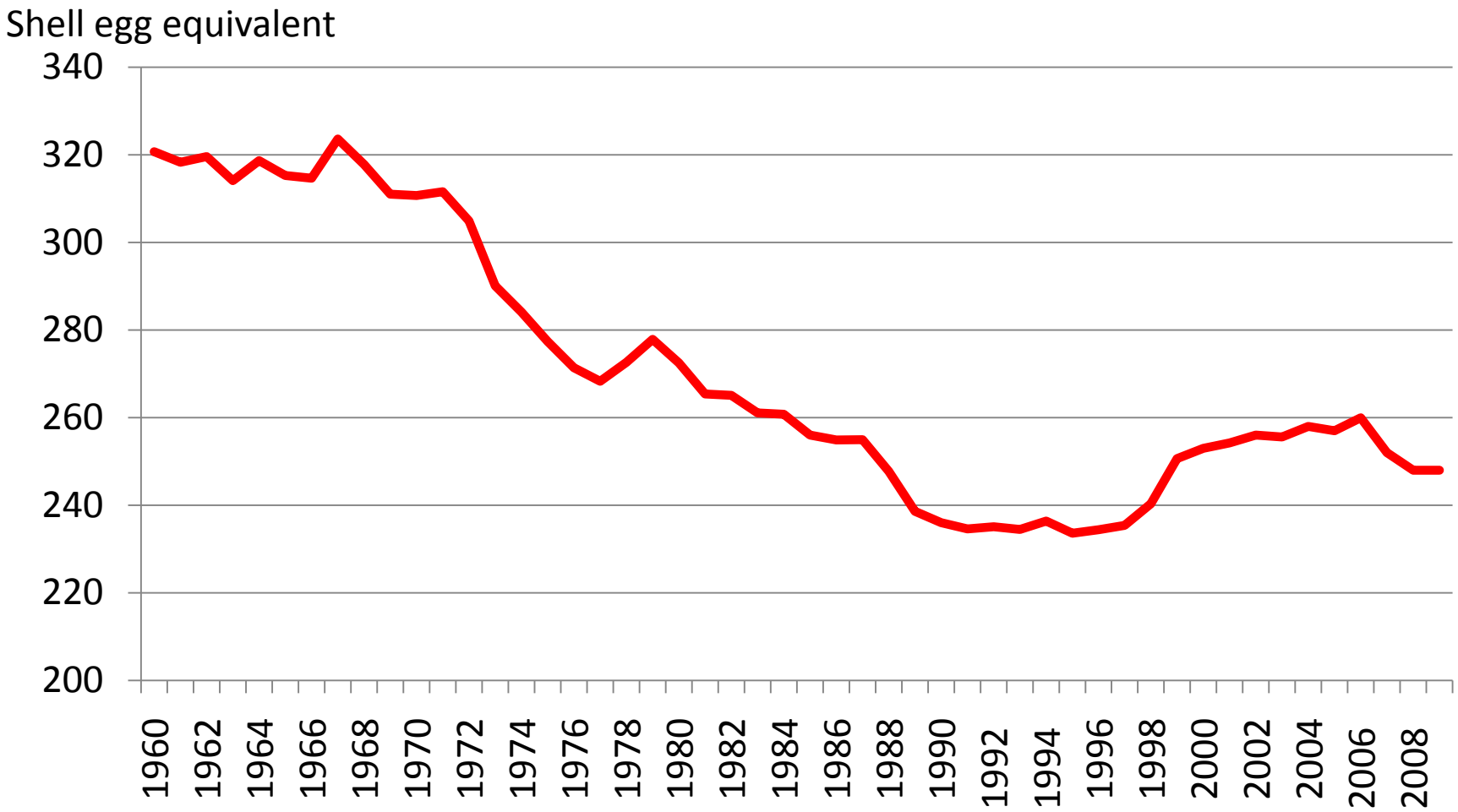
US per capita meat consumption



US Per Capita Consumption of Dairy Products



US Per Capita Egg Consumption



US consumption of beef and pork by household income as percent of poverty threshold

Income/poverty threshold ratio	Population (%)	Beef (lbs per capita)	Pork (lbs per capita)
Under 130 percent	19.2	71.9	54.0
131 - 350 percent	41.8	67.6	52.4
Over 350 percent	39.0	62.6	48.0

Source: Davis and Lin 2005 based on data from USDA ARS 2000: 1994-96 and 1998 Continuing Survey of Food Intakes by Individuals

Food consumption by income level

Group	Food as a share of total expenditures	Food at home as share of total food expenditures	Meat, poultry, eggs as share of total food at home	Meat, poultry, eggs as share of total expenditures
All	12.8%	58.1%	19.2%	1.4%
Lowest 20%	15.6%	68.2%	19.8%	2.1%
Second 20%	14.4%	64.2%	20.7%	1.9%
Third 20%	13.1%	61.3%	20.5%	1.7%
Fourth 20%	12.9%	57.2%	18.5%	1.4%
Highest 20%	11.3%	51.4%	17.9%	1.0%

Source: BLS, Consumer Expenditure Survey, 2008

Effect of higher prices on consumers

own price elasticities

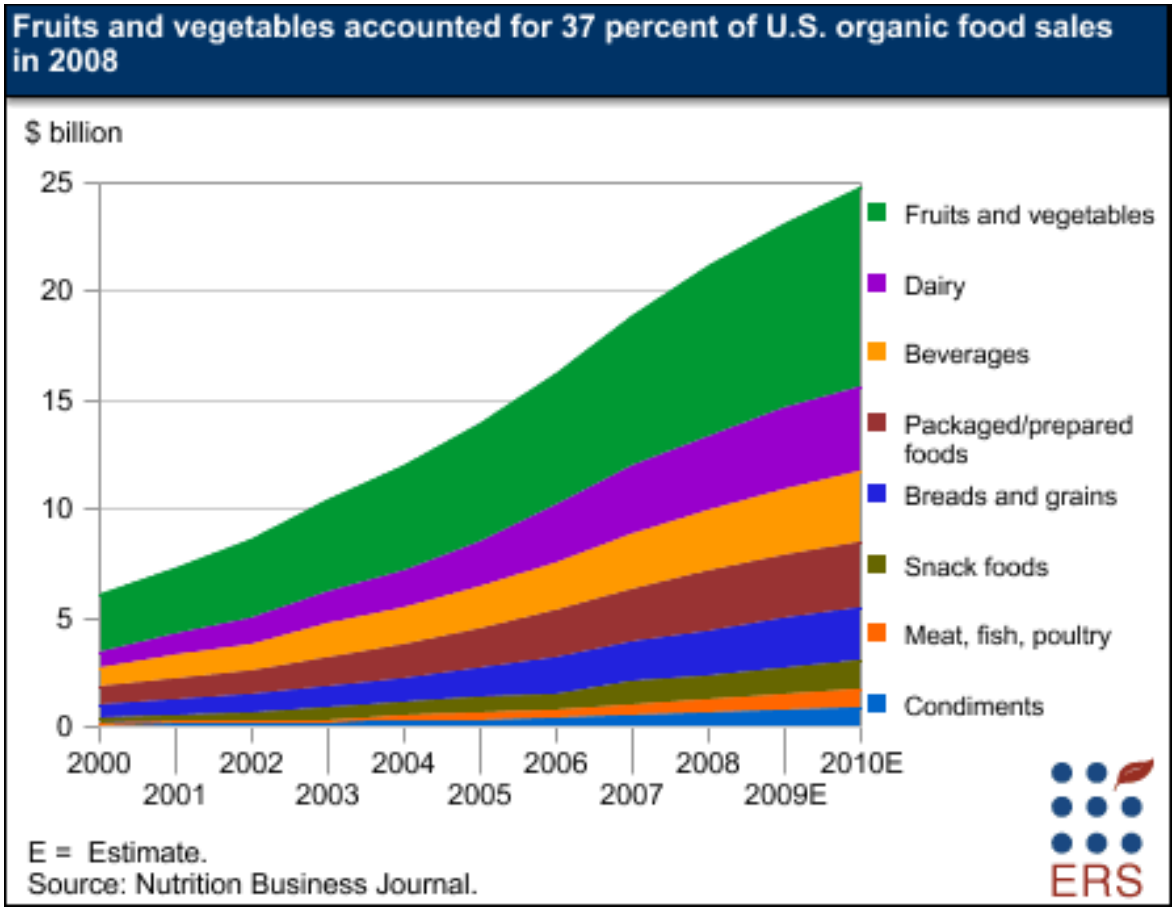
Commodity	All	Low income	Middle income	High income
Beef	-0.3540	-0.2929	-0.2615	-0.4080
Pork	-0.6867	-0.7199	-0.6349	-0.6729
Other meat	-0.3554	-0.5125	-0.293	-0.2957
Poultry	-0.6437	-0.5738	-0.6317	-0.6632
Dairy	-0.7949	-0.7818	-0.8144	-0.7731
Eggs	-0.0569	-0.1849	0.0159	-0.0491

Source: Huang and Lin 2000.

Consumer preferences for sustainable animal production practices

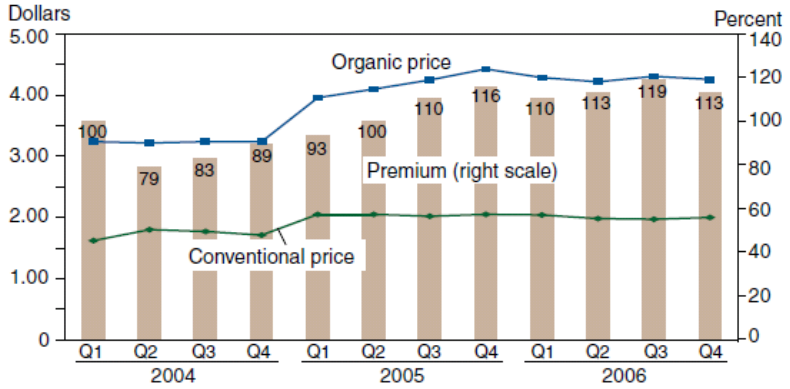
- In addition to price effects, important to consider the degree to which potential consumers value sustainable production practices.
- How much are consumers willing to pay for such practices?

Growth in organic sales



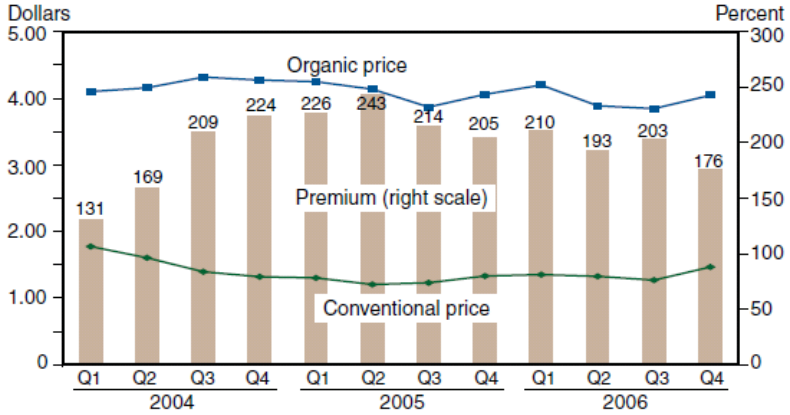
Retail prices for organic eggs and milk

Figure 14
Organic milk retail prices are roughly double conventional prices, 2004-06



Note: Prices are per half gallon of milk. Price premiums are shown as percentages. Organic price premiums are calculated by subtracting the conventional price (whether computed monthly, quarterly (Q1-Q4 above), or yearly) from the organic price and dividing the difference by the conventional price. For additional price premiums, see www.ers.usda.gov/data/organicprices.
Source: USDA, Economic Research Service calculations of Nielsen data.

Figure 16
Retail organic egg price premiums are high, 2004-06



Note: Prices are in dollars per dozen. Price premiums are shown as percentages. Organic price premiums are calculated by subtracting the conventional price (whether computed monthly, quarterly (Q1-Q4 above), or yearly) from the organic price and dividing the difference by the conventional price. For more price premiums, see www.ers.usda.gov/data/organicprices.
Source: USDA, Economic Research Service calculations of Nielsen data.

Source: Dimitri and Oberholtzer 2009

Who is more likely to purchase organic food?

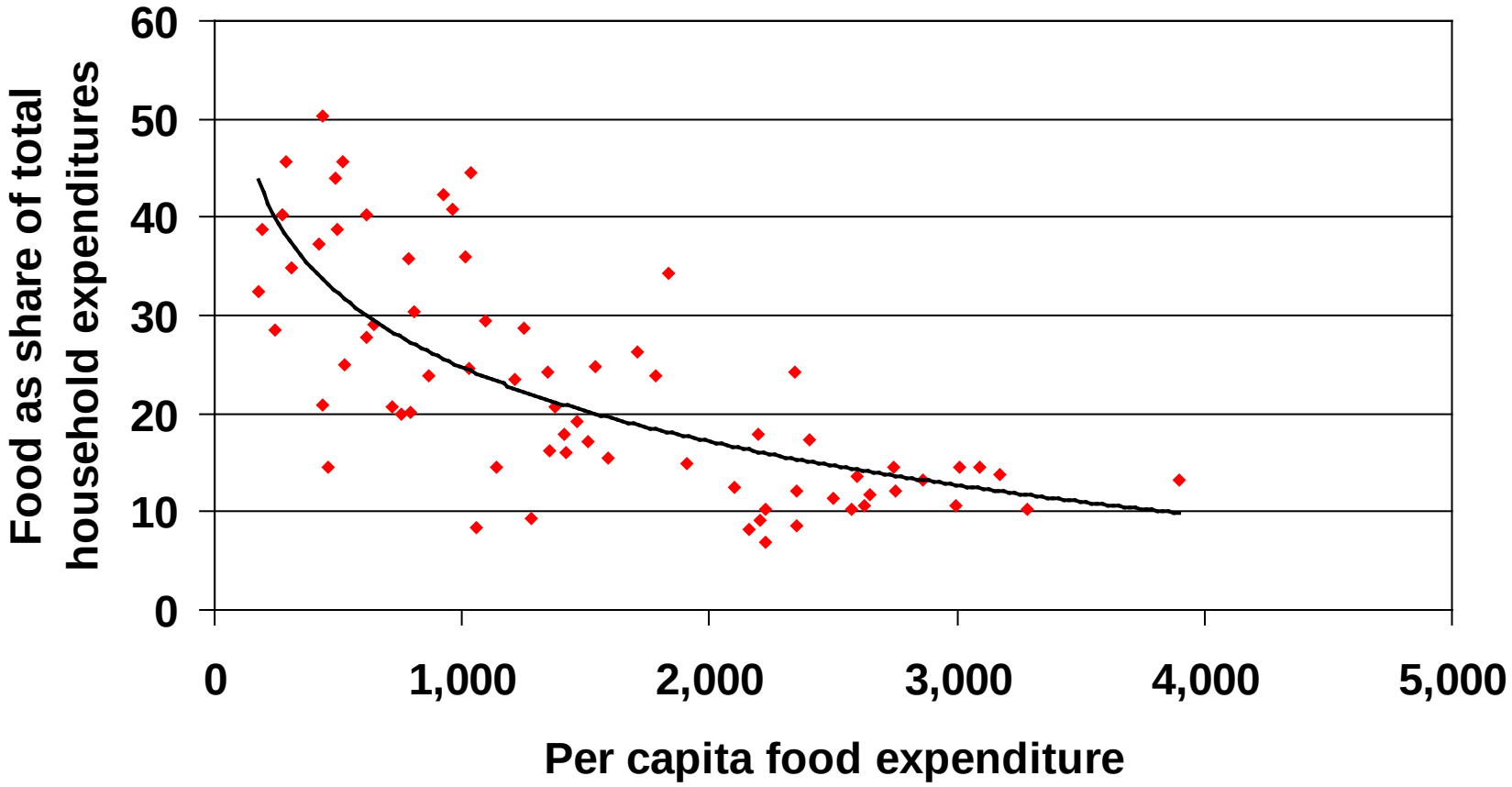
- Most studies find education level is positively related to purchases of organic products
- Evidence regarding other factors is mixed:

  Households with younger children
  - More likely to purchase (Loureiro et al. 2001)
  - Less likely to purchase (Zepeda and Li 2007)
  - Not a significant factor (Durham 2007)

  Ethnicity
  - Asian and Hispanic families more likely (Hartman 2006)
  - Asian and Hispanic less likely (Dittmann and Dimitri 2010)

  Income
  - Positively related (Govindasamy and Italia 1990)
  - Not a significant factor (Durham)
- Willingness to pay is difficult to assess

Wealthy countries spend smaller portion of their household budgets on food



Projected Meat Consumption

Region	Per Capita Consumption of Meat	
	2000	2050
	(kg/person/year)	
Central and West Asia; North Africa	20	33
East and South Asia and the Pacific	28	51
Latin America and the Caribbean	58	77
North America and Europe	83	89
Sub-Saharan Africa	11	22

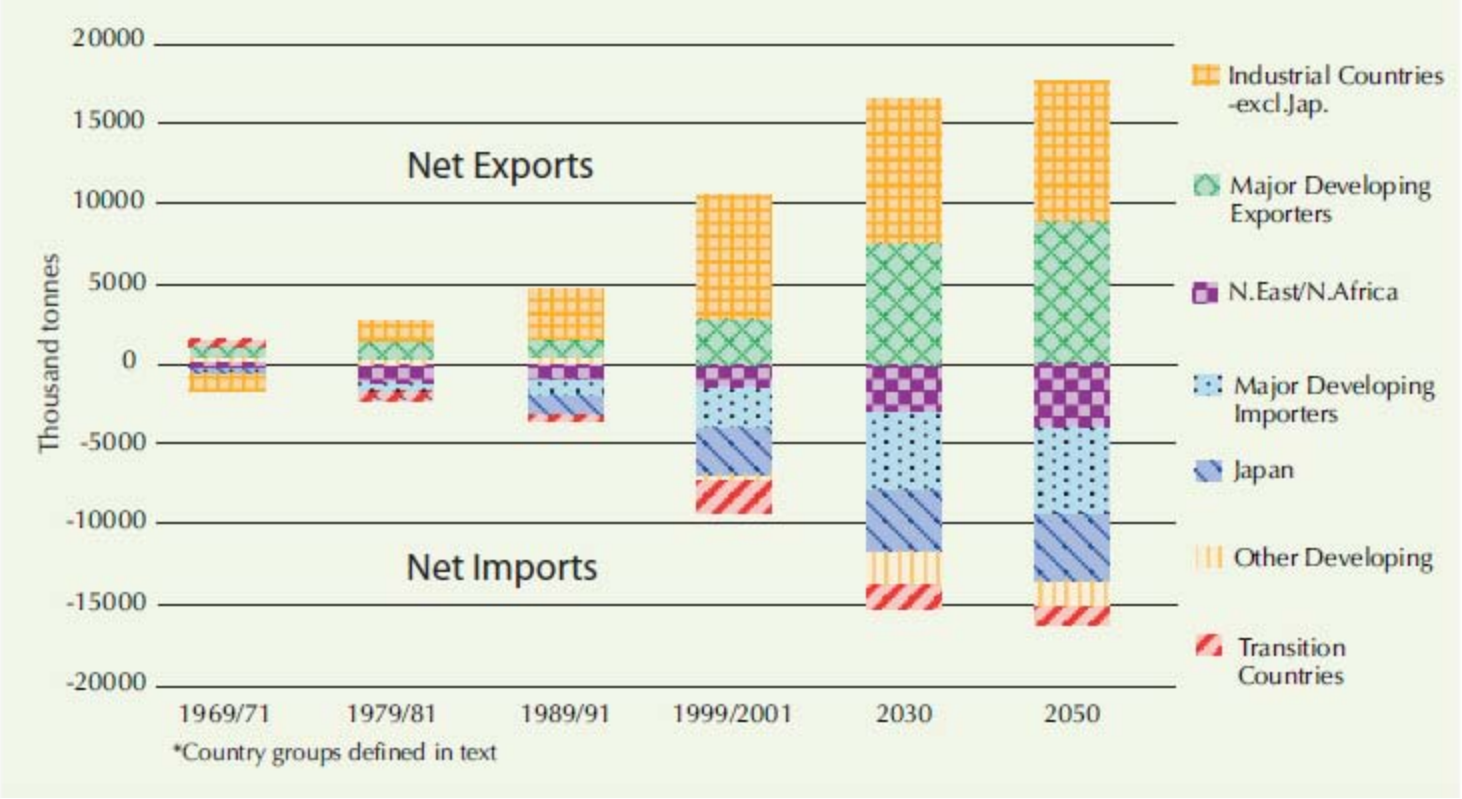
Source: Rosegrant and Thornton, 2008.

Annual growth rates in meat and dairy consumption in developing countries

	1999/01-2030	2030-2050
Beef	2.2	1.3
Pork	1.7	0.6
Poultry	3.4	1.8
Dairy	2.5	1.3

Source: FAO 2006

Meat trade



Source: FAO 2006

Projected dairy imports

mmt

	2030	2050
Sub-Saharan Africa	3.8	4.3
Near East/North Africa	10.2	13.6
Latin America/Caribbean	4.6	2.2
South Asia	2.2	4.6
East Asia	11.9	14.1
Total developing countries	32.7	38.8

Source: FAO 2006

Summary comments

- Increased production costs due to adoption of more sustainable animal production practices will likely raise consumer prices.
- Due to inelastic nature of consumer demand for animal products, price increases would result in increased food expenditures for these items.
- Because food expenditures for animal products consumed at home are proportionately higher for low income population, the effects of price increases will be felt more for this segment.
- Consumer demand for sustainable practices is a small but growing segment of market. Willingness of consumers to pay additional costs for such practices is less well understood, particularly how preferences may be related to income and other factors.
- Developing countries are forecast to consume more meat and dairy products, much of which is forecast to come from developed countries such as the US. Effects of sustainable production practices on world food availability will ultimately depend on the costs

Are farmers and rural communities destined to be second-class citizens?

Paul Lasley
Iowa State University

Are farmers and rural communities destined to be second class citizens?

Paul Lasley
Iowa State University
plasley@iastate.edu

Some Disclaimers:

1. I was raised on a general family farm in Missouri, not large enough to make a full-time living, and too big for a hobby.
2. I did not choose the title of this presentation.
3. I interpret “second class citizens” as being poor or marginalized.

Explanations for being poor

- Don’t work hard enough
- Failure to invest in themselves
- Uneducated
- Lazy
- Changing consumer preferences that affect prices

Other possible explanations

- Structurally disadvantaged by market conditions
  - Can’t get large enough to achieve economies of scale
  - Can’t effectively compete against larger firms
- Market shift or changes
  - Finding oneself producing things that are no longer demanded

AGRI CULTURE

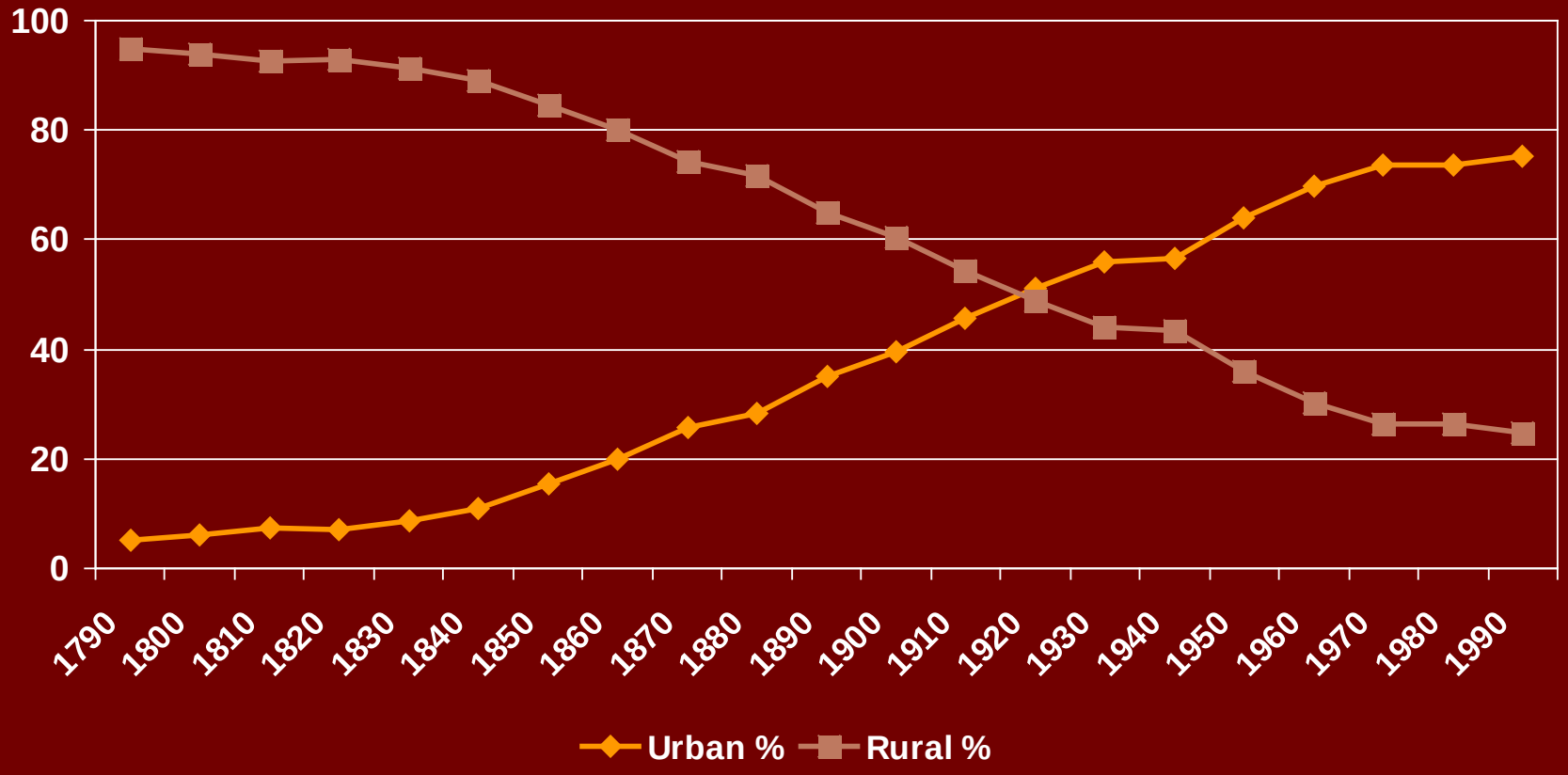
- Is it agriculture or agri culture
- The challenges of the food system are both technical and social in origin.
- The technical solution can not be adequately applied until there is consensus on the social issues.

Agriculture vs. Culture

Old paradigm

Agriculture and rural life were closely integrated. Most people who lived in rural America were associated with farming or agriculture. Bound together by common experiences, similar values and beliefs, shared culture, understanding and appreciation for raising crops and livestock

U.S. Urban and Rural Population Percent of Total Population 1790-1990



Agriculture vs. Culture

- New Paradigm

  The majority of people living in rural America no longer are dependent upon farming for a living. They live in rural America for a variety of reasons, but not because they farm nor want to farm. Reasons for living in the country...open spaces, privacy, out doors experiences, quality of life. Guests of the country.

The Changing Culture of Agriculture

- Emergence of new set of values, beliefs and attitudes about agriculture and how food should be produced

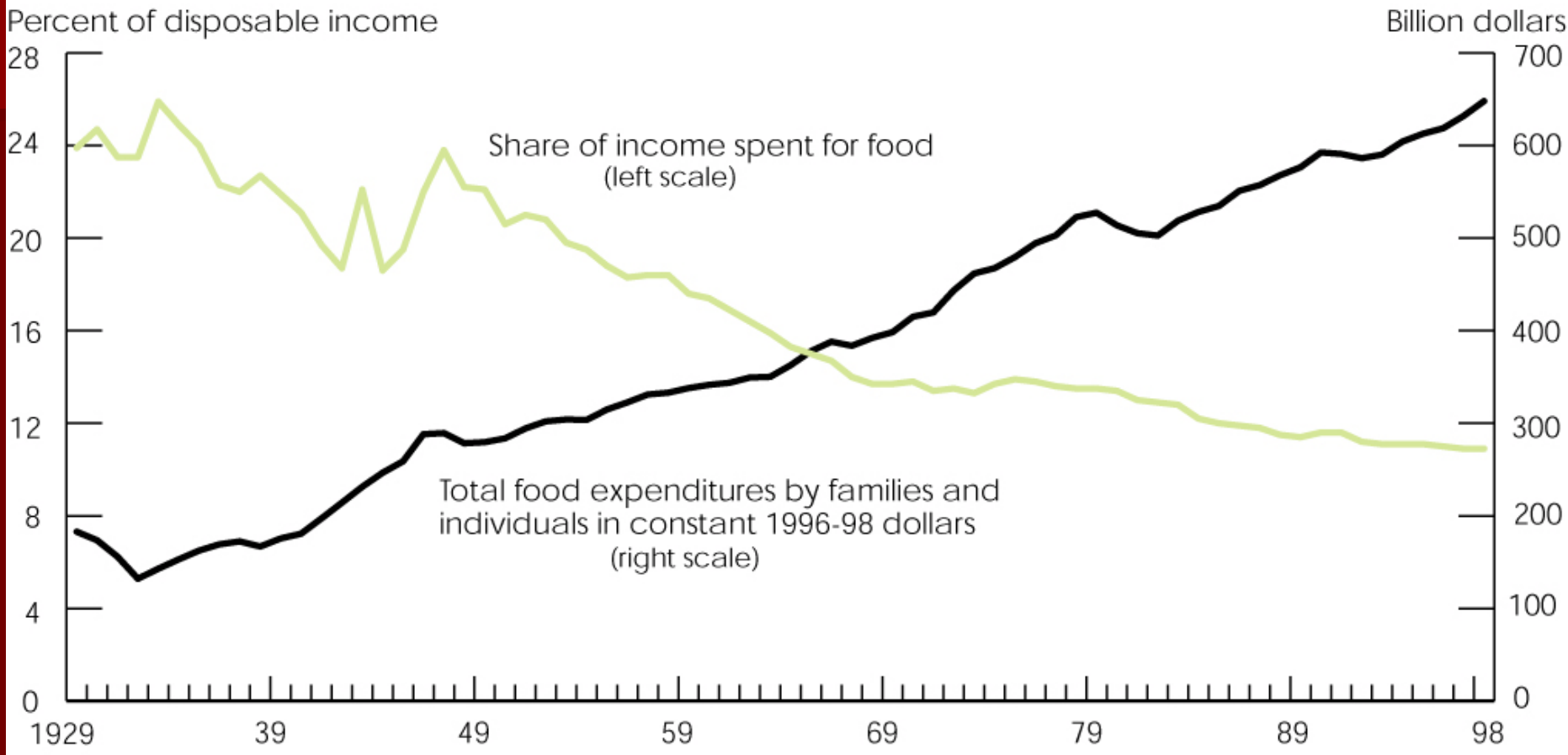
- Changing paradigm of food production
  - Cultural change
    - New set of values about animals, their care, etc
    - Crops-fossil fuel, ethics between food and fuel, natural resource protection, etc

Emergence of New Food System

- More attention to place of origin
  - Where their food comes from
- Reconnecting producers and consumers
  - Food with a face, CSAs, farmers markets
  - Local food system
  - Green movement
- Understanding the modern food production and processing system
  - Knowledge is power.

Figure 1

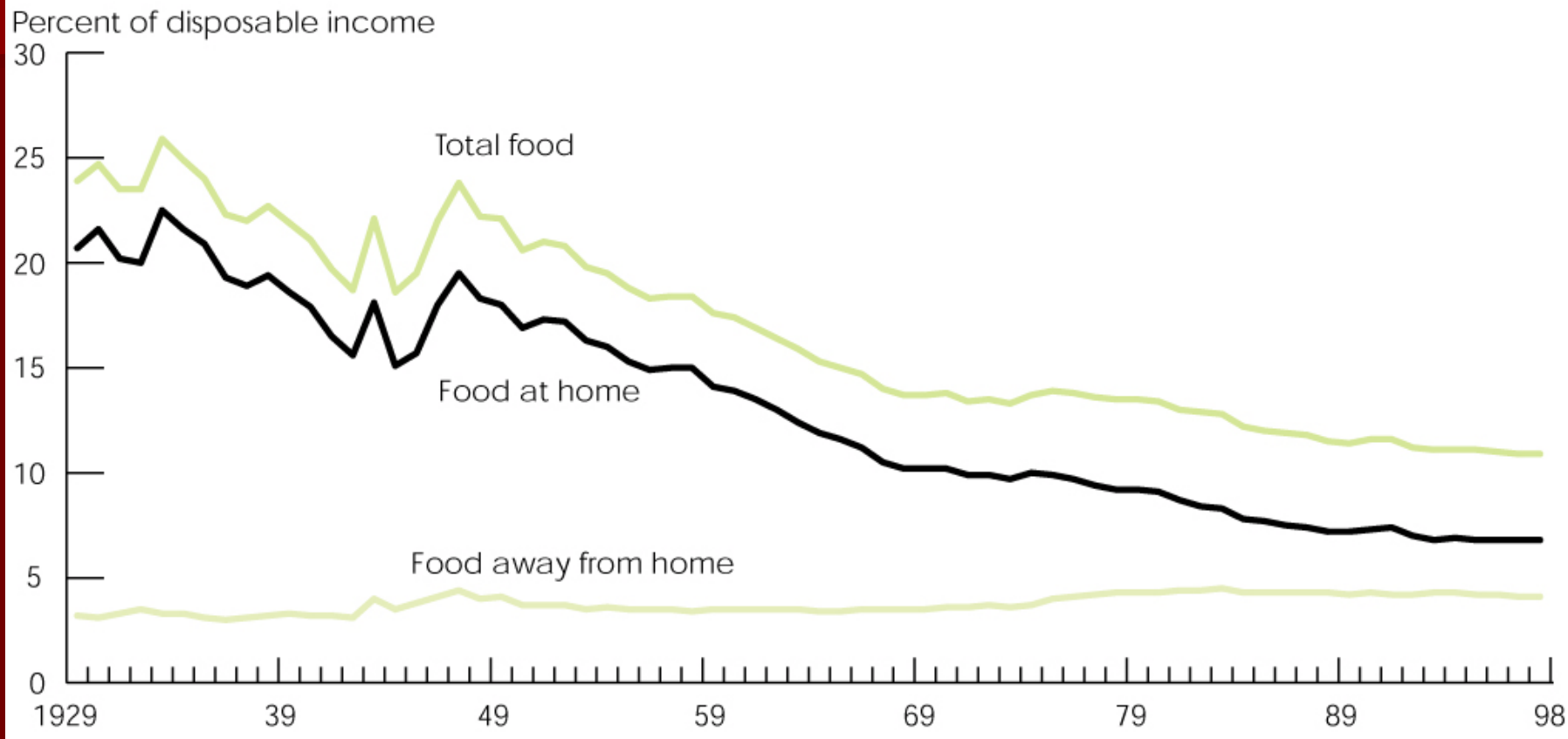
Food Expenditures



Source: USDA's Economic Research Service.

Figure 2

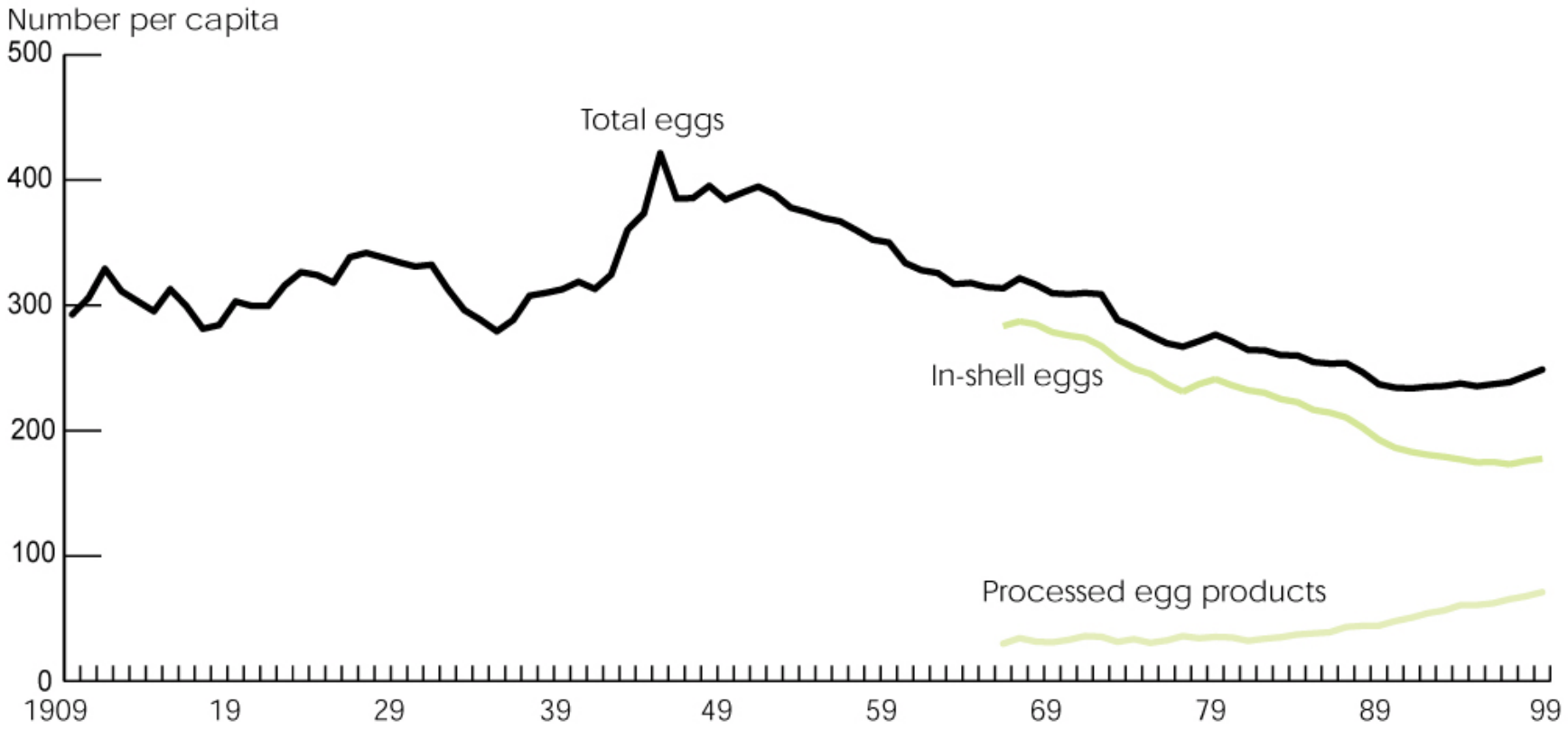
Share of Income Spent on Food by Families and Individuals



Source: USDA's Economic Research Service.

Figure 4

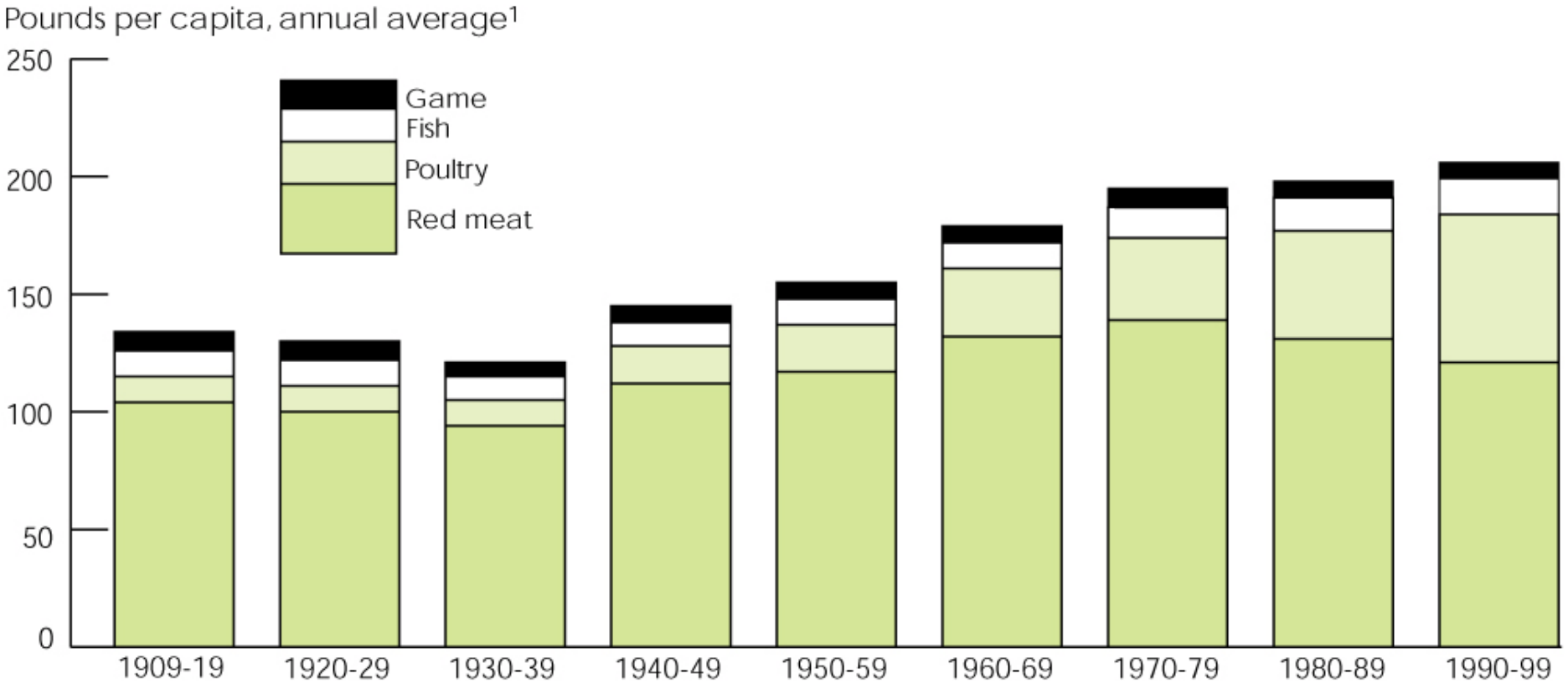
Egg Consumption



Source: USDA's Economic Research Service.

Figure 5

Total Meat Consumption

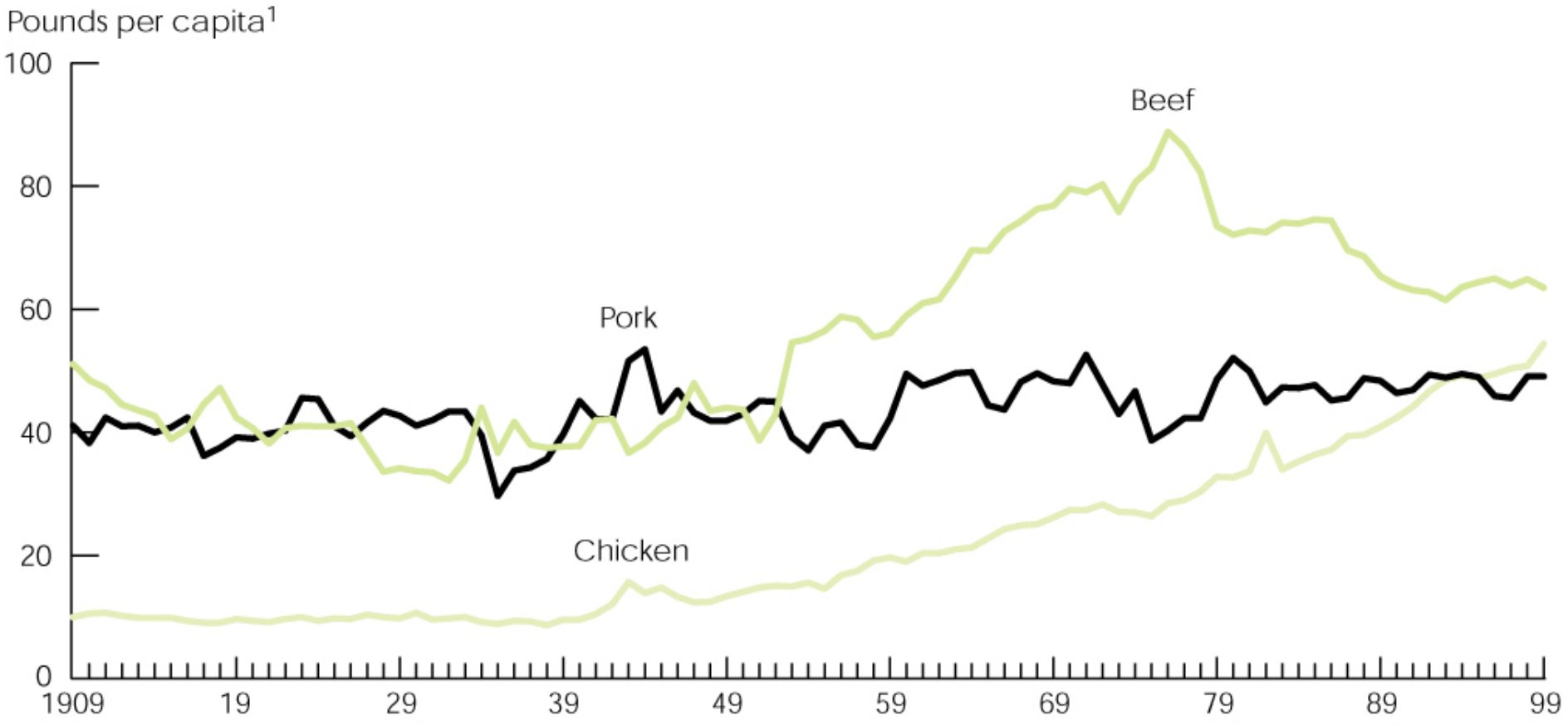


[1]Boneless, trimmed weight. Includes organ meats.

Source: USDA's Economic Research Service.

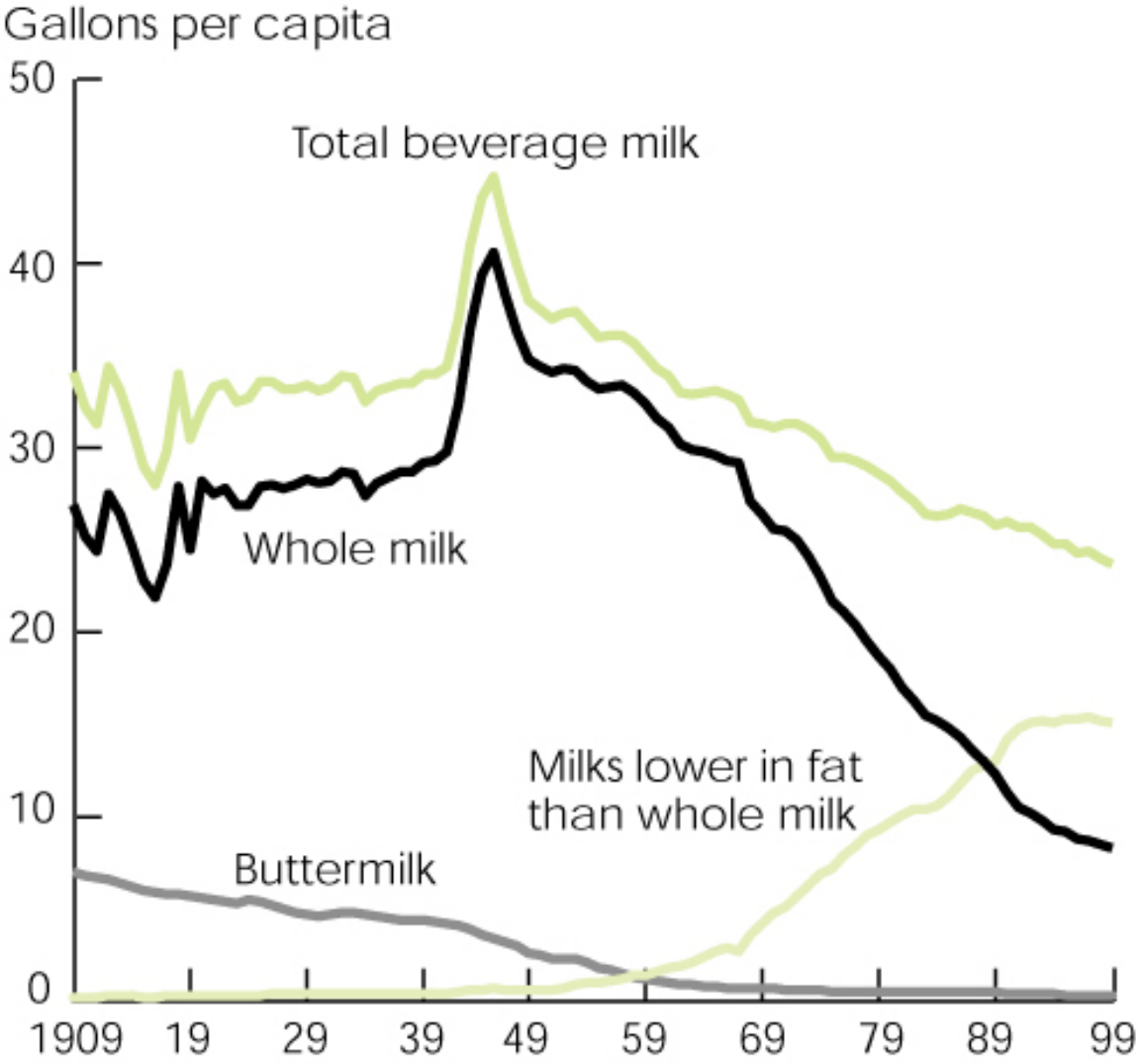
Figure 6

Beef, Pork, and Chicken Consumption



[1]Boneless, trimmed weight. Excludes beef and pork organ meats.
Source: USDA's Economic Research Service.

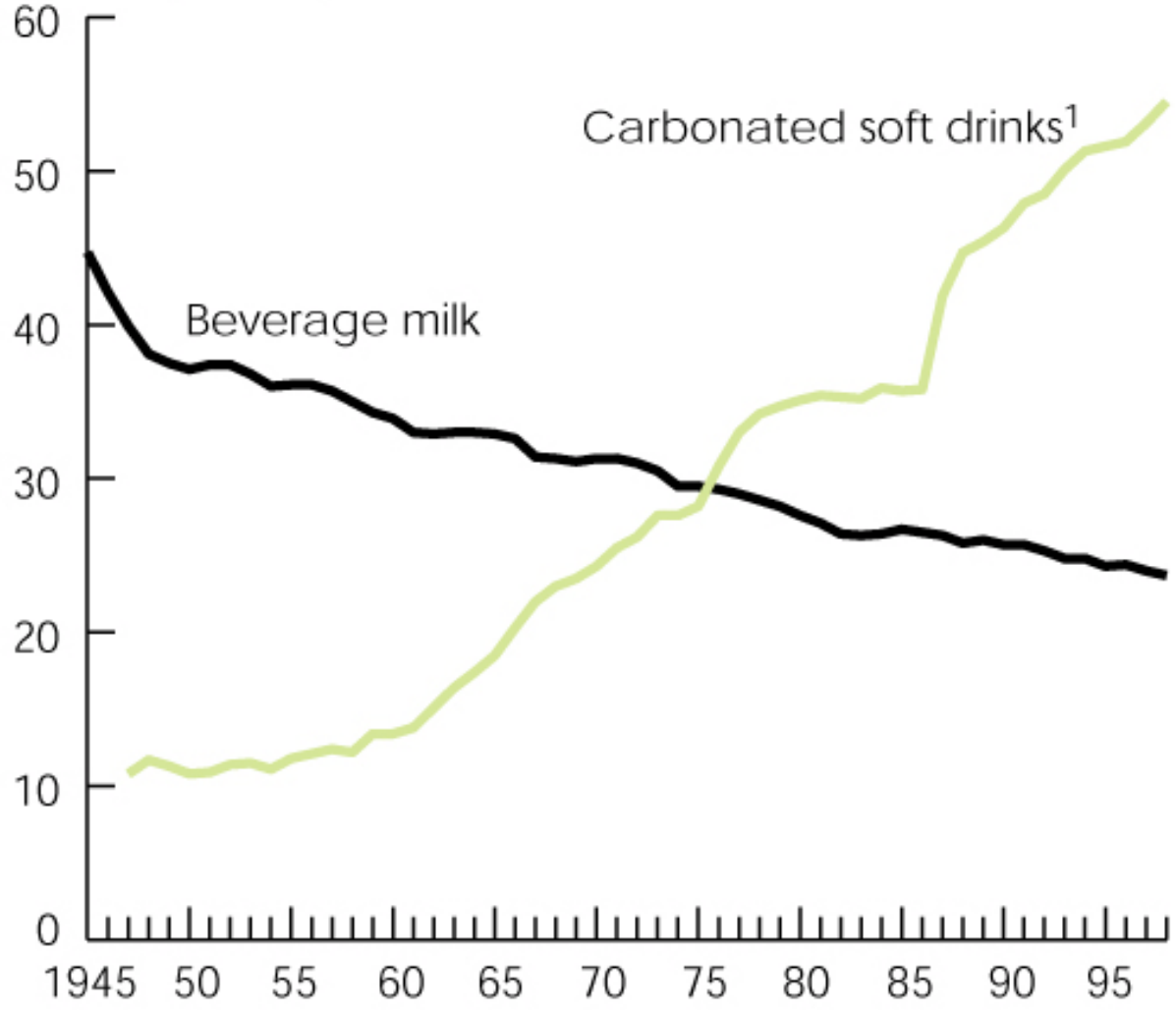
Figure 7
Milk Consumption



Source: USDA's Economic Research Service.

Figure 8

Milk Consumption Compared With Soft Drink Consumption



[1]1947 is the first year for which soft drink consumption data are available.

Source: USDA's Economic Research Service.

Even though the structure has changed the primary function of agriculture has not changed

- Produce food
- Produce feed for animals
- Produce fuel
- Produce fiber

These functions are accomplished by:

GROWING PLANTS and **RAISING LIVESTOCK**

In this changing marketplace and culture, it is important that we better communicate and connect with consumers, explain what we do, and equally important, why.

Growing up on a farm

- It was intuitive that livestock would eventually be sold and slaughtered
- But husbandry was instilled early in life
  - Caring for livestock was a daily ritual that had to be done on time, every day, and most importantly done right
  - The chores often had be done before we ate
  - I was an animal husbandry major...maybe we need to re-emphasis husbandry

Anthropomorphism

The attribution of human characteristics to characteristics to non-human creatures and beings, phenomena, material states and objects or abstract concepts, including animals and plants and forces of nature such as winds, rain or the sun depicted as creatures with human motivation able to reason and converse.

John Tenniel's depiction of this anthropomorphic rabbit was featured in the first chapter of Lewis Carroll's Alice's Adventures in Wonderland

Human responsibilities for animal welfare

Most people agree about humane treatment of animals

- Farm animals
- Companion animals
- Wildlife
- Zoos
- Research animals

Animal Welfare: Happiness?

- How to measure
- Judgments about what animals desire
- Judgments about feelings, pain, intelligence, and sociability

Brambell Report, 1965 Report of the Technical Committee to Enquire into the Welfare of Animals kept under Intensive Livestock Husbandry Systems

Five Freedoms

1. Freedom from Hunger and Thirst
2. Freedom from Discomfort
3. Freedom from Pain, Injury or Disease
4. Freedom to Express Normal Behavior
5. Freedom from Fear and Distress

Has husbandry declined?

- The number of animals needed to be an efficient farm makes it difficult to give individual attention to every animal
  - Our dairy cows had Christian names
  - So did our dogs and most of the cats
  - Hogs didn’t have names
  - Our horses had names
  - We felt that chickens, turkeys, and other fowl didn’t deserve names

Elements of husbandry

- Feeding, watering, tending to their physical needs
- Attending to birthing, providing warmth and comfort
- Caring for animals was more than a good business practice, it was a moral act.
- Orphan animals—pet pigs, lambs, etc

Is Farm Size related to level of Husbandry?

- It is disingenuous to argue that the number of animals is correlated with animal care.
- I have witnessed poor animal husbandry in small herds on small farms, and likewise I have seen high levels of husbandry on very large farms.
- Size is not nearly as important as the intention, values and compassion of the operator.

Animal Abuse

- Hot button issue
  - Puppy mills
  - Circuses
  - Zoos
  - On Farms
  - Hoarding animals
  - Euthanasia

American spend billions of dollars on companion animals

- Business Week in 2007 reported that American spent $41 billion on pets and this is expected to rise to $52 billion in 2009
- Some people object to how pets are treated—declawing, tail docking, cropping of ears, kenneling,
- Others raise ethical issues about this wasteful spending when others go hungry

What are consumers being told

- It is true?
  - Is it widespread?
  - How many cases are needed to make the case of being a industry vs. business problem?
- It is balanced story?
  - Do industry standards exist?
  - Is there inspections and enforcement

Are farmers and rural communities destined to be second class citizens?

- Without livestock the answer is most certainly yes. There are large portions of the US that are unsuitable for continuous tillage, and grass-based, livestock foraging is ecological and environmentally sound
- Without livestock, these regions will experience accelerated outmigration, unemployment and stagnation.

Re-connecting with Animals

- Diverse range of opinions, values and beliefs about human responsibilities and duties towards animals
  - Confusion between livestock, wildlife, companion animals, laboratory animals, zoos,
- Over 200 national and international groups and organizations that speak on the issue of animal care and welfare

2001-2010 The Decade of the Animal

October 18, 2009 Chronicle of Higher Education

1. The Age of Empathy: Nature's Lessons for a Kinder Society, de Waal
2. Unto Others: The Evolution and Psychology of Unselfish Behavior, Sober and Wilson
3. The Mermaid's Tale: Four Billion years of Cooperation in the Making of Living Things, Weiss and Buchanan

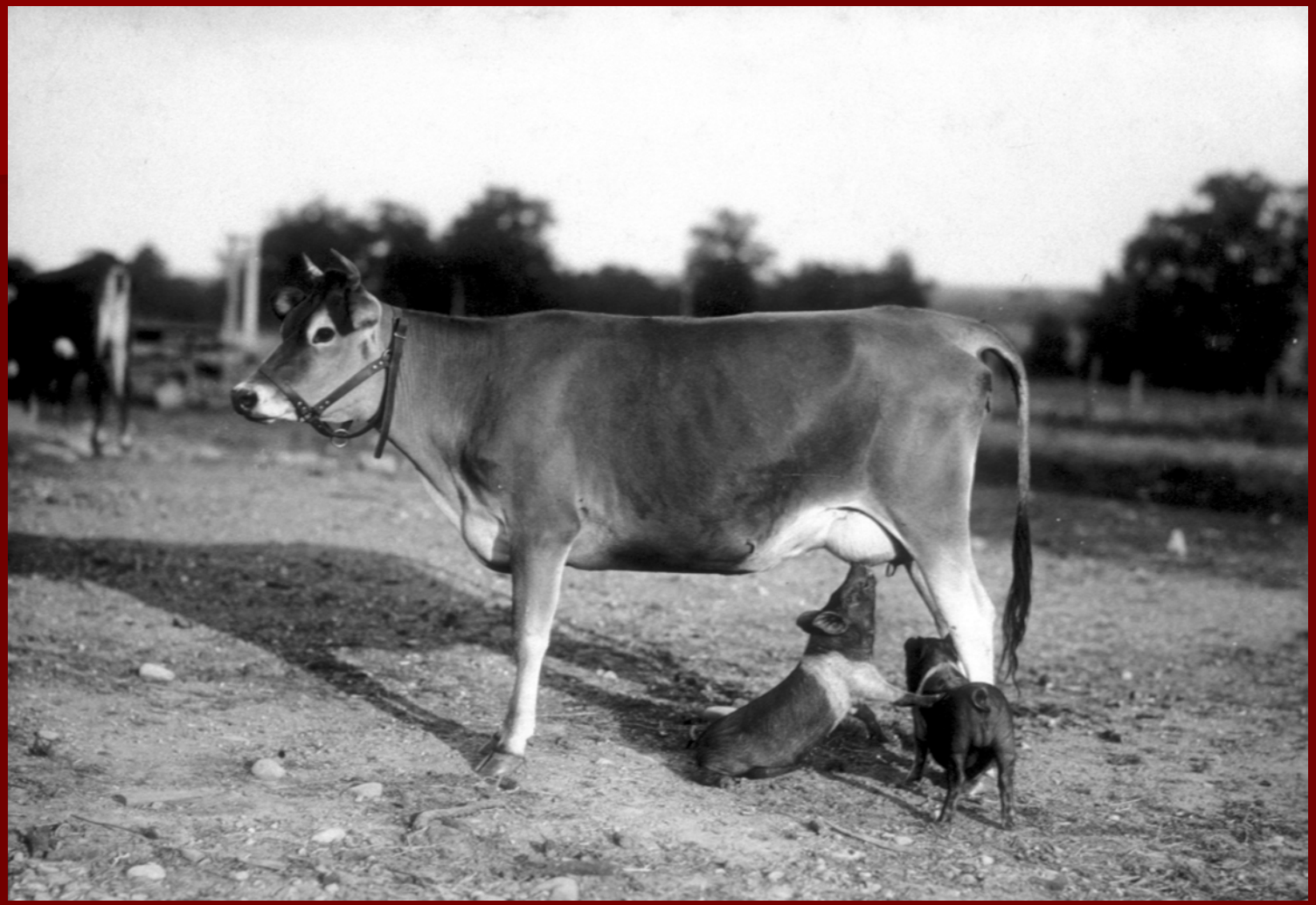
The Human-Animal Agenda

- Knowledge of the interdependency and interaction between animals and people
- Understanding of options and alternatives to humane care for animals—raising the husbandry standard
- Code of ethics on animal care

- I am concerned that we have lost sight of the end result

- What are the common elements of the agricultural vision that we can agree upon
  - A well fed populace
  - A stable and reliable food system
  - Respects the integrity of all living things, both plants and animals

- We need to dial down the rhetoric and demonstrate respect for each other by increasing dialogue and less blaming.



THANK YOU

NOTES