



# Environmental Issues in Animal Agriculture

Charles W. Abdalla and Jennifer L. Lawton

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The evolution of animal agriculture in North America is focusing increased attention on its impacts on water and air quality. The adoption of new technologies and the restructuring of the food and agricultural system are generating new economic and environmental impacts and influencing public perception about animal agriculture. The expansion of livestock and poultry production, particularly larger confined animal operations, is increasingly leading to private disputes and public issues concerning agricultural production and the environment. These disputes are leading to new patterns of costs and benefits and, in some cases, public policies that are affecting competitiveness of this sector. The issues and options to resolve them are complex and require increased understanding and involvement by all stakeholders. While new technologies to improve environmental performance and monitor progress will be developed, constraints on resources may limit implementation.

This article draws on a much longer report, *The Future of Animal Agriculture in North America* (Farm Foundation, 2006).

## Current Situation

Livestock and poultry farms generate manure, bedding, milk-house wash water, spilled feed and dead animals that, if not properly managed, can impact water quality. Animal manure and related byproducts contain elements that, under certain circumstances, might reach surface or ground water and cause pollution. The location of an animal operation plays a role in how pollutants may reach water and the magnitude of environmental damage. Animal production in grain deficient regions may generate manure nitrogen or manure phosphorus in excess of the assimilative ability of nearby land for manure application.

Air quality issues associated with confined animal operations are traditionally nuisance concerns, such as odors, but there is increasing focus on possible links between dust and other particulates, ammonia and hydrogen sulfide from animal operations and human health. Concerns include the possible effects of ammonia and particulates on respiratory systems (e.g., asthma) and prolonged exposure to odors on mental health effects (e.g., depression). Only a relatively few studies (e.g., Thu et al., 1997; Wing & Wolf, 2000) have attempted to measure health impacts of odors and air emissions on nearby residents.

There are scientific concerns about bioaerosols—tiny airborne particles that contain microorganisms or their byproducts—due to their potential for causing human and animal disease and microbial toxins. Bioaerosols may be released into the air by such practices as land application of animal biosolids, livestock wastewater spray irrigation, livestock wastewater injection or animal pen scraping. Other sources of bioaerosols include exhausted air from livestock confinement buildings, high winds that carry bioaerosols from open livestock wastewater systems and dust blown from outdoor livestock pens. Much more needs to be known about the possible connections between air emissions from animal operations and health of rural residents. The results from scientific studies of these linkages are likely to drive future environmental policies for animal agriculture in the United States.

In addition to direct emissions from cattle, the anaerobic decomposition of manure during storage produces methane, a greenhouse gas (GHG). GHG emissions from farm animals have increased during the last decades due to the overall increase in the number of livestock and the relatively low rate of adoption of technology to reduce emissions.

## Forces of Changes and Their Implications

**Industry Concentration and Specialization.** Economic forces influence the expansion in operations' size and geographic concentration of the animal industries. Regional clusters form around economic advantages, such as climate, processors, transportation access and costs, infrastructure, and proximity to inputs. In addition, industry marketing practices, such as contracting, have resulted in higher concentration of poultry and swine production in a few geographic areas (Vukina, 2001). Expansion into areas with existing nutrient surpluses may exacerbate the region's water quality pressures and possibly other environmental problems. Where contracting has become prevalent, producers have been responsible for manure management and dead animal disposal since these activities are not typically covered by the contract (Vukina, 2001). Thus, contracting has raised questions about producers' ability to afford and be rewarded for good environmental management and what role integrators should play in helping with such management and its costs.

**Uncertainty about Human Health Impacts.** As in many other environmental and public health issues, technology for detecting contaminants in the environment outpaces our ability to understand the human health implications. There are also emerging concerns over possible effects of endocrine disruptors, antibiotic resistance and air emissions from animal facilities. In the United States, the Environmental Protection Agency (EPA) is researching emissions from Concentrated Animal Feeding Operations (CAFOs), and the transport and fate of Food and Drug Adminis-

tration-approved pharmaceuticals used in animals. It has called for National Pollutant Discharge Elimination System (NPDES) permits to include best management practices (BMPs) for pathogens.

**Weak Federal Leadership and/or Policy Implementation Failures.** In the United States, the responsibility for protecting the environment from the effects of animal agriculture has been shared between government levels. For example, in principal strong federal oversight has existed over permitting CAFOs under the federal Clean Water Act since the mid 1970s. In practice, however, the federal leadership role has been slow in developing and unevenly applied across the United States. It was also largely ineffective in dealing with emerging water quality problems from changes in animal industry structure and location in the last 20 years. To fill the void, some states and local governments have developed their own water and air laws. A patchwork of state policies and capacities for implementation now exist across the nation, resulting in difficulties for the industry in meeting differing rules, differences in the competitive economic environment of states, and an incentive to the industry to locate in states with less stringent environmental policies. While recent proposals by the federal government have attempted to improve and update its approach, they have been delayed due to court cases. Available evidence indicates that Mexican environmental rules also suffer from implementation shortcomings.

**Technological Advances.** New and improved technologies have historically generated tools to mitigate environmental problems in the animal agriculture industry. New treatments for

manure can help reduce the loss of nutrients to the environment. Animal-feeding strategies have been developed to reduce nutrient excretions, emissions and odor from manure. Attention is being turned toward economically viable uses for manure that reduce the environmental impact. New methods have learning and adjustment costs, as well as some risks. Without a focused strategy for implementing new technologies, adoption may be slow.

**Environmental Activism and Use of Information Technologies.** Advances in information technologies have allowed neighbors of proposed large animal operations to communicate effectively. The Internet allows local groups to communicate, obtain information about issues and legal or political strategies, form alliances with groups across longer distances, and select their own sources of information to use in discussions and debates. In the United States, these developments add to the challenges of public policy decision-making and increase the potential for decision-making gridlock and delay.

**Litigation.** Litigation is a common strategy to settle disputes in the United States, but much less so in Canada and Mexico. Neighbors or environmental groups may continue to use litigation as a strategy to force implementation of regulations in the United States. Concerns regarding litigation relate to costs, delays, uncertainties, loss of control and loss of representation for all stakeholders. These problems may impact the size and number of animal operations, as small- and mid-size farms may not have the resources to challenge a lawsuit. Increasingly, a community's acceptance of animal agriculture is a key factor in where the industry can

expand. It may also impact the competitiveness of regions within the United States. If other countries, including Canada and Mexico, do not have these costs and uncertainties due to more stable regulatory regimes, an incentive exists for U.S. animal firms to relocate.

**Perceptions of Agriculture.** Farmers are traditionally viewed as good stewards of the land and the environment, and enjoy a large amount of good will among the public. The public may be less tolerant of environmental and nuisance impacts of animal agriculture, especially larger units. Improved scientific understanding of the impacts certain management practices have on the environment and human health may change public perceptions.

**Environmental Monitoring.** It is often difficult to attribute specific efforts of farms implementing BMPs to environmental outcomes. Measurement challenges include time delays, influences of weather, and difficulties measuring and monitoring smaller and diffuse sources of pollution. Advances in measurement technology have the potential to drastically change our understanding of pollution sources and to create new systems of accountability. Such advances will reduce monitoring costs and likely make resulting information accessible to watershed and/or other groups concerned about the environment. Bacterial source tracking has been proposed as a method to determine not only the species, but also to pinpoint the specific flock, herd or community causing any contamination. These developments can help inform the debate about the relative contributions of farming or other land uses (e.g., lawn fertilization or septic tanks) to pollution. Increased

requirements for monitoring, along with decreased costs of doing so, will likely be a major driver of environmental policy for animal agriculture in the future.

**Resource Constraints.** Resource constraints have for some time been a limit in conservation and environmental programs affecting animal agriculture. These resources include personnel and funds for cost-sharing, research, technology development and technical assistance/education. There will be increased need for government agencies to set priorities. There may be an increasing role for the private sector, private-public partnerships, and multi-state and multi-national programs. Regardless of the origin of the resources, the priority must be on actively seeking practical solutions.

**Uncertainty about Global Agreements, Kyoto Implementation.** It is expected that the Canadian and Mexican efforts to implement the Kyoto Protocol for reduction of GHG emissions will continue to evolve. In Canada, a commitment exists to ensure that pollution credits can be supplied by projects under its offset system during at least the next eight years. As this system evolves, animal agriculture has the potential to be an important contributor by reducing its GHG emissions. Moreover, uncertainty exists about the future of Canadian and Mexican GHG reduction programs because the Kyoto agreement period ends in 2012. However, there is potential for a continuation beyond that date.

The Kyoto agreement on global climate change created a market for the reduction of GHG emissions. If a successful pollution credit trading market is established, there may be greater potential to reduce animal ag-

riculture emissions than to do so through cropland management and carbon sinks. However, there are a number of important obstacles to the development of trading for GHG emissions. One of the major impediments is the need for the establishment of a regulatory limit or "cap" on total emissions in a particular region or air basin. If obstacles to market-based programs can be overcome, the potential may develop to create incentives for producers to adopt technologies and reduce overall environmental abatement costs.

### Options for the Future

Five potential options for addressing environmental issues are discussed below. When making choices involving the five options below, it is important to recognize that none alone offer a single solution to address all environmental issues. The best choice may not be between different options, but deciding on the right mix of policy options.

**Strengthen the public-sector role.** The first option is establishing stronger federal, state or provincial policies to encourage responsible growth of the animal industry in locations with less environmental risk. A uniform regulatory playing field across countries, states and provinces could reduce overall environmental risk. This option could include increasing commitment to implementing regulatory and incentive programs, including adequate funding for staff.

**Expand systems research.** There is a need for more systems-oriented research by the public and private sectors on the environmental impacts of agriculture. Increased public funding for this type of research would give decision-makers better information about the interrelationships of envi-

ronmental/health, social, economic and legal/policy implications of animal agriculture. Results could identify solutions for different scales of farming and regional environments that take social/behavioral factors into consideration. There should be an emphasis on performance-based solutions to assure accountability. This research should be regional, national and global in scope, future-oriented and anticipatory of emerging challenges, multidisciplinary, and include agricultural universities, medical schools, and public and private partnerships. There is a need for information to reduce uncertainty concerning the relationship between animal agriculture and human health. Private research, with appropriate oversight to ensure objectivity, would be one way to fill this critical information gap.

**Target best management practices to the highest priority environmental concerns.**

This approach would target efforts to areas and farms with the greatest water or air quality problems. Some types of animal agriculture provide a flow of goods or services that society values, including ecological services and possibly amenities. Payments from government to producers to provide ecological services—known as “green payments”—have been suggested as a major new direction for farm policy. This targeted policy option could utilize the green payments idea to integrate ecological goods and services into agri-environmental policy to reach desired broader environmental outcomes. Because the focus is on implementation, this option would use existing social and economic research knowledge on implementation and adoption, including incentive-based tools. It would require improved coordination among agencies and possibly other water or

air quality monitoring groups, and development of information systems to assure cross-compliance with existing farm programs.

**Use market-like mechanisms to “get the prices right”.** This option involves public and private cooperation to explore and foster promising innovative arrangements that internalize external costs of the fair, i.e., off-farm impacts on neighbors, communities and the environment. Such arrangements could more accurately reflect the off-farm costs of animal production in market prices, providing incentives to better manage manure and animal byproducts. Changes in government policies, such as new regulations or clarification of property rights, may be needed to help start a market in which the prices of agricultural commodities reflect true costs to the environment incurred in their production. This might provide an incentive for producers and processors to adopt systems that maximize profits while being environmentally friendly. This option could benefit from the trend among consumers and food retailers to demand products that are environmentally friendly. Public and private efforts to inform producers, agribusinesses, food wholesalers and retailers, and consumers about products produced in such a manner would complement such policy changes.

**Legal reform.** Many legal reform proposals have been put forward to provide the industry with some certainty or a “safe harbor.” These reform efforts generally fail because they are perceived as taking rights from one group and giving them to another without compensation or required action by the industry. The crux of this policy approach is the need for multiple parties—industry, scientists

and the public through government—to act together. In exchange for some protection against complex and costly litigation, the industry supply chain would take specific responsibility for the handling of animal manure and other environmental impacts using recognized science-based methods.

A second opportunity area for legal reform relates to the division of responsibility for manure management and dead animal disposal between the integrator and producer. Research indicates that the social benefits of greater sharing in responsibility of environmental management by the integrator depends on the relative bargaining power of the two parties (Vukina, 2001).

**Summary**

The expansion of animal production is increasingly leading to public policy issues concerning the environment. The options to resolve these issues are complex and require understanding and involvement by all stakeholders. While new technologies to reduce or eliminate the environmental impacts of animal agriculture will be developed, resource constraints of government agencies or producers may limit successful implementation of these technologies.

As animal agriculture evolves in North America, it faces new challenges and opportunities. Uncertainty in the face of possible regulation at the national, state/province or local level may hinder new developments or cause the industry to seek to locate in areas where environmental regulations are less stringent. New policies can create financial and technical burdens for producers and other firms and increase uncertainty. At the same time, successful policies will create benefits to farmers, neighbors

and more broadly, those in the community and society who benefit from improved water or air quality. It will be necessary to address environmental issues related to animal agriculture in a way which promotes stewardship of the environment and the well-being of the industry.

**For More Information:**

Farm Foundation. (2006). *The future of animal agriculture in North America*. Available online: <http://www.farmfoundation.org/projects/04->

32ReportTranslations.htm. Oak Brook, IL.

Thu, K., Donham, K., Ziegenhorn, R., Reynolds, S., Thorne, P.S., Subramanian, P., Whiten, P., & Stookesberry, J. (1997). A control study of the physical and mental health of residents living near a large-scale swine operation. *Journal of Ag Safety and Health* 3, 13-26.

Vukina, T. (2001). *The relationship between contracting and livestock waste pollution*. White Paper. National Center for Manure and Animal Waste Management. Raleigh, NC.

Wing, S., & Wolf, S. (2000). Intensive livestock operations, health, and quality of life among Eastern North Carolina residents. *Environ. Health Perspectives* 108(3), 233-238.

*Charles W. Abdalla (cabdalla@psu.edu) is Associate Professor, Agricultural and Environmental Economics, and Jennifer L. Lawton (jennylawton@gmail.com) is former Graduate Research Assistant, Department of Agricultural Economics and Rural Sociology, Pennsylvania State University, University Park, PA.*