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Cattle and the Environment: What's the Beef?

by
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Worldwide debate on the environmental impact of the livestock industry is intensifying (see Rifkin; Steinfield, de Haan, and Blackburn). In most of the world, beef cattle are produced primarily with forage-based feeds. Consequently, the chief global environmental concern related to cattle is the direct impact of production and processing systems on air and water quality, soil structure and erosion, plant composition, wildlife interactions, and biodiversity. In the U.S., however, most beef cattle are grain-fed prior to slaughter, adding an important indirect linkage between the cattle industry and the environment through the production and use of grains and oilseeds for animal feed.

Given U.S. cattle-beef industry production systems, questions arise whether the industry is becoming more environmental friendly and whether further progress is possible in the future? This article provides an overview of the environmental impacts of the U.S. cattle and beef industry and assesses trends toward abatement and/or intensification. Some of the obstacles impeding needed changes are then considered and the potential effectiveness of some of the proposed alternative approaches to dealing with the major environmental challenges posed by the industry are assessed.

How Does the U.S. Cattle and Beef Industry Impact the Environment?

The potential environmental impacts of the cattle and beef industry have been of particular concern only since about the beginning of the 20th century. Technological advances and related structural changes in the production, feeding, processing, and retailing of cattle and beef have created growing pressure over the last century on U.S. soil, water, air, energy, and other resources. A more detailed discussion of the U. S. cattle-beef industry's interactions with the environment is provided in Conner, Dietrich and Williams. Some of the more important cattle-beef industry environmental impacts are summarized in the following paragraphs.

Methane Emissions

In the cow-calf and stocker segments of the industry, the production and release of methane into the environment is a primary concern. Because cattle are ruminants and utilize forage, they generate relatively large amounts of methane. Over the past 200 years, however, livestock methane emissions have not increased net emissions, but instead, replaced wild animal emissions (Khalil et al.). Given the current USDA outlook for a continuing slow decline in U.S. cattle numbers over at least the next decade (USDA 2003-1), the beef industry is not likely to become any more important as a source of methane emissions in the future.

Plant Composition and Biodiversity

U.S. cattle production has also altered the native plant community composition and impacted biodiversity and wildlife through habitat disruption. Plant communities have been altered over much of the U.S. from direct interventions like plowing up native vegetation and establishing monocultural swards of derived pasture forages or by continuous overstocking of native rangelands and eliminating periodic burning from the ecosystems (Conner et al.).

Many plant communities in the U.S. have been so severely altered by cultivation or cattle grazing that, even if grazing were eliminated completely, they will never recover their original ecological state without extensive, costly restoration practices. In recent decades, cattle ranchers and public land management

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agencies have recognized the error of earlier overstocking. Through reduced grazing pressure and other management practices, they have succeeded in improving the ecological condition of much of the nation's rangelands (USDA Forest Service and US General Accounting Office). This success is due largely to the intense educational and technical assistance effort of the Natural Resource Conservation Service (NRCS) of the U.S. Department of Agriculture over the last 50 years. Many ranchers and land managers are now managing for improved wildlife habitat along with or instead of enhanced livestock grazing. Given the opportunity to use wildlife profitably, most U.S. livestock ranchers may actively preserve wildlife habitat. The success of such USDA programs as The Conservation Reserve Program (CRP) and The Environmental Quality Incentive Program (EQIP), as indicated by high landowner participation rates, indicate that the trend toward more landowner emphasis on wildlife and biodiversity will continue.

Air and Ground Water Pollution

The cattle and beef industry's potential for negatively impacting the environment both directly and indirectly is perhaps greatest in the feedlot segment. Important direct impacts include contributions both to air pollution through odors and dust and to surface and ground water pollution through nutrient loading from improper handling of manure given the concentrations of large numbers of animals in relatively small areas. Government regulation has forced reductions in the direct environmental impact of cattle feeding. The Environmental Protection Agency (EPA) and its state agency counterparts have increasingly focused on feedlots as point sources of pollution and have become increasingly vigilant in their regulation of potential pollutants from feedlots (Johnson, Wheeler, and Christensen). Thus, as with the cattle raising segment, the additional direct damage to the environment by the cattle feeding segment of the industry is likely to be small.

Production of Feed Grains

The major environmental impact of the U.S. cattle and beef industry may be indirect through the demand for animal feeds which drives the production of feed grains. In turn, feed grain production generates potentially serious pressure on water quality and quantity from erosion and fertilizer runoff and deposition in groundwater. Feed grain production also generates concerns about the potentially adverse effects of the excessive use of pesticides such as atrazine on wildlife habitat and genetic diversity. Researchers are identifying and quantifying the extent and impact of environmental degradation related to U.S. agricultural crop production (see, for example, Faeth).

Of course, not all crop production is for animal feed and not all animal feed is for beef cattle. According to the USDA (1998), feed production accounts for only a little more than half (56%) of total U.S. crop production. Thus, because cattle on feed represent only about 23% of all U.S. grain-consuming animal units, only about 12%-13% of all crops produced in the U.S. are utilized as cattle feed. The remainder is utilized either as feed for non-ruminant livestock, primarily hogs and chicken, or as food for human consumption. Moreover, because they are ruminants and can utilize roughage as feed, beef cattle are generally not placed on feed until they reach 700 to 750 pounds. Beef cattle slaughter weights average about 1,100 to 1,200 pounds so no more than 40% of the average cattle slaughter weight is put on in the feedlot. Because grains comprise about 70% of fed cattle rations, only about 28% of the average cattle slaughter weight can be attributed to grain feeding. In contrast, virtually 100% of all pork and poultry produced are from concentrates comprised of grains and oilseed meals.

What Are the Obstacles to Change?

Despite current and past efforts to improve the cattle-environment interface, a number of obstacles will likely make further improvements difficult. The unique biological ability of cattle to utilize grazed forages has led to a cow-calf and stocker industry characterized by many small, widely dispersed producers. In addition, many of the small operators, and some of the larger ones, are motivated to produce cattle by goals other than financial gain and efficiency; *e.g.*, lifestyle. The more concentrated

and financially motivated segments of the industry (feedlot, slaughter, processing and retail) must utilize the highly variable quantity (seasonally) and quality of animals provided by cow-calf and stocker producers. This atomistic, dispersed, and often economically insensitive portion of the industry limits the ability of the entire beef industry to make adjustments of any kind, whether market or socio-culturally induced.

Another obstacle to reducing the dependence on feed grains is that in most areas of the U.S., maintaining grazeable forage of the quality required to fatten cattle year-round is impossible. As a result, forage-based fattening systems are seasonal and subject to a high degree of variation in the volume and quality of the resulting beef product.

An entrenched institutional obstacle to changes in the cattle-environment interface is the highly competitive, consumer-driven market within which the industry operates and which provides strong economic incentives to grain feed cattle. In recent decades, beef has lost significant market share to poultry, primarily because consumers have increasingly viewed poultry as a less expensive, more convenient, and healthier source of protein that is consistently tasty and tender. To meet this competition, the U.S. beef industry has moved away from finishing cattle on the highly variable forage-based systems. The U.S. beef industry now relies almost entirely on grain finishing of cattle to achieve the consistency in the taste, tenderness, and availability of product that is increasingly demanded by consumers. Moreover, feedlot finishing produces the beef products desired by consumers at a lower cost than forage-based programs (Brokken et al.).

Taken together, these factors - competition from pork and poultry, the particular biological characteristics of cattle production, consumer preferences for grain-fed beef, the cost advantage of feedlot finishing, and more - all strongly suggest that grain finishing of cattle will remain the standard for U.S. beef production for the foreseeable future.

What Can Be Done?

Despite the obstacles, progress has been made in ameliorating the environmental impact of the cattle industry. Public information efforts in recent decades have increasingly focused on the potential environmental dangers of technology and the rates of resource use. While much has been done to maintain clean air and water and preserve biodiversity through protection of endangered species, notably less has been done to reduce the rate of fossil energy consumption and the resulting build-up of atmospheric CO_2.

Given our current culture and fossil energy-based economy, the challenge of achieving further progress in both reducing the rate of consumption of natural resources and improving the assimilative capacity of our environment is formidable. Our representative form of government and the consumer-minded electorate make the political task of implementing environmentally friendly regulations with the presumed negative economic impacts extremely difficult. Some of the major environmental problems are truly global in scale, such as the levels of atmospheric CO_2 and methane, the solutions to which require multi-national concessions, agreements, and programs. The difficulty in achieving progress on this scale is evident in the slow rate of progress to date resulting from the 1992 U.N. Conference on Environment and Development in Rio de Janeiro, the so-called “Earth Summit.”

Most approaches proposed for improving the cattle-environment interface focus primarily on the direct, rather than the indirect, impact of cattle on the environment. In general, these approaches either are already in place in this country or are most appropriate for developing countries. One such set of proposals was offered by a recent major study sponsored by the U.N. Food and Agriculture Organization, the World Bank, and the U.S. Agency for International Development (Steinfeld, de Haan, and Blackburn).

The study offers three groups of solutions to internalize the externalities created by the livestock sector. The *policy solutions* offered include measures to reduce grazing pressures (such as implementing/

increasing grazing fees), input subsidy elimination, a variety of incentives/penalties to control excessive application of animal waste in mixed farming systems, and continued education of cattle producers and land managers on the potential benefits of enhanced wildlife habitat and biodiversity. *Production technology solutions* suggested include those that enhance and/or conserve resources such as "deferred grazing" of rangelands and the use of derived pastures of perennial grasses and legumes in more humid areas. *Production system strategies* proposed include measures to reduce negative environmental impacts during the transitions between different production system phases (grazing, mixed, industrial, etc) in developing countries.

The Steinfeld, de Haan, and Blackburn study also discusses the indirect impact of livestock feeding on the environment primarily in developed countries but fails to provide effective alternative solutions. According to conventional wisdom, policies and educational programs to encourage increased forage over grain finishing of cattle could feasibly reduce the indirect environmental impacts of cattle feeding. A growing demand for lean beef is generating interest in forage feeding of cattle. At the same time, an increasing number of up-scale restaurants featuring "specialty" meats and grocery meat markets specializing in "organic" or "natural" foods are educating consumers that forage-finished beef is both a healthier (reduced fat) and an environmentally friendlier product.

Of course, a wholesale move of the U.S. cattle industry to forage feeding would alleviate much of the indirect environmental impact of cattle feeding but would exacerbate the direct impacts. Such a move would also create a host of other concerns. For example, much of the forage grazed by cattle is fertilized with non-organic chemicals and frequently subjected to chemical pesticides. Furthermore, many forage-finished cattle are treated with anabolic steroids, other pharmaceuticals, and/or pesticides. Moreover, a large-scale conversion to forage feeding could have important consequences for Midwest agriculture and rural communities whose economic viability depend heavily on grain and feed production.

An often mentioned general solution to environmental pollution is to force consumers to pay the full cost of fossil-based energy use, including waste disposal costs, through a carbon tax (Nordhaus; Woodward and Bishop). Success in reducing fossil fuel use could make grain and other foods directly derived from plant products less expensive relative to animal-based food products derived from the feeding of grain to cattle. The net result would be a reduction in meat consumption and, hence, cattle and beef production. Measures like a carbon tax, however, would be difficult to implement through a process that would likely be slow and incremental.

Summing Up

While the cattle and beef industry has and will continue to have direct negative impacts on the environment, improved grazing and land management practices have considerably reduced the threat of additional direct environmental degradation by the U.S. cattle industry. The most pressing concern is the indirect effects of the cattle feeding industry on the natural resource base. Many forces have combined to minimize the possibility of any significant decline in the U.S. rate of grain-finishing of cattle in the foreseeable future. The best hope for reducing the indirect environmental pressure of the U.S. cattle feeding sector may well be the market-led trend of consumer preferences away from beef toward poultry, pork, and other protein sources. The net effect of that trend could well be negative for the environment, however, because the beef cattle industry is a minor force in the U.S. demand for feed grain production. Non-ruminant livestock (pork and poultry) production drives the demand for feed grains and, thus, is indirectly responsible for the majority of the adverse effects of feed grain production on the environment. In this light, a successful "eat more beef" campaign by the cattle and beef industry might be considered to be pro-environment to the extent that poultry and pork consumption are reduced.

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