



BEEF FACTS: SUSTAINABILITY

BEEF RESEARCH

Fact Sheet 16 in the Series: Tough Questions about Beef Sustainability

Ecosystem Services — What are they and how do they relate to beef production?

Laura Goodman and Ryan Reuter

Oklahoma State University, Natural Resources Ecology and Management and Animal Science Departments

Because beef cattle producers often manage large tracts of land, they are managing ecosystems and ecosystem services. Those terms may be unfamiliar, but they describe simple and innately understood concepts.

What are Ecosystems?

Ecosystems are communities of living organisms interacting with their physical environment and one another. The living organisms include plants, animals, people, fungi, and bacteria, while the physical environment includes non-living components like sunlight, soils, water, air, and mineral nutrients. Each ecosystem community is unique in how its living and non-living components interact, but all healthy ecosystems provide critical goods and services necessary for human well-being.

What are Ecosystem Services?

Ecosystem services are the benefits which people obtain from the ecosystem (**Table 1**). In most cases, ecosystems provide these services at little or no financial cost. These benefits can accrue to an individual or to society as a whole.

The Beef Cattle Industry's Contribution to Ecosystem Services

Livestock production is generally categorized as a provisioning service. These services produce a commodity or product, in this case, beef. Products from beef cattle do not mean just steak and hamburgers though, because by-products from beef cattle are a part of our everyday lives. They are found in many goods like tires, sheetrock, antifreeze, insulin, clothing, and even deodorant.³

Grazing animals are important for providing food to people for two reasons: (1) they convert indigestible plant parts (fiber) into a form our bodies can absorb (protein) and (2) they provide a product from lands that are otherwise limited in their potential for human food production. Humans cannot breakdown cellulose, which is the primary component of fiber. Ruminants (cows, sheep, goats) consume high-fiber plants like grasses and convert it to valuable protein for human use. They can do this because of their specialized digestive systems.

Table 1. Examples of the goods and services from ecosystems by category^{1,2}

Ecosystem service category	Examples of ecosystem services within category
Provisioning	Food; Fresh water; Fiber; Fuelwood;
Supporting	Cycling of nutrients; Soil building, preservation, and fertility renewal; Photosynthesis
Regulating	Regulation of disease carrying organisms; Climate stability; Moderation of weather extremes; Agricultural pest control; Air and water purification; Polination of natural vegetation and crops; Decomposition and detoxification of wastes
Cultural	Support of spiritual and cultural heritage; Educational, aesthetic and recreational opportunities

Many of the lands used for grazing beef cattle are rangelands or pastureland. These lands are characterized by limited use for cultivation due to shallow, fragile, or rocky soils, steep terrain, and/or low rainfall. Rangelands are the predominant land type across the world, making up 70% of the earth's land area. Meat from livestock grazing rangelands is an important product these ecosystems provide.⁴

The process of grazing also provides services like developing wildlife habitat by increasing plant species diversity and creating variation in plant structure as cattle select certain plants to eat over others⁵ which is important for supporting a wide variety of wildlife species.

Lastly, beef cattle production in the United States promotes rural communities and provides a cultural service as the backdrop of our historical heritage as witnessed by many of our American songs and stories.

Examples of Ecosystem Services Important to the Beef Cattle Industry

With nearly 94 million head of cattle in production in the United States and each animal capable of producing 19,800 pounds or 740 cubic feet of solid manure per year, disposing of their manure can be challenging. Luckily, beetles in the Scarab family (Scarabaeidae), commonly known as dung beetles, assist in decomposition of this waste on pastures and rangelands

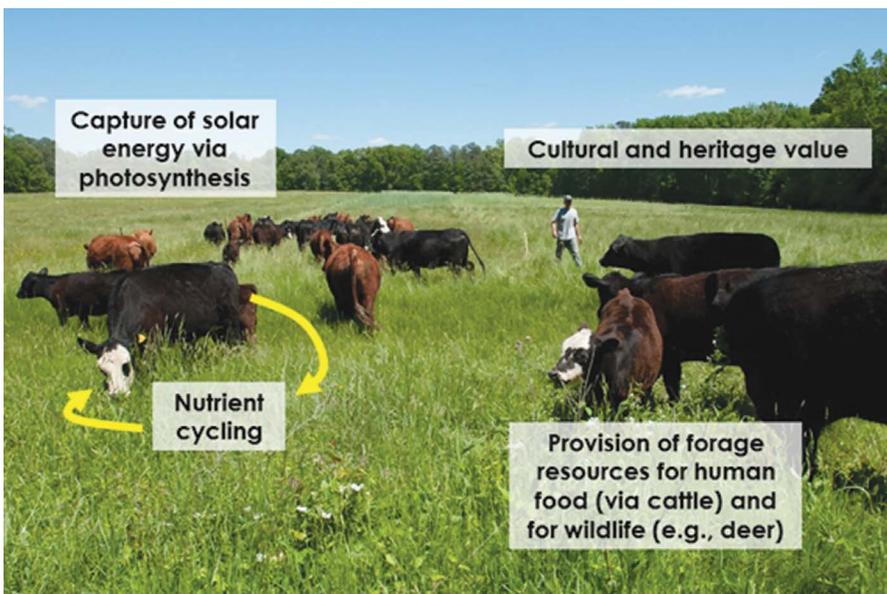


Figure 1. Examples of ecosystem services important to the beef industry and the beef industry's contribution to ecosystem services.

Photo courtesy of U.S. Department of Agriculture

by burying the manure and incorporating it into the soil. The removal of dung from the soil surface reduces losses due to forage fouling (\$122 million), nitrogen cycling that would have been lost to the environment (\$58 million), and decreases habitats for parasites (\$70 million) and flies (\$130 million) for a total of \$380 million of averted losses to the beef cattle industry in the United States.⁶

Alfalfa hay and supplements containing alfalfa products are commonly used as winter protein supplements in beef cattle production. The seed used to grow that alfalfa requires pollination by bees. In fact, alfalfa is the most valuable U.S. crop requiring pollination by bees. The value attributed to the pollination services provided by leaf cutter bees in alfalfa hay production was over \$7 billion in 2008.⁷

Can Ecosystem Services Be Lost?

Poor grazing land management can reduce an ecosystem's ability to provide ecosystem services. On grazing lands, examples of poor management may include:

- Reduction in plant biodiversity from broadcast herbicide application or the introduction of invasive plant species
- Runoff of fertilizers, herbicides or pesticides⁸
 - Soil erosion from overgrazing⁹
 - Encroachment of woody plant species into their non-native habitat¹⁰

Bottom line:

Beef cattle production, including the proper management of grazing lands associated with it, is an important source of diverse ecosystem services to humans. In turn, beef production also benefits from ecosystem services.

References

- ¹Daily, G. C., Susan Alexander, P. R. Ehrlich, L. Goulder, J. Lubchenco, P. A. Matson, H. A. Mooney, S. Postel, S. H. Schneider, D. Tilman, and G. M. Woodwell. 1997. Ecosystem services: Benefits supplied to human societies by natural ecosystems. *Issues in Ecology* 2:1-15.
- ²Millennium Ecosystem Assessment, 2005. *Ecosystems and Human Well-being: Synthesis*. Island Press, Washington, DC.
- ³Jayathilakan, K., K. Sultana, K. Radhakrishna, and A.S. Bawa. 2012. Utilization of byproducts and waste materials from meat, poultry and fish processing industries: a review. *Journal of Food Science and Technology* 49:278-293.
- ⁴Holechek, J. L., R. D. Pieper, and C. H. Herbel. 2001. *Range management: Principles and practices*. Prentice Hall. Upper Saddle River, New Jersey, USA.
- ⁵Hartnett, D. C., K. R. Hickman, L. E. Fischer, and Walter. 1996. Effects of bison grazing, fire, and topography on floristic diversity in tallgrass prairie. *Journal of Range Management* 49:413-420.
- ⁶Losey, J. E., and M. Vaughan. 2006. The economic value of ecological services provided by insects. *BioScience* 56:311-323.
- ⁷Calderone, N. W. 2012. Insect pollinated crops, insect pollinators and US agriculture: Trend analysis of aggregate data for the period 1992–2009. *PLoS ONE* 7:1-27.
- ⁸Hart, M. R., B. F. Quin, and M. L. Nguyen. 2004. Phosphorus Runoff from Agricultural Land and Direct Fertilizer Effects: A Review. *J. Environ. Qual.* 33:1954–1972.
- ⁹Hogan, C. M. 2009. Overgrazing. *Encyclopedia of Earth*. Sidney Draggan, topic ed.; Cutler J. Cleveland, ed., National council for Science and the Environment, Washington DC.
- ¹⁰Wine, M. L., and J. M. H. Hendrickx. 2013. Biohydrologic effects of eastern red cedar encroachment into grassland, Oklahoma, USA. *Biologia*. 68: 1132. doi:10.2478/s11756-013-0252-9.

For more information, contact:

National Cattlemen's Beef Association
Contractor to the Beef Checkoff Program
9110 East Nichols Avenue
Centennial, CO 80112
303.694.0305

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