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Multifunctional Rural Landscapes: Economic, Environmental, Policy, and Social Impacts of Land Use Changes in Nebraska

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Multifunctional Rural Landscapes

**Economic, Environmental, Policy and
Social Impacts of Land Use Changes
in Nebraska**

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University of Nebraska – Lincoln

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Introduction

The conversion of farmland near cities to other human uses is a global trend that challenges our long-term capacity to provide food, fiber, and ecosystem services to a growing world population. If current trends continue in the U.S., the population will reach 450 million by the year 2050. At the same time, an accelerating change in land use will reduce today's two acres per person of farmland to less than one acre per person. This is scarcely enough to produce food for our domestic population, without any food available for export – even assuming advances in technology. We need to take these trends seriously, as the national economy and domestic food security are threatened by conversion of land to non-farm uses.

This bulletin provides insight on the multifunctional aspects of the rural landscape, including an overview and agricultural production (MFRL 1), human decision making (MFRL 2), landscape structure and function (MFRL 3), economic dimensions (MFRL 4), policy and legal dimensions (MFRL 5), and potentials for peri-urban agriculture in Nebraska and the Midwest (MFRL 6). Twyla M. Hansen compiled this information in fulfillment of requirements for her Master of Agriculture degree project; it is an outgrowth of the UNL course, *Urbanization of Rural Landscapes*, taught by Charles A. Francis.

The information is suitable for a general audience, and especially valuable for city and county planners, county extension boards, natural resource district boards and administrators, Extension and NRCS educators and specialists, university and college classes in planning, high school classes in agriculture, farmers and ranchers, and residents of rural communities concerned about the long-term future and stability of their towns and quality of life.

Through use of this bulletin in client workshops across Nebraska and classes in college and high school, we anticipate feedback from interested people and improvement in the information base. We welcome comments, additional references, and examples of application of the principles of long-term planning in this region.

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Multifunctional Rural Landscapes for the Future (MFRL 1)

Twyla M. Hansen, Charles A. Francis, J. Dixon Esseks

Rural Land Conversion in the U.S. and Nebraska

In recent years many parts of the rural landscape in the U.S. have been converted to other uses through development, resulting in a loss of farm, ranch and forest land from production. In part, this change is due to an increase in the urban population. Between 1980 and 2000, the U.S. added more than 50 million people, a 24 percent increase. During the same time period the amount of land in urban uses increased by more than 34 percent, with most converted from crop and forest lands. A USDA survey shows a twelve percent decrease in cropland between 1982 and 2003—from 420 to 368 million acres. Urban sprawl development and rural land conversion are becoming causes for concern, and alternative strategies for using land need to be examined. Many areas of the country are now taking steps to improve efficiency of their land-use practices and are using thoughtful planning to limit sprawl.

The majority of Nebraska's population is concentrated in the eastern end of the state. According to a recent three-year land use study of eastern Nebraska and western Iowa, the metro area population is projected to double from about 1 million in 2000 to 2 million people by 2050 within a 60 mile radius surrounding Omaha. This includes Lincoln and Council Bluffs, Iowa. Urban-influenced growth will impact ecological and agricultural systems and the region's quality of life. Rapid urbanization is occurring between the two metropolitan areas along the I-80 corridor, especially at the interchanges. One result is conversion of agricultural and wooded land to other uses, as well as damage to the area's fragile ecosystem.

Policy-makers, food producers, and urban and rural people have many common interests at stake, and it is wise to explore means to plan for land-efficient, environmentally-sensitive growth in the future according to the Joslyn Castle Institute in Omaha.

Implications of Rural Land Use Changes

National agricultural statistics show that we have about 360 million productive acres in the U.S., or less than 1.2 acres of quality farmland per person with a national population of just over 300 million. We have a current rate of farmland loss of 2 million acres per year and a 1.1% increase in population per year. Projecting these rates of change over the next fifty years, assuming the same rate of farmland loss and increase in population, there will be less than 0.6 acres per person of productive land in 2056. This is a conservative estimate, since rate of

farmland conversion is actually increasing each year. Obviously the economics of land use will change, food prices will increase, and many other adjustments will occur. But the need for good farmland in the future is clear.

Yields per acre of corn, the major U.S. cereal crop, have doubled over the past fifty years. In order to maintain adequate domestic food supply and agricultural exports, crop yields per acre would have to more than double again over the next 50 years. Many agricultural scientists are convinced that this will not be possible, especially with the coming scarcity of fossil fuels, the concurrent increased demand for biofuels, scarce water resources for irrigation, and the negative effects of global climate change on crop yields. While some scientists believe food security is not an issue in the U.S. because of increasing crop efficiencies and productivity, recent studies predict a 17 percent decrease in both corn and soybean yields grown in the Midwestern U.S. for every one degree rise in the growing season temperature because of climate change according to Lobell and Asner in 2003. In the long term, with reduced productive land available, increased global temperature, and rising demand, the world and the U.S. could face a serious food production challenge.

In Nebraska, the long-term implications of farmland conversion include:

- Reduction in the supply of fresh local food for human consumption;
- Decline in local, established businesses that serve agriculture;
- Fewer opportunities in rural economic development, such as employment in businesses that produce, process, package, and market agricultural products serving metro-area customers;
- Loss of wildlife habitat and ecosystem services provided by farm and ranch lands;
- Reduced recreational opportunities on farmed areas and adjoining woodlands and stream corridors;
- Elimination of the “viewshed” of working agricultural landscapes;
- Reduced water quality and less ability to recharge the groundwater supply when land is covered with houses, roads, and other impermeable surfaces;
- Lower flood control capacities due to loss of permeable land surfaces;
- Reduced potential to retain and attract highly skilled persons who value outdoor recreation, wide choices of fresh food, and other amenities provided by the agricultural landscape; and

- Increased pressure on public finances due to the higher fiscal burden of providing services to low-density developed areas such as rural subdivisions and individual acreages.

Managing Urban Growth

In the U.S., urbanization has been greatest in the Northeast and Great Lake States, California, Florida, Texas and Appalachian states. Rapidly urbanizing communities are struggling with the question of whether or not the loss of farmland and agriculture is inevitable in expanding metro areas, and an unexpected but essential cost of economic development. They are exploring whether public and private efforts can succeed in preserving open space and viable food-growing land. Many communities in this U.S. and other countries have been able to balance expanding populations and commerce with a desire to maximize the remaining open space.

European cities often use green belts or open areas around cities to provide a buffer that forces upward growth rather than outward development. Through deliberate planning and public policy, Curitiba, Brazil has successfully protected substantial “green areas” and parks from development since the 1970s in spite of population growth from 600,000 to 1.8 million people in 2000.

Eastern Nebraska has more people and less well-distributed water resources than the rest of the state. Productive soils and normally adequate rainfall allow dryland farming, and there is limited irrigation of high-value crops. Rural areas and communities have access to growth management tools that can be used to phase the expansion of urbanized areas into agricultural land, reducing many of the associated problems with sprawl development near cities. These land-use management tools include zoning, purchase of development rights, and designation of historical sites including farms. Another option is donation of land—with or without maintaining the right to farm—to public or non-profit groups that will preserve the character of the landscape and make it available to society at large through conservation easements. For more information on growth management tools, see *Policy & Legal Dimensions in Multifunctional Rural Landscapes* (MFRL 5). The city of Lincoln has demonstrated an orderly and contiguous expansion, due in part to an active City-County Planning Department that enjoys wide public support.

Obstacles to slowing unplanned development and maintaining land in agriculture include unaffordable land prices and inadequate resources for beginning farmers, including young

persons with farm background lacking land and equipment. Other challenges are government zoning and other regulations, as well as non-farm neighbor complaints that hinder farm management freedom. However, successful efforts in Nebraska so far have resulted in:

- Policies in place to protect floodplain areas for agricultural use;
- Zoning policies such as cluster zoning to protect upland agricultural areas;
- Discussions of transfer of development rights in Lancaster County;
- Growing consumer interest in farmers' markets and increased numbers of metro-area growers willing to produce for them;
- Expanded production of nursery crops in metro areas with low transportation costs between the producing farms and the ultimate consumers;
- Farming of energy crops in metro areas on other than temporary or remnant fields; and
- Regional, multi-disciplinary and stakeholder studies and consensus-building approaches to land-use practice, policy and planning.

Impacts of Changes in Today's Agriculture

Along with urbanization, there have been major changes in agricultural practices over the last few decades. The majority of land in Nebraska is in private ownership, and most of it is used for farming and ranching. The rural landscape produces food, forage, biomass fuels, fiber and timber, and products used in other industries. Because of growth in farming, according to Nebraska Game and Parks Commission, the state has lost a majority of its historic native prairie vegetation in the eastern half, and thirty-five percent of its historic wetlands. In recent years there has been a significant improvement in wetland awareness, preservation and restoration, along with prairie preservation efforts.

Changing the natural ecosystem into crop and livestock production causes a loss of biodiversity at all levels of scale, as the land is concentrated into agronomic crops. From highly diverse small family farms, Nebraska agriculture has evolved to mostly monoculture or two-year rotations, and economic conditions in farming and ranching have forced consolidation of many commercial units into larger operations. Both agricultural technologies and federal support programs have encouraged production of a limited number of crop and livestock commodities, resulting in a relatively homogeneous rural landscape. Increasingly, crop and livestock operations are separated, there are few perennial pastures and forages on the landscape in southeast Nebraska, and annual summer crops of corn and soybeans dominate the fields. Change

from a diverse landscape into one that is mostly monoculture crops may enhance short-term economic gain, but it reduces the long-term potential for providing ecosystem services. These natural processes are vital to both urban and rural populations but are often taken for granted. The increased use of technology and monoculture crop practices result in externalized costs to the environment, such as natural resource depletion and pollution, that are not reflected in the market or in low food prices at the supermarket, but instead are passed on to society and the environment and paid for through other means, often in the future. For more information on ecosystem services, see *Landscape Structure & Function in Multifunctional Rural Landscapes* (MFRL 3).

High-input farming practices that allow soil and chemical runoff in the central U.S. contribute to algae growth and the “dead zone” in the Gulf of Mexico. No-till farming, grass waterways, contours and riparian buffers are now being used more widely, especially on smaller farms with diverse enterprises. Without permanent buffer systems along streams and lakes there is no effective way to filter out sediment and pollutants carried in runoff from farming areas and developed landscapes, and no way to mitigate the potential for flooding downstream, as witnessed during the 1993 Missouri River flood event. Concentration of livestock in confined feeding operations produces large volumes of manure that become a liability, compared to extensive grazing that spreads this nutrient resource across the landscape. Also, with increase in demand for corn for grain ethanol and corn sweetener production, it will be even more important to provide greater protection for Nebraska’s rural landscape diversity. This demand is pushing increased corn acres, fewer soybean acres, and thus continuous corn cropping. There will be fewer acres in eastern Nebraska in the common two-year rotation in the near future.

Alternatives exist to maintain land for food production using methods that preserve biodiversity and enhance landscape services. The USDA supports the economic, environmental and social sustainability of diverse food, fiber, agriculture, forest and range systems through its Sustainable Agriculture Research and Education (SARE) program of the Cooperative Research, Education and Extension Service. The Sustainable Agriculture Network’s publication, *The New American Farmer: Profiles of Agricultural Innovation*, features farmers across the U.S. who are “renewing profits, enhancing environmental stewardship and improving the lives of their families as well as their communities”. *The Farm as Natural Habitat*, edited by Dana Jackson and Laura Jackson, also provides a number of examples related to biodiversity on diverse farms.

A new book, *Developing and Extending Sustainable Agriculture: A New Social Contract* describes successes of the SARE program over the last seventeen years.

Farmland Conversion Realities

Economic and social realities lead to changes in land use patterns in the rural landscape. People who desire open space purchase acreages or small areas of prairie or forest for home sites, or land for hunting and recreation. Rural lands carry an agricultural value, and are typically much less expensive than urban building sites. Acreage development leads to increased demand for services and infrastructure such as paved roads, police and fire protection, snow clearing, connections to sewer and water and the electricity grid. Need for all these services places a burden on nearby communities to which they are linked. Moreover, the longer trips by private cars, school buses, and other service vehicles to and from rural home sites, compared to urban locations, result in more fuel consumed and related higher carbon dioxide emissions that contribute to global climate change. For more information on social issues in regard to the rural landscape, see *Human Dimensions in Multifunctional Rural Landscapes* (MFRL 2).

There are obvious economic reasons for farmland conversion to other uses. Land that is suitable for dryland farming and priced at \$1,500 per acre, for example, would be worth ten times or more per acre for housing if it is near a city. Landowners would find it difficult to resist the temptation and accept the opportunity cost of staying in farming and not developing such land. Big box retailers want inexpensive land for parking and access to a large regional market, and often seek rural land on the urban edge that is far less expensive than similar areas in town. Tax bills on farmland, on which the assessments should be based only on the land's agricultural use value, often inflate due to additional rising school budgets and other taxing unit costs. Unless there is some relief or protection, or there is a financial commitment by the community to maintain those lands in open space – such as purchase of development rights – it can be costly to stay in farming at that location. There is opportunity to sell the land, move out of the area influenced by sprawl, and perhaps purchase more land elsewhere to continue farming or ranching. These and other factors are described in *Under the Blade: The Conversion of Rural Landscapes*. For more information on rural landscape economic issues, see *Economic Issues in Multifunctional Rural Landscapes* (MFRL 4).

Some communities have taken advantage of long-term planning strategies to provide for economic growth in less land-consumptive patterns and for preservation of productive

agricultural soils. There are advantages of maintaining farmland near the city, such as intensive food production for the nearby urban population market, which provides fresh food with lower transportation costs and energy conservation. Communities that value open space, farming, and local food production as integral parts of the local economy are motivated to take steps to assure that some of the land can remain open, and thus ensure the preservation of ecosystem services and provide for greater food security. For more information on local food systems, see *Peri-Urban Agriculture in Multifunctional Rural Landscapes* (MFRL 6).

Multifunctional Rural Landscapes for the Future

Multiple factors and points of view must be considered by private action groups as well as public sector planners in designing a future rural landscape. The goal is to maintain a productive landscape as well as allow economic growth, taking into account the future needs of society and the environment as a whole. Incentives can be provided for beginning and present farmers to help develop local food systems while maintaining a diverse landscape and ecosystem services for society. The SARE program offers loan and education assistance for beginning farmers. Often, immigrants to our region bring new crops, innovative small-scale intensive gardening practices, and exotic foods that find their way into the markets and restaurants of Nebraska. The increase in the number of Latin American and Southeast Asian foods available in Lincoln and Omaha are recent examples.

Innovation and incentives for change must be considered for rural areas. Often planning attention focuses exclusively on cities, where most of the people and votes and power are concentrated. But Nebraska is still a rural state, with 93 percent of the land used for farming and ranching. The economy and quality of life depends on a vibrant and diverse rural landscape and its contribution to a healthy environment. Economic incentives will need to come at least in part from the public sector in order to assure long-term progress toward equity in access to benefits of natural resources and the rural landscape. Success in future programs will depend in large part on education. Internet connections can now provide distance education to people in all parts of the state. The university has a vital role to play in working together with non-profit organizations and private landowners in the rural landscape to assure that all stakeholders—in rural and urban communities—have a part in the planning process.

Future Visions – Community and Regional

In the 1990s, many communities in Nebraska discovered they lacked the legal means to regulate large-scale confined animal feeding operations that were about to be built in their areas. With the assistance of state-wide legislation, many counties rushed to amend this situation and exert more control over their future and the immediate rural landscape. This is just one example of the need for long-term planning and for community consensus for future direction of rural development. There is a rational process in place in most communities that recognizes the needs of all members of society, and those who choose to become involved can have a voice for the future. Initiative 300 regulating corporate farming in Nebraska has been one factor in this process. The legality of the initiative is currently under review in the courts, and the public has an opportunity to assess whether this law has made a positive difference in Nebraska over the past two decades.

The issues surrounding farmland loss are complex, involving multiple factors and players. For a community to consider the long-term interests of all citizens it is important to establish a local forum where all are invited to participate. City and county governments periodically compile and update comprehensive plans that project their land use for decades into the future, and provide mechanisms for hearings on changes to these plans. Citizen groups interested in farming, food production, open space, habitat, public access, and the environment have learned that strong economic interests often drive the development process. Continuous activity and vigilance are needed by groups interested in the community good—environment, public space, productive farmland, ecosystem services that are valuable to all—as well as an ability to recognize the power of economics and specific interests that dominate the decision making process in most communities.

Regional visioning and consensus building can provide long-term benefits for a geographic area with shared interests. Providing jobs and economic development potential is important to every community and region, but this agenda is not a viable long-term strategy if it serves to benefit only a few people in the short term and pushes costs to all of society into the future. This series of fact sheets on multifunctional rural landscapes provides background information on the process of farmland conversion, and the ways that citizens of Nebraska can better understand the issues and take an active role in planning the future.

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Multifunctional Rural Landscapes for the Future

A series of issue papers describes the current conversion of farmland to other uses, and the economic, environmental, policy, and social impacts of these changes on agricultural production and landscape services in Nebraska. The series offers insight on the motivations for conversion, long-term effects of farmland loss, importance of ecosystem services, and achievable alternatives for the future. A similar series on rural land use is available from Iowa State University [www.extension.iastate.edu/store/].

Human Dimensions in Multifunctional Rural Landscapes (MFRL 2)

Twyla M. Hansen, Charles A. Francis, and J. Allen Williams, Jr.

Changes in the Rural Landscape

Rural landscapes and communities have undergone tremendous changes over the past half century. Farming was once characterized by diversified owner-operated family farms and supported by viable, nearby rural communities. Today agriculture is dominated by large farms, monoculture cropping, and consolidated livestock operations. These changes have altered the natural ecosystems as well as the social fabric of rural areas and communities as the population declines and land is converted to different uses. Humans are important in multifunctional rural landscapes, and a personal sense of place and community impacts how people make decisions in their land use and life styles. Farming decisions influence economic success and people's perspectives for the future. Farming management decisions and scale of agriculture also affect the services that cultivated and natural ecosystems provide. Changes in the ownership, management, and scale of farming are discussed as they impact ecosystem services and rural quality of life.

A Sense of Place

People create a sense of place where they live through awareness of the surroundings and community, and by recognizing and identifying with the area's natural environment. Other dimensions of place include the relationships among people in local social, political, and religious institutions. *Place* has more meaning than mere open space, farmland, prairie, or forest. Place is humanized space, providing a center of social values. People exist within communities, and each place is a unique collection of social relationships and wisdom. Rural and urban land ownership gives individuals a degree of control over their place, allowing them to make use of property as they desire within the law, and consistent with local customs. A deeper sense of place is achieved through understanding the land's topography, soils, water availability, area weather patterns and climate. Sense of place grows through understanding and appreciation of native vegetation and fauna, previous inhabitants, and the area's social and political history. This awareness can provide the knowledge and experience people need in order to live in harmony within each region's social, economical and ecological boundaries and realities, as well as with each other.

In contrast to the sense of place people develop from connection to a given geographic and social area is the pervasive sense of “placelessness” in U.S. culture today, especially as experienced in many urban areas. Development often fails to emphasize and preserve the unique qualities of a specific region, and many landscapes are becoming virtually the same everywhere. Landscapes are often homogenized and managed the same way, regardless of the unique potentials that they possess, and places often become indistinguishable from others as we view subdivisions, industrial parks, shopping malls, agribusinesses, and farming monocultures.

Individuals and Consumption

In the U.S. we prize individualism. While giving people self-satisfaction and pride, individualism comes at a cost. With just five percent of the world’s population, the U.S. consumes more than twenty-five percent of the world’s fossil fuels and other material resources. Growth is assumed to be essential for a healthy national economy and its population, but the quantity of goods and services consumed is ultimately decided by the individual. Social scientists observe that as individualism in modern life becomes stronger, the fabric of the social community is weakened. According to University of Wisconsin-Madison environmental sociologist Michael Bell, these weaker social ties often lead individuals to increase their consumption level of goods to compensate for lack of community. This in turn becomes a vicious cycle of consumerism using increasing amounts of energy and natural resources to produce goods of questionable necessity, and lessening the ability of nature to provide essential ecosystem services. The tyranny of many small decisions has led to over-consumption in the U.S., while in reality economic growth increases happiness to the point essential needs are met, but not beyond. Sociological factors in consumption and materialism affecting community are discussed in Dr. Bell’s book, *An Invitation to Environmental Sociology* (2004).

Land Use and Ecosystem Services

Today, most people are disconnected from their sources of food. For many, food in the global system comes from anywhere, reinforced by what we see locally – a specialized, industrial agriculture with consolidated food processing and distribution. Farms are growing in size, land is often acquired by absentee owners for investment purposes, and these owners may have no connection or concern for the local community. This creates even more distance, in space and in food consciousness, and can lead to a disregard for the natural ecosystem and nearby communities. Local and personal accountability disappears when land becomes a

commodity and owners cease to identify with that place. Agriculture traditionally is more than agribusiness, technology, statistics and food. It is also an interaction of human and non-human components, including the natural environment, water resources, and a renewably productive and living soil.

In the same sense, land near cities is valued more for its economic development potential than for food production, fueling farmland conversion to urban uses. Although some growth in the economy is useful to provide jobs and incentives for investment, rapid and unplanned growth results in landscape changes at the expense of agroecosystems. Converting land to urban or industrial uses may create short-term economic gain for a few, but defers the costs of loss in production, demise of community, and loss of ecosystem services to future generations.

Today's agribusiness practices, current economic realities, and federal farm support programs are leading to the demise of small farms. Big equipment and new technologies are costly, and one result is greater reliance on investments from distant landowners and less from the local community. In addition to causing departure of people from the land, some industrial farming practices contribute to increased soil erosion and water resource depletion, and over-fertilization and excessive pesticide use have polluted soil and waterways. With increase in field size, crucial wildlife habitat is often fragmented or lost. Most external costs are not reflected in the price of food, but are eventually paid for by all of society. Both urban and rural populations rely on the biological processes and ecosystem services in natural areas in the rural landscape that are expensive or impossible to duplicate or provide with technology. Ecosystem services include filtering impurities from surface and ground water, nutrient cycling, erosion and flood control, soil formation, pollination and biological insect pest control, and genetic resources. A more complete discussion of ecosystem services is found in Gretchen Daily's book, *Nature's Services*. How this relates to the loss of farmland can be found in Richard Olson and Tom Lyson's book, *Under the Blade: The Conversion of Agricultural Landscapes*. For more information, see *Landscape Structure and Function in Multifunctional Rural Landscapes (MFRL 3)*.

Growth and Land Use

When rural areas dwindle in population, cities grow in the amount of land used, resulting in a proliferation of low-density housing and commercial development on the outskirts (often called sprawl), under-funded city centers, increased traffic, runoff pollution, strip malls, and

isolated workplaces. Often there is a loss of open space, productive farmland, and sense of community. Sprawl development is essentially irreversible. It creates even more dependence on personal vehicles, which in turn increases use of dwindling fossil fuels and contributes to greenhouse gases and air pollution. In most areas where sprawl develops, there is no alternative to individual vehicle use, even for short distances in which public transportation, a bicycle or walking would be more appropriate. Federal and state policy and decisions support this model, as roads are highly subsidized by non-local funds.

Many people in the U.S. and in Nebraska prefer to live in a rural setting, but within 30 miles of a city to be near jobs and urban amenities. Individualism is often expressed through the “freedom” of acreage development on rural land, especially near cities such as Lincoln and Omaha. But the explosion of low-density acreages in rural areas lacking public transportation has led to an increase in demand for city-like infrastructure and services. These include paved roads, fire and police protection, and often water and sewer connections. A twenty-year study by the American Farmland Trust in more than 100 areas of the U.S. shows on average that agricultural land does not generate as much income per acre for municipalities or county tax rolls as residential land, yet this lower revenue is more than offset by substantially higher costs incurred from providing residential infrastructure services to dispersed, low-density acreages. Converting agricultural land to residential land is not a viable way to increase revenue and balance city budgets, since the costs of providing many services to remote dwellings is much higher than what they cost for typical city development.

Communities and Smart Growth

In recent years, developers, planners, policy-makers and citizens have found profitable, community-oriented alternatives to sprawl. Many cities in the U.S. and elsewhere have turned industrial brownfields and other underused areas within city limits into pedestrian-friendly shopping areas with affordable housing near public transit. Making use of “Smart Growth” principles such as mixed land uses, compact neighborhood design with opportunities and choices, and walkable communities creates a distinctive sense of place, preserves open space, saves farmland, protects natural beauty and critical environmental areas, directs development toward existing communities, provides transportation choices, makes development decisions fair and cost-effective, and encourages community and stakeholder collaboration in decisions. Alternatives exist to restrict development in order to consume less agricultural land through

agricultural zoning, planned concentric and contiguous urban growth, and providing open space and housing in a higher-density cluster design with open commons.

Urbanization of land suited for local food production systems, such as many areas in southeast Nebraska near Lincoln and Omaha, is not the inevitable outcome of increased economic development. According to Iowa State University sociologist Cornelia Flora, community growth is planned mostly at the local level by considering local capital— people, their relationships, the natural environment, and economic capital. By diversifying all of these, communities create a greater balance and sustainability that affords resilience to change over time. Communities can balance individual freedoms with the needs of the majority of their citizens through policy and collective agreement and investment, by exploring alternatives, and by creating a shared vision for the future. Examples of the dynamics between communities, their surroundings and decision-making are explored in the book *Interactions Between Agroecosystems and Rural Communities*, edited by Cornelia Flora (2001). For more information, see *Policy and Legal Dimensions in Multifunctional Rural Landscapes (MFRL5)*.

Alternatives and “FoodSheds”

Ways to promote alternatives to industrial agriculture include support for family farms, greater reliance on local food production, design of renewable agroecosystems, and embracing the concept of a geographical region’s “foodshed” as described by University of Wisconsin rural sociologist Jack Kloppenburg. Small, independent farms in a region can encourage biodiversity in the landscape through intercropping, pasture livestock grazing, growing a greater number of plant species and using smaller-scale equipment. Organic and other renewable farming methods can promote sustainability. Along with local food systems and greater reliance on people, different strategies have emerged as alternatives to the industrial agribusiness model: owner-operated and family-partnership farms, greater diversification, more on-farm resource use and site-specific decision-making. Contrary to conventional views, these low-input sustainable systems can be productive and profitable, reducing damage to the environment and contributing to strong rural communities. However, economic barriers to sustainable agriculture include agribusiness influence on government policy that maintains large support payments to the largest farms.

North Carolina State University sociologist Ronald Wimberley states that as farm populations have dwindled and fewer people are involved in food production, farmers are more

dependent today on public perception of what they do. Society often judges farmers on their large benefits from government programs, apparent environmental stewardship or lack of it, and media reports on food safety and the treatment of animals. Because of large numbers of voters in cities, the general society gains more economic and political clout to control agriculture through public policy. Both urban and rural people can join forces to make change in current U.S. agriculture policies such as in shaping federal farm legislation and calling for additional research in how to increase profitability on small and mid-sized farms and ranches. The public can also explore ways to increase investment in rural non-farm economic development strategies for rural communities.

Urban-Rural Connections

Consumers play a huge role in urban-rural connections: food is central to social life. The foods we consume acquire meaning to us through social rather than biological means, and what we eat is filled with social meanings and cultural identity. In recent years, the standardization of food production, homogenization of food consumption, exportation of industry practices and rationalization of everyday life have become an industrial model food system. Shipping food all around the world causes pollution and contributes to the sense of “placelessness,” along with plastic-tasting tomatoes. However, consumers are increasingly concerned about food safety and flavor, and make these concerns known through their food purchases. The food system in the U.S. has focused on production and mass distribution, but today it must take into consideration consumer concerns for food freshness and for the environment among the criteria for business decisions.

Urban people can support local food producers by making purchases at farmer’s markets, from community-supported agriculture, and directly from local growers’ farms. There is great potential on open lands not too distant from cities for local food production instead of more farmland being developed for urban uses. Promoting and supporting local markets increases economic and ecological diversity, enhances local food security, preserves the rural character of landscapes, and develops greater links between urban and rural communities. The Slow Food Movement began in Italy in 1986 and has spread worldwide as a response to the globalization of food and the fast food industry, advocating traditional, regional and national cuisines and cooking techniques. It promotes local food traditions and food festivals, research, consumer education, lobbying efforts and agricultural biodiversity and sustainability. In addition, the

organic foods market has grown by twenty percent every year since 1990, driving up production to meet demand. In this case, consumer demand has led to the industrialization of some organic food production. Knowing your farmer, or at least where your food comes from, how it is produced and how it tastes, goes a long way toward creating community and accountability in agriculture. For more information on local food systems, see *Peri-Urban Agriculture in Multifunctional Rural Landscapes (MFRL 6)*.

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Landscape Structure and Function in Multifunctional Rural Landscapes (MFRL 3)

Twyla M. Hansen and Charles A. Francis

Why Are Rural Landscapes Important?

Both urban and rural residents depend on rural landscapes in ways that are not fully understood or appreciated. These systems support human populations, and many have been modified by commercial and residential development and by agriculture. For example, most people do not relate the massive 1993 floods on the Mississippi and Missouri Rivers to the extensive draining of wetlands and prairie potholes and channelizing of rivers and streams throughout these watersheds. Human decisions, activities and development strongly impact ecological function in rural landscapes.

According to the American Farmland Trust, the U.S. is currently losing 1.2 million acres of farmland each year to development, mostly near cities, and often where the most productive soils are found. The interface between urban and rural is a unique zone of social interaction and landscape change. Residents along this interface have certain expectations for city convenience along with proximity to open space. Rural residents may view their urban neighbors as a potential interference to farming and a threat to the security of equipment, facilities or livestock. Beyond these challenges, the expansion of housing developments into current farmland has implications for the ecosystem services from agricultural landscapes that are essential to both urban and rural residents.

When city dwellers move into the countryside, they often adapt the surroundings to suit their expectations. Additional building sites and roads can cause erosion, and the use of chemical pesticides and fertilizers on lawn areas contribute to pollution. Wildlife habitat is often lost or fragmented. On the other hand, if acreage owners restore prairie and other plantings, they can diversify the landscape to create habitat for wildlife and beauty, and improve some ecosystem services. When there are rural areas with a number of such developments it may create an island of biodiversity in otherwise uniform monoculture agriculture areas.

Land speculation and increased values on farmland near cities causes uncertainty in how long owners will be able to remain in farming with the increased opportunity costs of keeping that land in agriculture. A rational short-term economic strategy for operators is to forego improvements on the farm and to mine the soil for nutrients, since land will be converted into

housing anyway in the near future. Creative solutions are needed to keep productive land available for growing food, provide open space for other activities, and preserve important ecosystem functions of the rural landscape. For more information on farmland preservation strategies, see *Policy and Legal Strategies in Multifunctional Rural Landscapes (MFRL 5)*.

Ecosystem Functions

Ecosystems are those integrated combinations of plants, animals, and microorganisms that function together in a given environment, often adversely impacted by increasing demand on natural resources. Human consumption of resources and changes in land use result in the reduced capability of ecosystems to function and provide biological services. An intact natural ecosystem, or a diverse agricultural landscape, is covered most of the year with green plants that photosynthesize, intercepting sunlight and capturing carbon dioxide, releasing oxygen and producing the vital carbohydrates that drive food production and sustain all life. Even stored fossil fuels are the product of past photosynthesis in the landscape, and it is essential to find replacements for these nonrenewable resources as they become scarcer.

Gretchen Daily's book *Nature's Services* (1997) describes a large number of landscape functions on which people depend. In addition to providing oxygen, the green landscape intercepts rain and snow and stores moisture for field crops, forages, and livestock. Trees filter out dust and odors, and mitigate some of the force of strong winds. Vegetation slows water runoff to allow soil to settle out and reduces danger of floods. Wetlands and meandering streams slow surface water flow, increase infiltration to the ground water, trap sediment, and detoxify chemical contaminants. Biodiverse habitats in natural areas, farm fields, and borders provide natural predators and parasites that control most crop pests, and a diverse insect community helps in plant pollination. Wildlife is part of a natural food web that contributes to system stability. Many of these functions change with agricultural industrialization, and especially with conversion of agricultural lands to other purposes.

Impacts of Monoculture Farming and Farmland Conversion

A combination of factors including large equipment, chemical fertilizers and herbicides, federal support for a few commodity crops, and efficiencies of scale in farming have led to consolidation of land into large farms and specialization in a few crops and livestock species. Grain feeding of livestock and poultry has reduced the need for forages. Irrigation efficiency with pivot systems has further pushed consolidation of fields into management units of a quarter

section or more. Loss of biodiversity means greater use of chemical pest control, an important factor in development of chemical-resistant pest genotypes, and fewer forage acres mean greater reliance on chemical fertilizers. Separation of livestock from crops converts animal manure from a valuable resource to a disposal problem to be solved in the most economic manner. More monoculture cropping practices result in a less diverse landscape, and many of the biological functions are reduced or lost. A uniform field reduces immediate production costs, but in the long term will affect biodiversity on land, water and in other environmental resources—external costs that are passed on to all of society.

Converting farmland or other open space to urban and commercial development reduces food production potential, a factor in long-term U.S. food security. Highway construction often divides fields, increasing production costs and decreasing convenience in farming. Paving for commercial construction or low-density housing not only takes land out of production, it reduces potential for water infiltration to recharge groundwater, and increases runoff. Research suggests that once a watershed reaches 10-20 percent impervious cover, ecosystems services such as infiltration and bank stability greatly decline. Biological diversity is decreased through increased urban expansion into rural land, bringing non-native animal and plant species to the area along with roads, fences and other disturbances to wildlife. Dredging channels and draining wetlands further simplifies the landscape hydrology and reduces ecosystem services. Building on the city's fringe increases the property interfaces of farms with city dwellings and introduces potential conflicts.

Challenges at the Rural-Urban Boundary

As the urban population increases, alternatives exist for expanding the space needed for housing, commerce, manufacturing, recreation, and other human uses. Some needs can be accommodated by building up and infilling areas now vacant within the city. Housing can expand upwards, for example, while manufacturing often cannot. In geometric terms, there is reason to expand the boundaries of cities around their perimeters. A doubling of the diameter of a city provides four times the area, while only increasing the circumference or urban/rural interface by two times. However, housing on the edge often creates lower-density use of the land. With the streets, parks, schools, and shopping malls that often ring the city, the city/farm boundary increases at least as fast as the area inside the city. Acreage development outside the

city adds greatly to the interfaces. For example, the acres for one house may be completely surrounded by agricultural land.

Table 1 shows several areas of possible conflict that arise when farming activities suddenly come into close proximity with urban neighbors.

Table 1. Potential problems at the rural/urban boundary (see Schoeneberger et al., 2001)

<u>Problems for city dwellers</u>	<u>Problems for farm families</u>
Noises from tractors, combines, cattle	Complaints about noise, odors, dust
Odors from confined livestock, poultry	Problems from lawn/yard pesticide drift
Dust and pesticide drift from fields	Gates left open and livestock escape
Slow-moving implements on roads	Fast-moving vehicles on country roads
Tilled fields and blowing crop residues	Yard waste and garbage thrown over fence
No control over changing landscape	Security issues with equipment and facilities

Even though Nebraska is a rural state with 93 percent of the land used for farming and ranching, the majority of Nebraskans are concentrated in the eastern part of the state near the metropolitan areas of Lincoln and Omaha. Creative solutions are needed to keep productive land available for growing food, provide open space for other activities, and preserve important ecosystem functions of the rural landscape. Development of a peri-urban agriculture, a more diverse use of land for food production and managed recreation, can provide a positive, long-term alternative.

Alternative Options in Farming

Smaller farm size, niche approaches such as locally-grown produce, organic and sustainable growing methods, and greater cooperation among neighbors in the rural landscape could all lead to enhanced services from rural areas. Consumers benefit from a greater awareness of the rural landscape, and are rewarded by the availability of fresh local food products in the market. Since most foods are not differentiated by their method of production, with the exception of organic foods, it will be necessary to have government supports as incentives or regulations to guide the establishment of farming methods and ecosystem services that benefit both urban and rural people. For more information, see *Peri-Urban Agriculture in Multifunctional Rural Landscapes (MFRL 6)*.

In their book *The Farm as Natural Habitat*, editors Dana Jackson and Laura Jackson collected essays from authors involved in creating greater diversity and a wider range of habitats

and niches on farms. Combining crop and livestock enterprises on the same farm can restore perennial forages in the system, providing year-round cover on some fields and creating a diversity not found in monoculture row cropping. Manure can be spread by the grazing animals, rather than concentrated as waste in confined livestock feedlots. Grazing systems on perennial pastures can reduce the chance of polluted runoff and loss of water quality.

Planting systems that are spatially diverse can keep each field more heterogeneous, with crops of different maturities, rooting patterns, and growth cycles. Alternating narrow strips of corn, soybean, and winter wheat provide another diverse option. Growing more than only corn and soybeans introduces different habitat through the year that can provide alternative reservoirs of beneficial insects. Planting roadsides and fence lines with native plant species can provide another refuge for good insects as well as habitat for other wildlife. Agroecosystems can also be managed to enhance biodiversity through greater water-use efficiency, buffer strips near waterways, integrated pest management and creating wildlife habitat. Many of these options have support from current FSA programs directed at preserving the environment and improving water quality.

The use of carbon credits can enhance the establishment of some desirable conservation practices. Also, perennial woody plants such as trees and shrubs have a potential for use as a source of raw material for biofuels production, while at the same time working as conservation plantings providing ecosystem services.

Ecological Planning & Diverse Landscapes

The current planning of farms and landscapes relies on individual decisions about which enterprises are most profitable and how they can be arranged most efficiently on each farm. The dominant land ownership pattern and spatial organization in the U.S. is by sections and townships with property lines and often roads every mile in each direction, an arbitrary though useful grid laid over the natural landscape. Except for the presence of major rivers and lakes that sometimes act as natural boundaries, there is little correspondence of natural landscape features with the land ownership lines, and thus equipment and farming practices and systems are adapted to rectangular fields and strict geometric shapes. Natural features and landscapes are not geometric in pattern, and are in fact composed of spatial structure elements – patch, corridor, and matrix – combining to form land mosaics. These elements affect the movement and flow of animals, plants, water, wind, materials and energy through the landscape.

To preserve ecosystem services it would be necessary to take into consideration planning based on the natural landscape, such as fields that correspond to natural flows of water, wetland restoration, and within-field diversity. Planning across farm boundaries to connect habitat, to trap water from rain and snow, and to regulate water flow in ways that minimize soil loss and fertilizers and pesticides leaving the field and farm would be a positive step toward ecological enhancement of agricultural land. Placing crop and livestock enterprises on the landscape in ways that would enhance their interdependence, even across property lines, would lead to a higher level of cooperation among neighbors and enhance the stability of the rural landscape and preserve ecosystem services.

Potential at the Peri-Urban Fringe

The rural-urban interface presents opportunities for social and economic integration that can benefit residents. Biodiversity in agriculture can provide beauty and open space for city people and attract wildlife along the boundary, and result in habitat for desirable species such as birds and small mammals, along with beneficial insects that help manage unwanted pests in vegetable gardens or ornamental plantings.

Ecobelts, diverse planting areas similar to greenbelts that limit sprawl around the perimeter of European cities, have been proposed by ecological planners. The design could follow natural features into and out of a city for the benefit of both urban and rural residents. The National Agroforestry Center in Lincoln describes wide *ecobelts* with woody plantings and pathways as attractive areas for active recreational uses such as hiking, birding, biking, and horseback riding. The plantings could serve as a buffer between urban housing and farming activities, reducing the effects of dust, odors, or noise from agricultural activities. It could also serve as a connection between farm and city, an area of shared ownership and gathering for education and recreation, and could include limited production of berries, mushrooms, ornamental plants, or Christmas trees.

The ecological functions of woody buffers such as an ecobelt include:

- Habitat: provides food, shelter and cover for wildlife;
- Conduit: source of energy, water, nutrients, seeds, biodiverse species and other elements;
- Filter/Barrier: slows wind, traps dust particles, filters surface and ground water, barrier for plant and animal species;
- Sink: receives and retains objects and substances from adjacent lands;

- Source: releases objects and substances into adjacent lands.

Since 2000, the *Green Topeka* project in Kansas has included multi-functional uses in their green area plantings. This project grew out of a community desire to better manage storm water runoff, erosion and water quality, and now includes green space on public and private projects throughout the city in woody plant buffers, wetlands and habitat improvements, recreational developments and city beautification. On a much larger watershed scale, the U.S. Geological Survey has designated the entire Platte River Ecosystem in Colorado, Wyoming and Nebraska, as a priority study area, using multidisciplinary teams to examine changes in the river patterns and water flow, the associated biological communities, and the ecosystem processes of the watershed in order to evaluate different management strategies.

Many activities and potentials for land use could make the rural/urban interface a zone of learning, economic activity, and positive communication between farmers and city dwellers. Better understanding of ecosystem services provided by the rural landscape, along with its structure and function, can lead to ecological and sustainable decisions that help preserve the quality of life.

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Economic Issues in Multifunctional Rural Landscapes (MFRL 4)

Twyla M. Hansen and Charles A. Francis

Loss of Farmland

The National Agricultural Land Study conducted in 1980-81 concluded that millions of acres of farmland in the U.S. were being converted each year to urban uses and development. One consequence is the associated redirection of natural resources that accompanies uncontrolled urban land-use expansion. The study also found that much of this rural expansion was caused by programs funded by the Federal Government, and recognition of this influence led to the passage in 1994 of the National Farmland Protection Policy Act. This legislation attempted to minimize farmland losses to activities such as transportation, power and communications projects. Additional federal, state and local public policies have since been implemented to protect farmland.

The loss of farmland, wildlife habitat and open space has accelerated over the last two decades. According to the National Resources Inventory, about 34 million acres—an area about 70 percent the size of all Nebraska—were converted to development between 1982 and 2001. According to the National Resources Conservation Service, factors included increased income that led to purchase of acreages, an increase in total population, and inadequate land-use planning, zoning and land-use laws. In Nebraska, 78 out of 93 counties were listed among areas nation-wide as having prime agricultural land vulnerable to change through development. Urban expansion into nearby farmland occurs mostly near Lincoln and Omaha; however, even with rapid non-farm land development, the majority of Nebraska land remains overwhelmingly agricultural, including Lancaster County.

Agricultural statistics on farm size show in the aggregate that change is rather small. This hides a trend toward polarization of rural land holdings, with a substantial growth in numbers of small, hobby or lifestyle farms that meet the minimum requirement of \$1,000 per year of gross sales to be classified as a farm. Large farms are growing even larger because of consolidation and industrial agriculture practices to grow a few commodity crops, which has resulted in unintended external costs to the environment and society. These include a loss of natural resources, wildlife and ecosystem biodiversity, and a decline in rural communities, costs that are not easily quantified. Many of these environmental costs, called *externalities*, are borne involuntarily, since they also do not have value in the market, and are described as a

disassociation of benefits and costs. A study by Iowa State economists conservatively estimates these external costs of industrial agricultural production in the U.S. at \$5.7 to \$16.9 billion per year. The market pays little attention and gives few rewards to smaller, diversified farm operations that produce fresh food for human consumption, and that also provide ecosystem services.

This discussion is not intended to imply that the market is “inefficient.” Indeed, investors in agricultural land can receive considerable value for their investment, often more than just the agricultural production value, and investors in land for non-agricultural purposes receive private benefits for their purchases. Those who purchase acreages recognize positive advantages that are not easily measured by conventional economics such as privacy, personal amenities, and security. But since external costs to the environment due to industrial agricultural practices and hidden costs of improvements to non-farm land development directly link to taxpayers in the vicinity where they occur, policymakers and voting citizens in the future must consider all of these costs, along with the physical loss of land for food production. More study is needed to assess future land-uses and management practice implications, in order to compare the advantages and disadvantages of land-use alternatives and options in regard to biodiversity and water use.

Land Use and Economics

Land use change in the U.S. is governed to some extent by public policy, but is based on the laws about individual property rights and expressions of choice. Economics can be roughly defined as a process of human choice, a science of trade-offs. Personal values and attitudes guide our individual economic choices. They are also influenced by acceptable cultural and social values within a complex set of rules that governs interactions with others, according to Richard Olson and Thomas Lyson in their book, *Under the Blade: The Conversion of Agricultural Landscapes*.

Individual ownership of property is highly regarded in the U.S., reinforced by the 14th Amendment “takings” law that states land cannot be restricted in its use without just cause. This contrasts with views in some European countries. In Norway, for example, there is much more communal use of outdoor space, and legislation was enacted to ensure that all undeveloped lands be used in a manner that benefits society and those working in agriculture. But even in the U.S.,

property rights are not absolute since government retains certain powers over private property, such as taxation and eminent domain, among others.

Farmland is both a resource and a commodity, and the value placed on it is determined by the services we believe the land generates, its scarcity, its transferability and the possibility of its future returns and opportunities. In farming, the land is primarily used for food production, but not all of the land's services are captured in its market price, such as wildlife habitat, scenic and recreational opportunities, and ecosystem services. (For more information, see *Landscape Structure and Function in Multifunctional Rural Landscapes - MFRL 3*.) Near cities, open land is valued higher by demand for housing and commercial development than for farming, or for what is termed its "highest and best use." For example, dryland farm land that would normally sell for \$1,500 to \$2,000 per acre can sell for ten times that amount near metro areas. This increase in value places pressure on landowners to sell and make other investments or buy less expensive land elsewhere to continue farming, a process that has the effect of raising prices in areas at a distance from urban centers. A 2006 news article in the *Lincoln Journal Star* stated one prime irrigated farm in rural Butler County (east central Nebraska) sold for over \$3,300 per acre, representing a nearly ten percent increase in land values over the previous year. While this particular sale cannot all be attributed to "rollover" land sales, it appears that the current price of Nebraska farmland in non-metro areas is also rising.

Converting land from one kind of use to another is a means of creating wealth in a free-market economy. These increased land values greatly influence land-use policy, fueled by the monetary incentives for converting land from agricultural to developed uses and also aided by the improvements and services paid for by all in the community. Indeed, the main purpose of zoning laws in most U.S. communities is for the orderly conversion of rural lands into developed properties, according to landscape architect Randall Arendt.

Farmland in rural areas within commuting distance of cities and urban amenities is increasingly subject to acreage development, a lifestyle often considered the "best of both worlds." Potential benefits of living in a rural acreage development include personal and family privacy, security and safety, fresh air, and natural surroundings. A recent study of Saunders County between Omaha and Lincoln looked at a complex and competitive market between farmland production and acreage development. The study showed that many factors influence this dynamic, including the land's farmability and productivity, site amenities, accessibility and

transportation routes, landowner age, off-farm income and family preference, and acreage demand. The study further showed that these factors could change over time depending on interest rates, income levels, public policy and change in demand. A substantial increase in the cost of transportation could also affect this dynamic. So far, there is no consensus in public policy or planning for preservation of prime farmland in Nebraska's urban-influenced areas.

Implications of Urbanization and Farmland Conversion

Currently, less than two percent of the U.S. population is directly involved in the production of food, and urban populations continue to grow. Nebraska's farm production employment is higher at just over five percent, but even in agriculture, the overwhelming majority of employment is found in non-production activities. Most people in the U.S., as well as in Nebraska, prefer to live within driving distance of a city to be near jobs and urban amenities. These pressures fuel the conversion of productive farmland to other uses, such as commercial and housing development and the growth in number of residential acreages and "ranchettes." While acreages and other non-agriculture uses of farmland may not be as destructive to ecosystem services and wildlife as industrial agriculture or commercial development, these low-density developments can lead to an increased demand for infrastructure and city-type services such as paved roads and police and fire protection. The higher costs of providing services to distant homes, compared to those integral to the current boundaries, can offset short-term financial gain to communities. They can also lead to an increased use of energy, the fragmentation or loss of wildlife habitat and ecosystem services, and possible loss of groundwater recharge.

How will the market process correct potential problems caused by farmland conversion? Can the market measure loss of land for food production, flood control benefits, wildlife habitat, waste assimilation and what some people value as rural beauty? Most of these resources are considered public goods, those not supplied by the market, and have no measurable short-term economic value. Farmland conversion is irreversible; once land is paved over for development, it no longer functions as before without an extremely high cost. The future costs of irreversibility are simply ignored. Many individual decisions can lead to a substantial loss for all. Land use decisions are most often based on short-term gains, and landowners often have a different view of future benefits than non-owners. Choices made today in the use of productive land will also affect the options available to future lawmakers. Public policy must work together with

investments from the private sector to prevent the loss of resources and protect the interests of both urban and rural populations for the future. Unmanaged urban growth and the loss of farmland are not inevitable, and can be solved by concerned citizens and well-planned communities. In *Under the Blade*, ag economist Lawrence Libby and political scientist Patrick Stewart state, “It is not a matter of choosing between agriculture and growth, but of encouraging higher density residential development consistent with available public services while retaining a viable agriculture.”

Farmland Protection Policies

Farmland protection policies are designed to retain conditions favorable to food production and other benefits of undeveloped farmland, but generally only protect land for production. Ideally, these policies would also include the beneficial non-production ecological functions of rural landscapes used for farming and address the harmful external effects of many present-day industrial agriculture practices, in order to keep the land renewably productive for the future. Farmland policy influences the land market through its economic signals to buyers and sellers. It is important to remember that both rural and urban populations benefit from farmland protection policies. While the policy may seem formed to benefit and acknowledge only the role of farmers, agricultural land provides valuable services to non-owners. Consumers—all of us—play a huge role in shaping farmland policy and food production through our support of preservation programs and our economic choices in the marketplace. Various policy tools are available to help preserve farmland, such as conservation/preservation payments, zoning, tax differential assessments and incentives, and acquisition methods. (For more detailed information, see *Policy and Legal Dimensions in Multifunctional Rural Landscapes - MFRL 5.*)

Outlook for Rural Landscapes

In spite of recent low profitability and rising costs in conventional farming, the outlook for multifunctional rural landscapes is good. Opportunities exist for both conventional and beginning farmers in alternative agricultural systems, such as sustainable and organic farming, and in agri-tourism. Sustainable agriculture is defined as a system that is productive and profitable without depleting earth’s resources or polluting the environment. The organic market is rapidly growing; recent figures show a 20 percent or more market growth in sales per year every year since 1990. Consumers are increasingly demanding safe and fresh food products that can be supplied by locally-accountable growers through local markets such as food co-ops,

farmer's markets, community-supported agriculture (CSA), and direct farm and internet sales, which can help create greater connections between urban and rural people. While it unrealistic to believe local food systems can supply all of our needs, in the face of rising fuel and transportation costs and increasing urbanization of land in the food basket states of California, Florida and Texas, one alternative strategy would be to encourage greater reliance on local food systems and protection of productive farmland.

Included in local food systems, agri-tourism opportunities have increased in recent years across the U.S. and in Nebraska. According to the Natural Resources and Conservation Service, alternative agriculture systems and agri-tourism allow farmers and ranchers to earn higher profits by replacing or supplementing traditional farm operations with innovative on-farm or on-ranch ventures such as recreational, scenic, nature- and educational-based, and alternative methods such as organic farming. These can be seasonal, full- or part-time depending on the venture, and have the effect of boosting local economies. One example is the recent growth of grape growing and wineries across Nebraska, attracting urban people to visit rural areas. (For more information, see *Peri-Urban Agriculture in Multifunctional Rural Landscapes - MFRL 6.*)

While globalization has changed many facets of historic U.S. economic forces, it also increases the ability of rural communities to establish sustainable forms of economic development through goal-setting, incentives, and local mobilization to achieve a balance of economic vitality, environmental stewardship, and social equity, according to Colgate University sociologist Adam Weinberg. As the U.S. economy continues to change toward more specialized and global production systems with an emphasis on the service sector, and land continues to be converted to industrial systems and non-agricultural uses, expectations may also change over time. Awareness of present land-use patterns and food production systems will help both urban and rural populations shape policies that can retain a sustainable agriculture system and renewably productive land base.

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Policy and Legal Dimensions in Multifunctional Rural Landscapes (MFRL 5)

Twyla M. Hansen, Charles A. Francis, J. Dixon Esseks

Farmland Loss in the U.S. and Nebraska

The U.S. has been losing high quality farmland to development at an increasing rate in recent years. According to the National Resources Conservation Service, in the two decades between 1982 and 2001 about 34 million acres – equivalent to over half the state of Nebraska – were converted to non-farm uses, such as commercial, housing and acreages. Many people today recognize the need to balance short-term development with long-term conservation of productive agricultural land and natural resources. Agriculture provides an abundance of food, but farmland is crucial for much more than just food or economic development. Well-managed farmland and open natural areas provide recreation and wildlife habitat, filter impurities from air and water, and provide other essential ecosystem services for urban and rural communities. Farmland also provides beauty and scenery. Viable rural towns reflect our heritage and the character of our state.

According to the American Farmland Trust, the U.S. is currently losing 1.2 million acres of farmland each year, mostly near cities and often those lands with the most productive soils. According to the 1997 National Resources Inventory, between 1982 and 1997, about 94,000 acres of agricultural land in Nebraska was converted to urban development, acreages and other uses. Over the last decade, it is evident to all who travel Interstate 80 in eastern Nebraska that recent building activities and development pressures on rural land are highest near urban centers such as Lincoln and Omaha. According to the Omaha-based Joslyn Castle Institute for Sustainable Communities, present planning and development policies are inadequate to stimulate thinking about integrated, sustainable systems that are necessary for communities in the long term. Instead they promote housing and commercial development dependent on vehicle transportation systems. In a recent survey for the Lincoln/Lancaster County Planning Department, city and county residents felt that it was extremely important or very important (72 percent) to preserve our rural quality of life and productive agricultural land. Preserving quality farmland contributes to the economic, environmental and social well being of Nebraska and our nation.

Should productive farmland always be lost to what is termed land's "highest and best use," residential or commercial development, when such use is measured only in short-term economics? Do the benefits of development only reach a small proportion of citizens? Transportation routes and other developments are essentially permanent. Once land is paved over, it is very difficult and expensive to return that land to its previous use. Impervious surfaces such as roads, parking lots, and rooftops can degrade water quality with contaminating chemicals and prevent groundwater recharge. Wildlife habitat becomes fragmented or lost to development. Uncontrolled development also affects quality of life because of increased driving distances and risk of fatal crashes, increased levels of ozone-layer pollution, and fewer opportunities to walk and use alternative transportation.

In addition to enjoying open space for food production and recreation, rural and urban populations both benefit from ecosystem services provided by natural areas and farmland. The book *Under the Blade: The Conversion of Agricultural Landscapes* lists important processes such as filtering pollutants from water and air, providing biodiversity, nutrient cycling and waste assimilation, flood and erosion control, soil formation, pollination and pollinators, biological control of pests and genetic resources. Those processes in nature are nearly impossible to duplicate through technology. For more information on ecosystem services, see *Landscape Structure and Function in Multifunctional Rural Landscapes (MFRL 3)*. In order to maintain the good life in Nebraska, we have a responsibility to protect our quality farmland and natural resources for future generations.

Policy Tools to Protect Farmland in Nebraska

Policy tools to protect farmland can be categorized into three general areas: agricultural competitiveness efforts, planning efforts, and conservation tools. In Nebraska, public policies to preserve the land in farming and maintain its competitiveness include differential valuation assessment for agricultural and horticultural land, a right-to-farm statute, and agricultural zoning, along with federal farm income support programs.

In differential valuation, often called a "greenbelt" provision, land is assessed for taxation purposes by local governments at its value for agriculture instead of the current fair market value. Such valuation helps farm families maintain an economically viable farm through lower property taxes, though some acreage owners take advantage of farm valuation as well, and helps protect the land base for farm production. Farmland owners require less expense per acre for

local public services compared to urban or acreage landowners. American Farmland Trust studies over the last twenty years in more than 100 communities across the U.S. show that working agricultural lands generate more public revenues than they receive back in services, whereas taxes on most residential land and especially houses in the suburbs typically do not cover their costs for community services and infrastructure.

All states have enacted right-to-farm laws to protect farmers and ranchers from nuisance lawsuits that may result from conflicts with neighbors who move to an area after the agricultural operation was established. However, lawsuits may still be filed against landowners for alleged nuisance activities on their property. Nebraska's Right-to-Farm Act, regulated by the Department of Environmental Quality, affords landowners some but not absolute protection against nuisance claims on their farming for odors, flies, dust, noise and livestock waste management. A California study of county right-to-farm laws concluded that legal ordinances are not a sufficient solution to incompatible land uses on the rural-urban edge, and that good planning and design sensitive to farm operations are needed, along with resident education. In 1999, the U.S. Supreme Court refused to review an Iowa Supreme Court ruling that struck down that state's right-to-farm law, citing that it gave the farmer an unfair easement to maintain a nuisance, a ruling that may eventually abolish similar laws in Nebraska and in other states.

At the local level in Nebraska, agricultural zoning specifies areas where farming is the primary land use. To protect farming in these areas, the designation is for minimum lot size to qualify for a residential building permit, such as 20 acres for building in Lancaster County's agricultural district. Such zoning may discourage development since it is more land than necessary for a residence. However, the process is vulnerable to power and financial pressures, and at nearly any time a majority of the county's legislative body may liberalize the requirements to permit denser residential zoning, by rezoning parcels to a district with a smaller minimum lot size. In areas with immediate urbanization pressures, such regulatory changes often result in farmland conversion. They can also inadvertently add to farmland conversion as acreages may be larger than desired and can be sold to developers.

Public efforts to preserve farmland in Nebraska include planning. Comprehensive land use planning allows counties, cities, and towns to create a master plan that outlines policies, objectives and decision-making guidelines for future orderly development, including zoning for agriculture. Zoning can slow, but not always stop, non-farm development into farmland. The city

of Lincoln has used zoning since the 1920s to regulate density of development and land use, and its regulations apply to all areas within a three-mile jurisdiction from its city limits. Lincoln's first comprehensive plan was adopted in the 1950s, along with the formation of a joint Lincoln-Lancaster County planning commission. This joint venture increases citizen participation in planning matters, and helps create a shared vision for the area's future land use. In Lincoln, this process has promoted mostly a compact pattern of development. Omaha's growth has also been mostly compact, enabling it to rank as the sixth least-sprawling metro area out of 83 major metropolitan areas, according to a study released in 2002 by Smart Growth America. The index rating system used in the study was based on four factors: residential density; neighborhood mix of homes, jobs and services; strength of activity centers and downtown; and accessibility of the street network.

Conservation tools to help retain land in agriculture in Nebraska include agricultural conservation easements and several federal conservation programs. Conservation easements are flexible, voluntary agreements between a private landowner and a qualified land trust, conservation organization or government agency. The grantor retains the right to use their land for farming, ranching or other open-space purposes, holds title to their properties, and may sell, give or transfer their property as they wish with the continued development constraint, as well as receive tax benefits. Conservation easements are interests in real property imposing limitations on the use of the property, including:

- Retaining or protecting the property in its natural, scenic, or open condition;
- Assuring the property's availability for agricultural, horticultural, forest, recreational, wildlife habitat, or open space use;
- Protecting air quality, water quality, or other natural resources; and
- Other conservation purposes which may qualify as charitable contributions.

Conservation easements may be purchased at prices acceptable to the owners, or they may be donated with owners receiving no direct compensation. However, the donations should qualify them for deductions on their taxable income.

Federal farm conservation programs include the Farm and Ranch Lands Preservation Programs (FRPP), Grasslands Reserve Program (GRP), Conservation Security Program (CSP), and Wildlife Habitat Incentives Program (WHIP). These programs help retain land in agriculture and can also help sustain smaller-scale agriculture in transitioning areas near cities.

Other Farmland Preservation Tools

Other states have additional state-wide or locally-enacted tools to ensure the economic viability of agriculture, such as agricultural districts that provide protection from special tax assessments and nuisance complaints, urban growth boundaries, purchase of agricultural conservation easement (PACE) programs, transfer of development rights (TDR), circuit breaker tax relief credits offering tax credits to offset farmers' property tax bills, cluster zoning that allows or requires houses to be grouped close together on small lots to protect open land and create agriculture-residential transitional areas, and mitigation ordinances that require developers to permanently protect one acre of farmland for every acre of agricultural land they convert to other uses.

Purchase of conservation easements (PACE) programs have been used by several states and local governments to compensate farmers for preserving farmland and rural amenities. Land speculation is an obstacle to protecting farmland and open space in the path of urban growth. Such proximity also drives up land values to levels that established and beginning farmers cannot afford. In the PACE program, landowners sell agricultural easements to a government agency or private conservation organization, receiving the difference between the value of the land for agriculture and its potential development value. Some PACE programs place ceilings on their payments, such as \$5,000 per acre in Illinois. These programs provide a financially competitive alternative to selling land for non-agricultural uses. Permanent easements reduce the land's future market value, allowing the land to stay in the family or making it more affordable to beginning farmers, and create a way for the community to share the costs of protecting agricultural land with farmers. However, over time, the easement land may appreciate substantially in value as farmers bid on what may be the few remaining significant-sized parcels for farming and non-farmers are attracted to the land's potential as a country estate for "lifestyle farming".

Nationally, more than 250,000 acres of farm and ranch land have been protected by purchased conservation easements through the Natural Resources Conservation Service's Farm and Ranchland Protection Program (FRPP), a national program in which the federal government shares part of the cost to protect agricultural land with "prime, unique, or other productive soils or historical or archaeological resources," from conversion to developed uses. A national historic 524-acre site in northern Nebraska described in the 1804 Lewis and Clark journals has recently

been preserved as ranch land through FRPP and the Northern Prairies Land Trust and Nebraska Environmental Trust. The City of Lincoln has purchased over 40 acres per year in open space conservation easements for the last five years to preserve farmland, open space, rare saline wetlands and flood plain land.

Transfer of development rights (TDR) programs allow land owners to transfer development rights from one parcel of land to another through local zoning ordinances, which in the case of rural land protection shifts development away from agricultural areas to areas closer to municipal services. In 2006, the Nebraska Legislature authorized a study of TDR programs in response to recent introduced legislation.

Alternatives for Future Protection of Farmland

To increase agricultural competitiveness, quality farmland near urban areas has great potential for direct marketing of fresh fruits, vegetables, dairy and meat products in community supported agriculture (CSA) shareholder systems, farmers' markets, farm stands or stores, and pick-your-own operations. Direct market customers can enjoy fresh food from a local source. The interaction with growers may create greater connections between urban and rural populations, provide regional food security, and maintain the economic viability of productive farmland and nearby small communities. Greater participation in local food systems by more of the population tends to create more awareness of local land use issues and potentially greater involvement in the political process to protect farmland. Keeping quality land in farms can help stem the loss of wildlife habitat and ecosystem services to sprawl development. Urban areas have a stake in preserving existing farmland in greenbelt zones on their outer edges. Keeping these green zones can increase the quality of life for all citizens, both urban and rural, and encourage development of a local food system alternative. Farmers' markets have formed in all areas of Nebraska. There may also be a significant unmet demand in the Lincoln and Omaha metro areas for locally produced, directly marketed foods. More research is needed to assess this potential for local growers. For more on local food systems, see *Peri-Urban Agriculture in Multifunctional Rural Landscapes (MFRL 6)*.

Agricultural competitiveness near cities can be achieved through differential valuation, the right-to-farm statutes, agricultural zoning and federal farm income support programs. Alternatives exist for restricting development to consume less agricultural land through well-planned, contiguous urban growth. Planning takes place at the city and county level, and

developers often exert a strong influence to direct policies in their favor. Citizens can make their concerns known for more sustainable land use policies directly to their elected officials. A sustainable community is one that makes use of its resources to meet current needs, but also makes sure that adequate resources are preserved for future generations. If protecting farmland, open areas, recreation and habitat corridors for the future are priorities, the community can accomplish these through modification of growth policies in comprehensive planning.

Along with rural land preservation policies, “smart growth” is a phrase used to describe several deliberate land use strategies and incentives for new development by cities, such as favoring new development within the existing city limits rather than on the cities’ edge to lessen the need for additional infrastructure and productive agricultural land. This approach makes use of mass transit and existing transportation routes for new developments, creates housing, business and industry opportunities into pedestrian-friendly and mixed-use designs, and preserves farmland and environmental resources in open spaces. Also, conservation subdivision designs with higher-density cluster housing and larger commons areas can help preserve undisturbed open space in new developments, and protect wildlife habitat and sensitive ecological landscape features, as opposed to low-density residential and conventional development designs.

Conservation tools to help preserve farmland near cities include conservation easements, either voluntary or purchase of agricultural conservation easements, and transfer of development rights. Other federal farm conservation programs include Farm and Ranch Lands Preservation Programs (FRPP), Grasslands Reserve Program (GRP), Conservation Security Program (CSP), and Wildlife Habitat Incentives Program (WHIP).

Finding long-term alternatives to the present sprawl development patterns and farmland conversion will require public awareness of the issues and consensus of communities affected across the country. There is much at stake in Nebraska and changes due to urbanization are happening quickly, but these consumptive land use patterns are not inevitable. Concerned citizens, active groups and public policymakers can design a future that will benefit both urban and rural areas, and not one based on uncontrolled development. As stated by the motto above the entrance to the Nebraska state capitol, "The Salvation of the State is Watchfulness of the Citizen."

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Peri-Urban Agriculture in Multifunctional Rural Landscapes (MFRL 6)

Twyla M. Hansen and Charles A. Francis

Peri-Urban Agriculture

Peri-urban areas are those open lands and farmlands surrounding cities that are subject to commercial or housing development because of urban expansion and city growth pressures. Peri-urban agriculture refers to farming near cities that could serve the nearby urban population.

According to the American Farmland Trust, the U.S. is currently converting 1.2 million acres of farmland to other uses each year, mostly near cities and often with the most productive soils. In Nebraska, many towns and cities have expanded into nearby agricultural land. In recent years, the eastern rural areas near the metropolitan areas of Lincoln and Omaha are increasingly subject to commercial and residential development. These pressures present both challenges to conventional agriculture and opportunities to alternative food growers.

According to the USDA, farms in metro areas are an important part of U.S. agriculture, making up 33 percent of all farms and a third of the value of U.S. agricultural output. Unlike large-scale conventional agriculture, peri-urban agriculture can include smaller operations raising horticulture crops and livestock products—fresh food for direct markets as part of a local food system. Low-density housing developments near cities and rural acreages or “ranchettes” within commuting distances of cities often fragment or hinder conventional agriculture operations and open space functions. However, farmers on the urban fringe can adapt to urban-influenced growth by changing to alternative higher-value products and more intensive production methods on smaller land parcels.

Benefits of Peri-Urban Agriculture

Local food systems can provide a source of fresh fruits, nuts, vegetables, herbs, nursery plants, florals and livestock products grown near urban areas, reducing the need for extensive processing, materials for packaging and energy for shipping. Foods are grown for sale at peak freshness within a short time of harvest, providing a greater variety of nutritious and flavorful food with less processing. There is also less concern for its ability to withstand shipping or over-ripening, since it will be consumed in a short time.

Livestock have mostly disappeared from farms today, with large confined animal feeding operations (CAFOs) supplying meat, poultry and dairy products. Rotational grazing is an alternative on a small and medium scale, and a sustainable livestock rotational grazing system

often used by farmers can lower feed costs, recycle nutrients, and improve animal health in local food systems.

Today's conventional agriculture is geared toward producing products for the global market at the lowest price, often resulting in lower profits for individual farmers and increased long-term environmental costs—loss of biodiversity, wildlife habitat and ecosystem services—that are not reflected in the market. The conventional system, while providing a greater variety of foods from multiple countries across the world at low prices, also consumes large amounts of fuel and generates greenhouse gases that contribute to global climate change. According to a study by Rich Pirog at Iowa State University, conventional fresh produce in the U.S. travels nearly 1,500 miles from grower to consumer as compared to an average of 56 food miles for Iowa-grown produce. The Practical Farmers of Iowa have successfully expanded markets and farmers' profits by selling locally produced foods to Iowa institutions, with assistance from the Agricultural Marketing Service of the USDA. Consumers can play a huge role in agricultural production by purchasing fresh food raised locally by farmers. Local systems can provide a safe source of food from locally accountable producers, and grow the local economy through the food dollar multiplier effect.

Small, independent farms near cities, using more sustainable and often organic growing methods, encourage biodiversity by diversifying the landscape, reducing degradation of soil and water quality from erosion and run-off, improving air quality, providing habitat for beneficial insects, birds and wildlife and valuable ecosystem services in a sustainable system. According to the USDA, sustainable agriculture is defined as a system that uses local resources that are mostly renewable, cycles materials and produces wastes no faster than they can be absorbed in the local system, supports local communities, and provides income for farmers. (For more information on ecosystem services, see *Landscape Structure and Function in Multifunctional Rural Land - MFRL 3.*)

Peri-urban agriculture can make use of smaller parcels of land than conventional systems, providing opportunities for beginning farmers. It also helps preserve family farms practicing land stewardship. These smaller farmland parcels preserve open space surrounding cities, make efficient use of productive land, conserve energy resources, provide employment opportunities, and support the local economy. They can also provide recreational opportunities through on-farm activities such as agri-tourism and wild game hunting. Eating foods grown closer to home can

help preserve local cuisine and can promote greater connections between urban and rural people and their sources of food. It also helps participants become part of a local “foodshed” to appreciate the biological and social realities of farming, and the uncertainties that are part of food production. (For more information, see *Human Dimensions in Multifunctional Rural Landscapes - MFRL 2*.) The social and environmental amenities of nearby rural areas are often important considerations in the potential for attracting an educated work force to urban areas such as Lincoln and Omaha.

Potential for Peri-Urban Agriculture

Direct markets include seasonal farmer’s markets in cities, community supported agriculture (CSA) shareholder subscriptions, farm stands or direct on-farm sales, pick-your-own operations, restaurant and institution sales, food co-operatives, on-line Internet sales, independent grocers selling local farm products, customers on farm visits, and agri-tourism operations such as wineries. Along with supporting the local economy and buying fresh food, customers of direct marketing operations may also enjoy the social interaction with farmers, such as learning how the products are grown, the genetic history of the product, recipes for cooking, and invitations to tour the farm or ranch. A highly successful program in western Massachusetts promoted their “Be a Local Hero” campaign that identified customers who bought local food as the heroes of the community.

Direct marketing of farm products has grown in Nebraska in recent years. The popularity of farmers’ markets has spread to communities all across the state, and is now found in multiple locations in Lincoln and Omaha. Community supported agriculture (CSA) operations are unique in that they consider the environmental and social benefits of locally-grown produce, are often certified organic, and are mostly part-time labor-intensive businesses with subscribers and farmers sharing the risks (and sometimes labor) of growing seasonal edible crops and other farm food and fiber products. While there are only few CSAs in Nebraska, the system has gained popularity and rapid growth in Iowa with dozens across the state now in operation. According to the Leopold Center for Sustainable Agriculture at Iowa State University, the average net return in upper Midwest CSA operations, including Nebraska’s, in 2004 was \$2,920 per acre as compared to commodity crops such as corn (\$172), soybeans (\$134), and wheat (\$38). A recent USDA grant has facilitated development of the Nebraska Local Food Cooperative, a regional direct marketing system designed to improve the efficiency, profitability and competitiveness of

Nebraska producers. The University of Nebraska-Lincoln Center for Applied Rural Innovation supports projects, programs and resources in sustainable agriculture, including the Nebraska Cooperative Development Center that offers assistance to farmers in forming marketing alliances and for small market feasibility exploration.

Direct marketing, sustainable and organic agriculture operations continue to grow in Nebraska along with consumer demand. The organic foods market has grown 20 percent every year since 1990. Agri-tourism and other alternative on-farm/ranch enterprise activities such as growing alternative products can add value to present systems, use alternative and organic methods, and offer seasonal or recreational activities. They can allow farmers and ranchers to earn higher profits in addition to or instead of conventional methods. The increase in Nebraska wineries in the past few years is just one example of this growing potential for agri-tourism in the state.

It is unrealistic to believe that area farmers can supply all food needs for all local markets. However, both urban and rural residents can benefit from productive agricultural land and open space near cities. According to the Joslyn Castle Institute in Omaha, today's typical pattern of city growth is based on automobile transportation and favors suburban sprawl into the countryside, with little regard to the amount of land used, and offers few opportunities for interaction between urban and rural people. Keeping downtown areas viable is important to cities, and one way communities can achieve this is to support their local farmers' markets. Communities that value their local economy and communities can also plan for growth through comprehensive land-use policy and regulation, preserve open and farm lands near cities for future local food production, follow various "smart growth" principles for needed city expansion, offer incentives for peri-urban agriculture included in development plans, and help local farmers stay in business through tax relief on their development-potential land or by other means. (For more information, see *Policy and Legal Issues in Multifunctional Rural Landscapes - MFRL 5.*)

Keeping young people on the land and helping present farmers adapt to new opportunities will improve Nebraska's future rural economic outlook. The Center for Rural Affairs in Lyons has proposed a "New Farm Initiative" that specifically addresses the needs of beginning farmers and ranchers through change in national farm policy. The USDA-supported Sustainable Agriculture Research and Education (SARE) programs help advance farming systems that are "profitable, environmentally sound and good for communities." These alternative programs face

considerable challenges in the face of today's agribusiness influence of farm policy. But the potential long-term economic, social, and environmental benefits of searching for alternative and sustainable production and marketing systems are great. ATTRA, the National Sustainable Agriculture Information Service of the USDA, provides information on sustainable agriculture and organic farming news, events and funding opportunities. The government's comprehensive assessment of its agriculture programs and future challenges can be found in a USDA report from 2003, "Assisting America's Small Farmers and Ranchers in the 21st Century." In addition, the Nebraska Sustainable Agriculture Society, a 30 year-old non-profit member organization, helps educate farmers and non-farmers, holds an annual "Healthy Farms Conference," and helps to promote food systems that "build healthy land, people, communities and quality of life, for present and future generations."

Both rural and urban people have a stake in farm programs and policies to benefit small farming operations, to preserve the continued productivity of the land, and to preserve open space near cities. They can make their concerns and views known to public office-holders and other policy-makers. More consumer education is needed on how food is produced, and where it comes from, in order to increase the viability of peri-urban agriculture. Children can become knowledgeable about sources of their food through school community gardens, cross-curriculum education on farming and food, and field trips to local farms. Land-grant universities play a major role in providing research that supports innovation in peri-urban agriculture and education in sustainable farming methods for the future.

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