

Land Use Changes: Economic, Social, and Environmental Impacts

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JEL Classifications: Q24, Q28

Major land-use changes have occurred in the United States during the past 25 years. The total area of cropland, pastureland and rangeland decreased by 76 million acres in the lower 48 states from 1982 to 2003, while the total area of developed land increased by 36 million acres or 48%. What are the potential economic, social, and environmental impacts of land use changes? How does land use change affect agriculture and rural communities? What are the important economic and environmental implications for commodity production and trade, water and soil conservation, open space preservation, and other policy issues? This article addresses some of these issues and their policy implications.

Socioeconomic Impacts

Land is one of three major factors of production in classical economics (along with labor and capital) and an essential input for housing and food production. Thus, land use is the backbone of agricultural economies and it provides substantial economic and social benefits. Land use change is necessary and essential for economic development and social progress.

Land use change, however, does not come without costs (see Table 1). Conversion of farmland and forests to urban development reduces the amount of lands available for food and timber production. Soil erosion, salinization, desertification, and other soil degradations associated with intensive agriculture and deforestation reduce the quality of land resources and future agricultural productivity (Lubowski et al. 2006).

Urbanization presents many challenges for farmers on the urban fringe. Conflicts with nonfarm neighbors and vandalism, such as destruction of crops and damage to farm equipment, are major concerns of farmers at the urban fringe (Lisansky, 1986). Neighboring farmers often cooperate in production activities, including equipment sharing, land renting, custom work, and irrigation system development. These benefits will disappear when neighboring farms are converted to development. Farmers may no longer be able to benefit from information sharing and formal and informal business relationships among neighboring farms. Urbanization may also cause the "impermanence syndrome" (i.e., a lack of confidence in the

Table 1. Socioeconomic Impacts of Land-Use Changes

- Conversion of farmland and forests to urban development reduces the amount of land available for food and timber production
- Soil erosion, salinization, desertification, and other soil degradations associated with agricultural production and deforestation reduce land quality and agricultural productivity
- Conversion of farmland and forests to urban development reduce the amount of open space and environmental amenities for local residents
- Urban development reduces the "critical mass" of farmland necessary for the economic survival of local agricultural economies
- Urban development patterns not only affect the lives of individuals, but also the ways in which society is organized
- Urban development has encroached upon some rural communities to such an extent that the community's identity has been lost
- suburbanization intensifies income segregation and economic disparities among communities
- Excessive land use control, however, may hinder the function of market forces
- Land use regulations that aim at curbing land development will raise housing prices, making housing less affordable to middle- and low-income households
- Land use regulation must strike a balance between private property rights and the public interest

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stability and long-run profitability of farming), leading to a reduction in investment in new technology or machinery, or idling of farmland (Lopez, Adelaja, and Andrews, 1988).

As urbanization intensifies, agricultural and nonagricultural land use conflicts become more severe. This may lead to an increase in local ordinances designed to force farmers to pay for some of the negative impacts generated by agriculture. As the nearest input suppliers close because of insufficient demand for farm inputs, a farmer may have to pay more for inputs or spend more time to obtain equipment repairs (Lynch and Carpenter, 2003). Competition for labor from nonagricultural sectors may raise farmers' labor costs. When the total amount of farmland falls below a critical mass, the local agricultural economy may collapse as all agricultural supporting sectors disappear.

Urbanization also presents important opportunities to farmers. The emergence of a new customer base provides farmers new opportunities for selling higher value crops. For example, Lopez, Adelaja, and Andrews (1988) found that vegetable producers tend to receive higher prices in urbanized areas. The explosion of nurseries, vegetable farms, vineyards, and other high-value crop industries in many suburban areas illustrates how quickly agricultural economies can evolve. Many farmers have shown remarkable adaptability in adjusting their enterprises to take advantage of new economic opportunities at the urban fringe. They farm more intensively in areas with high population density (Lockeretz 1988). More than half the value of total U.S. farm production is derived from counties facing urbanization pressure (Larson, Findeis, and Smith 2001).

Urbanization has changed rural communities in many places. In some rural areas, urban sprawl has encroached to such an extent that the community itself has been lost. In

other areas, the lack of opportunities has turned once-viable communities into ghost towns. Urban sprawl intensifies income segregation and economic disparities between urban and suburban communities (Wu, 2006). Cities tend to gain lower-income residents and lose upper-income population. Between 1969 and 1998, the share of low-income families in central cities grew from 21.9% to 25.5% compared with a decline from 18.3% to 16.6% for high-income households (U.S. Department of Housing and Urban Development 2000). The change in income mix led to a smaller tax base and the need for more social services in urban communities.

Suburbanization brings urban and rural people and problems together. Most land areas are rural, most watersheds are in rural places, and most of the atmosphere exists above rural space. Urbanites and agencies have legitimate concerns about the use and condition of rural natural resources, just as rural populations have legitimate concerns about urban-based pressures on the natural world. These shared interests in the natural environment have important economic, social, and political implications, which may profoundly impact society in the future.

In response to the increasing urbanization, many local governments have imposed strict land use control. Some of the efforts have been quite successful in slowing down development. For example, Wu and Cho (2007) found that local land use regulations reduced land development by 10% in the five western states between 1982 and 1997, with the largest percent reduction occurring in Washington (13.0%), followed by Oregon (12.6%), California (9.5%), Idaho (4.7%), and Nevada (2.8%). A potential consequence of land use regulation is higher housing prices, which make housing less affordable to middle- and low-income households. There is sufficient evidence to

support the linkage between land use regulation and housing affordability. Two recent Harvard University studies found that land use regulation reduces housing affordability in the Greater Boston Area (Glaeser and Ward 2006; Glaeser and Gyourko 2002). Cho, Wu and Boggess (2003) analyzed the causes and consequences of land use regulations across counties in five western states and found that land use regulation increased average housing prices between 1.3 and 4.7%, depending on the intensity of land use regulations in a county.

Land use control must strike a balance between private property rights and the public interest. Oregon ballot measures 37 and 49 highlight the difficulty and controversy of the balancing act. In an attempt to protect private property rights from regulatory taking, Oregon voters passed Measure 37 in 2004. Measure 37 provides that the government must compensate the owner of private real property when a land use regulation reduces its "fair market value". In lieu of compensation, the government may choose to "remove, modify or not apply" the regulation. Measure 37 was ruled unconstitutional by a lower court, but was upheld by the Oregon State Supreme Court. By October 19, 2007, 6,814 claims had been filed, requesting almost \$20 billion in compensation (Oregon Department of Land Conservation and Development 2007). In an effort to reverse or modify Measure 37, Oregon voters approved Measure 49 on Nov. 6, 2007 to "ensure that Oregon law provides just compensation for unfair burdens while retaining Oregon's protection for farm and forest land uses and the state's water resources" (ODLCD, 2008). Measure 49 essentially modifies Measure 37 by replacing "waivers" of regulations with authorizations to establish a limited number of home sites.

In sum, land use change provides many economic and social benefits,

but comes at a substantial economic cost to society. Land conservation is a critical element in achieving long-term economic growth and sustainable development. Land use policy, however, must strike a balance between private property rights and the public interest.

Environmental Impacts

Land-use change is arguably the most pervasive socioeconomic force driving changes and degradation of ecosystems. Deforestation, urban development, agriculture, and other human activities have substantially altered the Earth's landscape. Such disturbance of the land affects important ecosystem processes and services, which can have wide-ranging and long-term consequences (Table 2).

Farmland provides open space and valuable habitat for many wildlife species. However, intensive agriculture has potentially severe ecosystem consequences. For example, it has long been recognized that agricultural land use and practices can cause water pollution and the effect is influenced by government policies. Runoff from agricultural lands is a leading source of water pollution both in inland and coastal waters. Conversions of wetlands to crop production and irriga-

tion water diversions have brought many wildlife species to the verge of extinction.

Forests provide many ecosystem services. They support biodiversity, providing critical habitat for wildlife, remove carbon dioxide from the atmosphere, intercept precipitation, slow down surface runoff, and reduce soil erosion and flooding. These important ecosystem services will be reduced or destroyed when forests are converted to agriculture or urban development. For example, deforestation, along with urban sprawl, agriculture, and other human activities, has substantially altered and fragmented the Earth's vegetative cover. Such disturbance can change the global atmospheric concentration of carbon dioxide, the principal heat-trapping gas, as well as affect local, regional, and global climate by changing the energy balance on Earth's surface (Marland et al. 2003).

Urban development has been linked to many environmental problems, including air pollution, water pollution, and loss of wildlife habitat. Urban runoff often contains nutrients, sediment and toxic contaminants, and can cause not only water pollution but also large variation in stream flow and temperatures.

Habitat destruction, fragmentation, and alteration associated with urban development have been identified as the leading causes of biodiversity decline and species extinctions (Czech, Krausman and Devers 2000; Soule 1991). Urban development and intensive agriculture in coastal areas and further inland are a major threat to the health, productivity, and biodiversity of the marine environment throughout the world.

Policy Implications

Land use provides many economic and social benefits, but often comes at a substantial cost to the environment. Although most economic costs are figured into land use decisions, most environmental externalities are not. These environmental "externalities" cause a divergence between private and social costs for some land uses, leading to an inefficient land allocation. For example, developers may not bear all the environmental and infrastructural costs generated by their projects. Farmland produces both agricultural commodities and open space. Although farmers are paid for the commodities they produce, they may not be compensated for the open space they provide. Thus, market prices of farmlands may be below their social values.

Such "market failures" provide a justification for private conservation efforts and public land use planning and regulation. Private trusts and non profit organizations play an important role in land conservation. For example, the American Farmland Trust claims that it has helped to protect more than one million acres of America's best farm and ranch land. The Nature Conservancy has protected more than 117 million acres of ecologically important lands. However, some have questioned whether private conservation efforts crowd out or complement public efforts for land conservation.

Table 2. Environmental Impacts of Land-Use Changes

- Land use and land management practices have a major impact on natural resources including water, soil, air, nutrients, plants, and animals
- Runoff from agriculture is a leading source of water pollution both in inland and coastal waters
- Draining wetlands for crop production and irrigation water diversions has had a negative impact on many wildlife species
- Irrigated agriculture has changed the water cycle and caused groundwater levels to decline in many parts of the world
- Intensive farming and deforestation may cause soil erosion, salinization, desertification, and other soil degradations
- Deforestation adds to the greenhouse effect, destroys habitats that support biodiversity, affects the hydrological cycle and increases soil erosion, runoff, flooding and landslides.
- Urban development causes air pollution, water pollution, and urban runoff and flooding
- Habitat destruction, fragmentation, and alteration associated with urban development are a leading cause of biodiversity decline and species extinctions
- Urban development and intensive agriculture in coastal areas and further inland is a major threat to the health, productivity, and biodiversity of the marine environment throughout the world

Land use regulation can take many different forms. The traditional command and control approach often involves zoning, density regulation, and other direct land use controls. Although these policies can be quite effective as regulatory tools, they could lead to substantial social welfare loss in the form of higher housing prices, smaller houses, and inefficient land use patterns (Cheshire and Sheppard 2002; Walsh 2007).

Incentive-based policies are increasingly used to influence private land use decisions. These policies may include development impact fees, purchases of development rights (PDRs), preferential property taxation, and direct conservation payments. From 1998 to 2006, voters approved 1,197 conservation initiatives in local and state referenda in the United States, providing a total \$34 billion for land and open space preservation (Trust for Public Land 2007). The implementation of locally based, long-term conservation plans has been touted as a critical element in achieving "smart growth" (U.S. Environmental Protection Agency 2007).

The incentive-based approach has many advantages over direct land use control. For example, a development impact fee can be used to achieve both the optimal pace and pattern of land development, a shortcoming of zoning regulations (Wu and Irwin, 2008). However, zoning may be preferred from a practical viewpoint as well as in cases where the environmental costs of land conversion are highly uncertain. In situations where the natural and human systems interact in complex ways, thresholds and nonlinear dynamics are likely to exist, and the environmental costs could be very high and sensitive to additional development. In such cases, zoning may be preferred. The policy challenge, however, is to know when the system is in the neighborhood of such thresholds.

While federal spending on land-related conservation programs has increased substantially over the last twenty five years, the federal government has yet to articulate a clear vision of how land use should be managed (Daniels, 1999). Most land use controls are in the hands of local governments in the United States, and the level of control varies considerably across counties and municipalities. Some local governments have few land use controls, while others are actively involved in land use planning and regulation.

Land use regulation is a contentious issue in many communities, particularly those facing rapid urbanization. Proponents argue that land use planning protects farmland, forests, water quality, open space, and wildlife habitat and, at the same time, increases property value and human health. Conversely, uncontrolled development will destroy the natural environment and long-term economic growth. Critics of land use regulation call those fears overblown. They argue that urban development is an orderly market process that allocates land from agriculture to urban use, and that governments tend to over regulate because they rarely bear the costs of regulation. The stakes are high in this debate. Any policy measures that aim at curbing urban development will ultimately affect a key element of the American way of life, that is, the ability to consume a large amount of living space at affordable prices. Policymakers must resist the temptation to attribute all "irregular" land use patterns to market failures and impose stringent land use regulations that may hinder the function of market forces. They should try to identify the sources of market failures that cause "excessive development" and address problems at their roots. Land use regulation must strike a balance between private property rights and the public interest.

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Figure 1. Changes in Major Land Cover/Use in the Contiguous United States 1982–2003

