BOSTON UNIVERSITY
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Land Economics and Policy

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An ECI Teaching Module on Social and Environmental Issues in Economics

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NOTE – terms denoted in **bold face** are defined in the **KEY TERMS AND CONCEPTS** section at the end of the module.

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"Land is foundational to entrepreneurship, capital accumulation and wealth formation; therefore, the long-run prosperity of society depends on how well we manage this resource whose use is not always reversible."
Barlowe, et. al. (2014)

FOCUS QUESTIONS:

1. What does economic theory tell us about land management? How can we evaluate land scarcity?

2. Are current land-use practices sustainable? What are the environmental effects of different types of land use?

3. Are markets for land economically efficient? Do land policies always achieve their goals?

4. What are the roles of institutions and property rights in the allocation of land resources? Is the distribution of land across the world equitable?

1. INTRODUCTION: THE VALUE OF LAND RESOURCES

Land occupies more than one-third of the planet's surface and represents an essential basis for human life and our economic activities. It is difficult to overestimate the value of land resources in our lives, from the value of land as an agricultural input to how it shapes economic activities and the distribution of population. Rapid population growth in the 20th century led to concomitant changes in land use patterns. Unfortunately, these changes do not always have a positive impact on the earth's environment and climate.

The role of economics is to find the optimal mix of development and conservation efforts to ensure that land use changes are environmentally sustainable and economically efficient. The first step in this direction is to evaluate the existing land resources in their current uses.

One estimate of the total value of land in the United States is about $11.9 trillion, as of 2005. To put it in perspective, the measure of overall U.S. economic activity, the gross domestic product, or GDP, was $13.09 trillion for that year. Note that the $11.9 trillion estimate did not include the value of built structures. The combined value of land and structures in the U.S. was about $35.8 trillion in 2005.[1] Another, more recent estimate of the land value, exclusive of structures, by the Bureau of Economic Analysis indicates that "the total value of the 1.9 billion acres in the contiguous 48 states is nearly $23 trillion—or about $12,000 an acre on average" in 2009.[2] The immense value of land resources highlights the importance of land in the economy and raises critical questions, such as:

- Are land resources so valuable because of scarcity? What are the principal sources of this value?
- Are current land use practices efficient, i.e., do we always put land to its highest-valued use?
- Do public institutions controlling the ownership of land promote the efficient and equitable allocation of land resources?
- What are the principal economic tools that can be used by governments to devise land regulation and policies?

In this module, we examine these questions utilizing the approach provided by the economic theories of land rent, social welfare, property rights, and environmental sustainability and attempt to analyze the implications of existing public policies and land regulation for the economy and the environment.

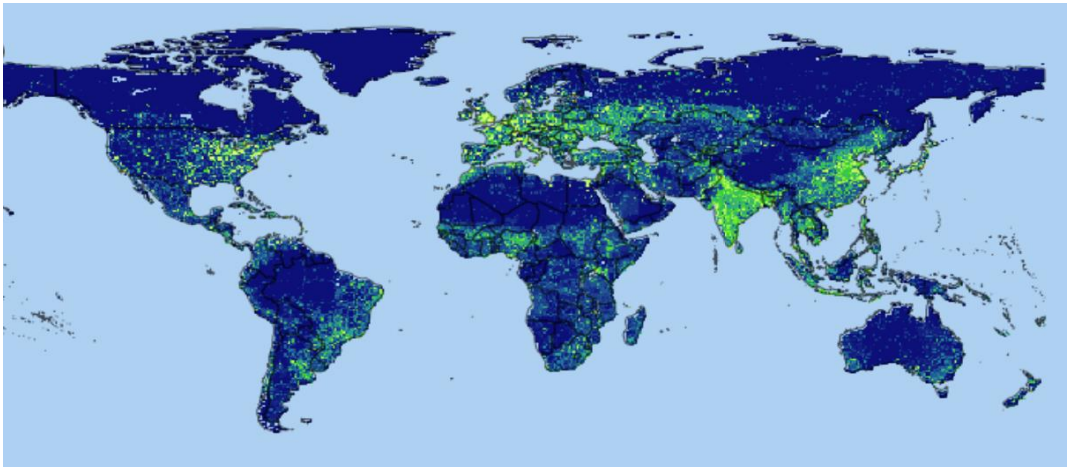
[1] Case, 2007.
[2] Frohlich and Sauter, 2019; William Larson, BEA, 2015.

2. RE-EVALUATING LAND SCARCITY

2.1 Defining Land Scarcity

The intensity of land scarcity varies across countries and regions. One attempt to evaluate global land scarcity is the mapping of the **human footprint index**, based on measures of the amount of cropland, forestland, grazing land, and built-up land required to support the average person in different regions of the world. Figure 1 shows a map of the cumulative human pressure on the environment in 2009, developed by Columbia University's Center for International Earth Science Information Network (CIESIN). The human pressure is measured using eight variables including built-up environments, population density, electric power infrastructure, croplands, pasture lands, roads, railways, and navigable waterways.

Figure 1. *The Human Footprint in 2009*



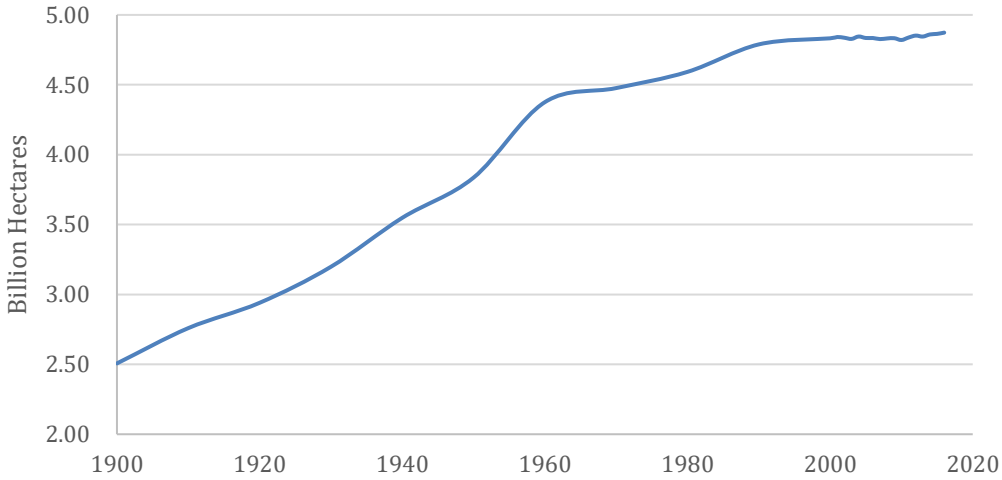
Source: Venter, et al. 2018. (Areas in green indicate the intensive land uses.)

The mapped human footprint helps to visualize differences in the regional intensity of land use and corresponding scarcity of land. As evident in Figure 1, land scarcity is not absolute—some types of land such as unassailable mountains and the polar icecaps can be considered abundant relative to human demands. However, the fertile valleys located in regions with a moderate climate and plentiful water are becoming increasingly developed and scarce. It is this type of land that we examine in this module.

According to a forecast by the United Nations, the world's population of 7.7 billion is projected to increase to 9.8 billion by 2050, and to 11.2 billion by 2100. Will humans have sufficient land suitable for housing and enough agricultural land to produce food for the rapidly growing population on earth? Can people adapt to the growing scarcity in per-capita land by changing lifestyles and advancing technology? So far, evidence suggests technological growth has kept pace with decreasing land availability per person. For example, the global average cereal yield per hectare has increased from 1,432 to 4,075 kilograms over the period 1961-2017, an average growth rate of about 1.9% per year. As a result, although the demand for food has been steadily rising with population growth, the amount of land devoted to food production has not risen much

in the last few decades, as indicated in Figure 2, which shows agricultural land worldwide from 1900 to 2016.

Figure 2. *World Agricultural Land, 1900-2016*



Source: Our World in Data: Land Use. https://ourworldindata.org/land-use

BOX 1. IS LAND SCARCER IN CHINA THAN IN RUSSIA?

Due to the fact that topography and climate exhibit huge variations around the globe, we need to be careful in making judgments about land scarcity in various regions. And it is even harder to predict what happens to land availability in the future. For example, consider Russia, the largest country in the world in total land area, and China, the most populous country. Russia's land area is about twice that of China, whereas the population is one-tenth that of China. Based on these numbers, relative land scarcity is much more profound in China. And while rapid population growth in China makes land increasingly scarce, the situation in Russia may not be much better. The reason is that the Western regions of Russia are characterized by high population density and concentrated economic activities, with little land available for accommodation of further population growth. The vast unsettled territories in the Russian East may seemingly provide an untapped potential for the growing population to expand spatially, but these "available" lands are marked by a harsh climate conditions and thick layers of permafrost—a subsurface layer of soil that remains frozen throughout the year. Permafrost may reach up to 1 mile in depth (!) in Northern Siberia. Since permafrost occupies nearly 65 percent of Russia's territory[3], it makes the endowment of readily available *developable* land in Russia comparable to that in China. There is a caveat however. Some climate experts believe that thawing of permafrost due to rising temperatures may make currently unlivable areas in Russian Siberia suitable for cities and agriculture in the foreseeable future.

[3] https://www.climatechangepost.com/russia/permafrost/

2.2 Response to Scarcity-Creating New Land

The 18th century's Malthusian theory predicts that exponential population growth will eventually result in catastrophic overcrowding, leading to widespread famine and political conflicts due to land scarcity. Although widespread Malthusian crises have not been realized yet, a tremendous increase in demand for land due to rapid population growth has pushed some land-scarce, technologically advanced nations to stretch their total supply of land, such as by filling water areas to create "new" lands.

This recently emerging trend includes the artificial islands erected in the Persian Gulf (the United Arab Emirates) and in the South China Sea (China), elevated lowlands in Holland, filled marshland in the cities of Boston (USA) and St. Petersburg (Russia), as well as a 6 percent increase in the total land area of Singapore, from 670 square kilometers in 2001 to 709 square kilometers in 2018. The images of the man-made islands in the Arab Emirates and China are presented in Figure 3.

Figure 3. *Images of Human-made Islands*

a) Human-made islands off the coast of Dubai in the Persian Gulf.

b) Human-made islands in the South China Sea.

Although the construction of man-made coastline and islands challenges Mark Twain's famous quote: "Buy land, they're not making it anymore", the creation of new lands only stresses the fact that humans face increasing land scarcity.

Only the technologically advanced nations can afford to create new lands, and even for these nations this represents only a temporary response to the fundamental scarcity of land. In the long run, it can be environmentally unsustainable and economically disastrous: the attempts to fill in coastal waters produce lands vulnerable to rising seas, as indicated by the example in Box 2.

BOX 2. NEW LAND IN THE BOSTON SEAPORT: PROS AND CONS

Figure 4. *Waves Crash onto Lynn Shore Drive on March 3, 2018 following a damaging nor'easter*

Source: Kristin LaFratta, MassLive

When English settlers began developing the delta of the Charles River in the 17th century, the city of Boston covered an area of about 200 hectares. Now it occupies more than 20,000 hectares, which includes over 2,000 hectares of man-made landfill (Shand and Gundy, 2018). Recently built commercial area that sits on a 400-hectare manmade peninsula in the Seaport District in Boston Harbor is in close proximity to top-notch universities, a cluster of high-tech firms, and a world-class transportation hub. The area has become home to General Electric, Liberty Mutual, Legal Sea Foods, Amazon, Fidelity Investments, Massachusetts Mutual Life Insurance, Reebok, PricewaterhouseCoopers and many high-end restaurants and luxury residential apartments, giving the city significant tax revenues.

Climatologists from the National Oceanic and Atmospheric Administration (NOAA) and the Woods Hole Research Center have noted the elevated risk of flooding in the area, with Boston Harbor being flooded "a dozen times a year, up from two or three times in 1960." (Diesenhouse, 2003) Experts predict that it will require significant investment by the city to offset the effects of climate change and rising sea levels on human-filled areas. For example, the estimated cost of a barrier along Seaport Boulevard is $19-22 million, whereas the estimated construction cost of a

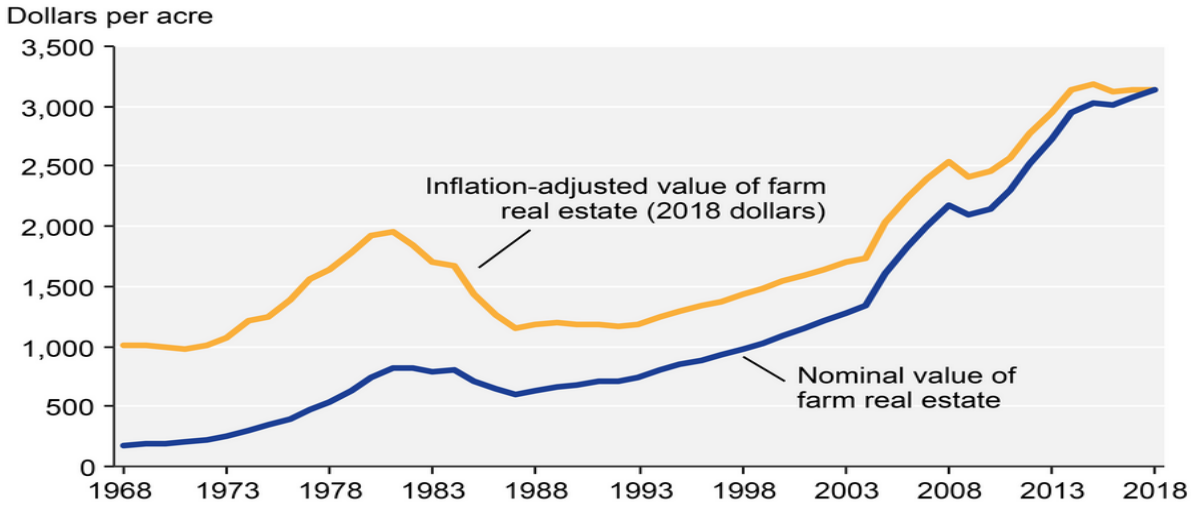
proposed barrier across Boston Harbor is $12 billion. After devastating flooding in winter 2018, "critics are wondering if it is a good idea to put so many people on a man-made peninsula that sits just above the sea level." (Shand and Gundy, 2018).

It may be costly for businesses as well as the city of Boston. General Electric announced that "the first floor of its new offices will be raised nearly 1.5 meters, or enough to protect it from the higher sea levels. Electrical systems are also being put on the second floor, and emergency power supplies will be on top of the 12-floor building". The question of whether these investments are worthwhile remains open. Only the future will reveal the true costs and benefits of locating in the filled coastal areas.

Sources: Shand and Gundy, 2018; Gopal and Sullivan, 2019; Boston City Report 2018; Diesenhouse, 2003.

As population growth makes land scarcer, economic theory predicts that the price of land should increase, reflecting the higher demand for land. While it is difficult to trace the dynamics of land prices at the global level, an upward trend in farmland prices observed in the advanced economies over the last several decades sends a clear economic signal of increasing land scarcity (see Figure 5).

Figure 5. *Average US farm real estate value, nominal & real, 1968-2018*



Source: The Economic Research Service, using annual National farm real estate USDA data, National Agricultural Statistics Service, QuickStats. Accessed at: https://www.ers.usda.gov/topics/farm-economy/land-use-land-value-tenure/farmland-value/

Economists measure land scarcity by the rental rate charged for use of a site, such as renting a piece of agricultural land for a growing season. Thus, it is important to understand the concept of land rent and the related notion of the market value of land. The following section examines the conventional economic approach to measuring land value by its rent and market values.

3. THE ECONOMIC VALUE OF LAND

The value of land can be decomposed into three major categories:

1. The social value of land, as measured by the additional attributes of land that contribute to the value of land as a natural resource but are usually not reflected in the market price of land such as aesthetic value of green spaces;
2. The intrinsic value of land measured by its value that is unrelated to its use by humans such as being a home to wildlife;
3. The economic value of land, as measured by the land rent and market value.

3.1 The Value of Land as a Social and Natural Resource

The intrinsic ecological and social values of land can be imputed using **nonmarket valuation** techniques. These techniques can be used to value public parks, conservation areas, and other land of social and ecological importance that is not commonly traded in markets. Nonmarket evaluation methods are divided into two broad categories:

1. **stated preferences techniques** that use surveys to directly ask respondents about the values they place of different resources. **Contingent valuation** is the most common stated preference technique*;*
2. **revealed preferences methods** which use market prices of related goods and services to infer values for natural resources. These methods include **hedonic pricing** and **travel cost models**.

We refer interested readers to the material in Chapter 6 of Harris and Roach's *Environmental and Natural Resource Economics: A Contemporary Approach* for details of the nonmarket evaluation techniques, while we will consider the calculation of land rent based on the *present value technique*.

3.2 Land Rent and Market Value

The notion of **land rent** dates back to the classical economists Thomas Malthus and David Ricardo. It is defined as income per period that can be earned by using or renting a parcel of land. For example, if the period is one year the corresponding land rent is calculated on an annual basis. Suppose that a parcel of land is expected to yield $Y of annual rental income accruing to the landowner every year into the future. Assume that r is the interest (or discount) rate, and t is the number of years in the future. As getting a rental income of $Y several years in

the future is not equivalent to getting the same income now, economists define the **present value** of a future income equal to the following formula:

$$PV (\$Y) = \$Y / (1+r)^t$$

Thus the present value of land represents the current value of a future stream of income calculated using a specified rate of return called the discount rate. It indicates how valuable a future income from land is from the perspective of the present. The higher the discount rate, the lower the present value of the future income. So getting a $1,000 income five years from now, using a 4% discount rate, would be given as present value of:

$$\$1,000 / (1+0.04)^5 = \$822$$

Thus a rental income of $1,000 from a piece of land five years from is considered to be worth $822 to the owner of that land. Economists define the **market value** of a piece of land as equal to the sum of its present values over a time period of T years as:

$$\textit{Market value} = \$Y/(1+r)^0 + \$Y/(1+r)^1 + \$Y/(1+r)^2 + \ldots + \$Y/(1+r)^T$$

If the annual rental income is constant at $Y and we are considering an indefinite time period, then the formula simplifies to:

$$\textit{Market value} = \$Y / r$$

We now see the relationship between land rent and market value—the market value of a piece of land is equal to the present value of the stream of all the expected rental income flows generated by the parcel. The market value of land obtained by using the formulas above is also called the **annualized or asset value of land**. One drawback of using the annualized value of land formula is that it assumes that the income generated by the parcel of land will be constant forever and there is no uncertainty about the appropriate discount rate in the economy. Despite of this obvious limitation, this approach is extensively used by economists, real estate professionals and property tax assessors.

Note that the discount rate plays a very important role in the present value calculations. The lower the discount rate, the higher the calculated present value of the future income and greater the market value of land. The numerical example in Box 3 illustrates the effect of the discount rate and the time period in valuing a piece of land.

BOX 3. ANNUAL LAND RENT AND MARKET VALUE OF AN ACRE OF LAND: AN EXAMPLE[4]

A numerical example will help illustrate the relationship between rent and market value. Let's assume an annual discount rate of 3 percent and annual rent of $10,000 per acre expected to last for three years. The discounted value of the potential rental income of $10,000 today is given by ($10,000/(1 + r)^0), or $10,000. With the discount rate of 3 percent, the value of a potential rental income of $10,000 one year from now is given by ($10,000/1.03^1), or $9,709, whereas the value of a potential rental income of $10,000 two years from now is ($10,000/1.03^2), or $9,426. If we assume that the land is not going to be usable in three years from now, then its market value, or equivalently, the market price of land is the sum of the discounted annual rental values over three years:

$$\text{Market value of land } (V) = \$10{,}000 + \$10{,}000/(1.03^1) + \$10{,}000/(1.03)^2$$

$$V = \$10{,}000 + \$9{,}709 + \$9{,}426 = \$29{,}135$$

This result implies that the owner of this property might ask about $30,000 for his property if he expects the stream of rental income from this land to last for only three years into the future.

In estimating the market value of land, economists usually assume that the stream of annual rental income is expected to last indefinitely. Then still assuming a rental value of $10,000 per year, the market value is calculated using the annualized value of land formula:

$$\$10{,}000/0.03 = \$333{,}000$$

A buyer who agrees to pay $333,000 for this parcel of land expects to make a return of 3% on the investment. If we assume that the discount rate is 5 percent instead, then the market value of the land will be calculated as $10,000/0.05, or $200,000. Note that an increase in the discount rate from 3% to 5% reduces the market value of land by more than a third. It's clear that financial market conditions can greatly affect the value of land.

3.3 Capitalization

The automatic adjustment of land and property values associated with the improvements in the local environment, public service and infrastructure is called **capitalization.** Capitalization happens because land is immobile and the value of land absorbs the quality of the local environment and economic development. Formally, capitalization represents the discounted stream of the enhanced land values.

[4] The discussion and example are based on Nechyba, 2017.

As an example, consider local amenities such as public schools and access to mass transit. Good schools and convenient public transportation increase the demand for land by attracting new residents who will be ready to pay a premium for housing in the neighborhood. As a result, the market prices of land and housing increase, and the value of schools and public transportation is said to be capitalized into the land and property values.

Thus, via the capitalization mechanism, any improvement in quality of life in a locality should lead to higher land and property values. The capitalization mechanism can work in the opposite direction also, decreasing property values. For example, excessively high property taxes may trigger a decrease in the demand for housing in town, decreasing the value of land and property. A lower market value of the land after the tax implies that the expected undesirable increase in future tax liabilities are capitalized in the price of the land. Besides property taxes, the quality of the environment may also be capitalized into the land and property values. Better environmental quality leads to higher property values in the neighborhood compared to a neighborhood with poor environmental quality, all else the same.

The close relationship between the value of land and the environment may lead to an increase in social inequality and **gentrification** of cities. Via the capitalization mechanism, a superior quality of the surrounding environment is absorbed, or capitalized, into the higher land values in the area, leading to higher housing prices in districts with better environmental quality that cannot be afforded by poorer households. Gentrification occurs when wealthier population groups reside in districts with better environmental quality, while the poor tend to live in districts characterized by environmental degradation and lower property values.

There is plentiful empirical evidence of the spatial relationship between environmental quality, land values, housing prices, and wealth. Data on housing and land values consistently indicate that poor environmental quality is typically associated with economically disadvantaged neighborhoods, leading to "environmental inequity" whereby environmental degradation and social inequality tend to exacerbate each other.

BOX 4: ENVIRONMENTAL INJUSTICE IN ACTION: BIRMINGHAM, ENGLAND

Using geographical information system (GIS) methods, Julii Brainard and coauthors have examined the relationship between air quality and indicators of poverty in the city of Birmingham in England. They combined information on the average income levels across city districts with data on carbon monoxide and nitrogen dioxide emissions and traffic density. The mapping results showed a strikingly strong positive correlation between the level of harmful emissions, lower land and housing prices, and the extent of poverty, with a clearly observed higher "concentration of more deprived populations and ethnic groups in areas with poor environmental quality."[5]

[5] Brainard et. al., 2002.

On the basis of their empirical analysis, the authors suggest that local policy makers should take the spatial evidence of "environmental inequity" seriously and undertake broader regional measures of "economic restructuring across cities", including stricter emission standards for air pollutants, overall restructuring of the spatial patterns of economic activities, and the development of transportation corridors with surrounding greenbelts. Such economic restructuring would smooth systematic differences in the quality of the environment across poor and wealthy neighborhoods.

3.4 Sources of Economic Inefficiency in Land Markets

Environmental inequality represents a serious concern for society, but unfortunately it is often ignored in the economic analysis of land. The absence of efficiency of land use allocation by markets, on the other hand, represents a focus of the mainstream research in economics.

The allocation of land is said to be economically efficient if it maximizes total social welfare by putting a parcel of land to the highest-valued use, relative to the value of potential competing uses.[6] The competing uses include urban, rural, and suburban types of land use. Urban land use is characterized by high population density, occupied by housing and commercial buildings along with the network of roads and parking areas. Rural land uses include agriculture and forestry, as well as state public parks and conservation areas. Suburban land use has some features of urban areas, such as a relatively high population density, along with significant amounts of public parks and green spaces, usually situated between the large metropolitan areas and countryside.

Due to high intensity of land use, urban areas are marked by higher per acre land prices compared to the suburbs and farmland. However, the true social value of land may not be clear in the presence of **market failure**—the failure of land markets to put a land parcel to its highest-valued use.

If the net social value of land use is not maximized, either due to market failure or because markets do not exist at all, then the allocation of land is not optimal and the market price of land is either misleadingly high (for example, due to the presence of speculative demand) or unjustifiably low (for example, if a plot of land with fertile soil is located in a poor developing country). If this is the case, the market value of land (i.e., price per acre of land) may not accurately reflect its true value:

> The actual values that are used to allocate land may be far from optimal; that is, the presence of market, policy and institutional failures can distort economic and political incentives that can lead to bias in favor of one type of land use over the other.[7]

[6] Tietenberg and Lewis, 2009, p. 203; Barbier, 2010.
[7] Barbier, et al., 2010.

Failure of land markets to achieve efficiency of land use allocation can be caused by various factors, such as negative or positive externalities, caused by the incompatible uses of land, spatial monopoly power, excessive government intervention, and insufficient land market activity due to thin or absent markets. In the following section, we will examine which types of land use—urban or rural—lead to a more significant departure of efficiency in land markets in the context of environmental externalities.

4. LAND USE AND THE ENVIRONMENT

Environmental degradation represents one of the most serious failures of land markets to achieve efficiency. While all types of land use may entail negative environmental impacts, there is a fundamental difference in the interaction with the environment occurring in urban and rural areas.

4.1 Environmental Degradation in Modern Cities

Since the majority of people in the world now resides in urban areas—the urban share of population reached 55 percent in 2018 and is expected to be 68 percent by 2050—the global scale of the environmental damage produced by urban land use is enormous[8]. The larger cities, with huge concentrated populations, high population growth rates, and dense transportation networks, put significant pressure on the natural ecosystem, triggering serious negative environmental changes. Large urban areas are associated with higher levels of air and soil pollution, noise, and coverage by impermeable surfaces. The presence of impermeable surfaces makes urban areas more prone to flooding due to insufficient natural infiltration of the rainwater and resulting rapid increase in river water levels. The smog that sometimes blankets large cities, such as Beijing, London, and Los Angeles, makes them unhealthy, while the environmental externalities of seaports and airports extend beyond the urban areas where they are located.

The spatial concentration of economic activities involves significant benefits, called agglomeration benefits, but the excessive concentration of people and economic activities creates negative externalities (pollution, noise) and congestion (traffic jams and overcrowded public parks). The tradeoff between costs and benefits of agglomeration raises a question about the existence of an efficient scale of population concentration or the optimal size of a city: “At what point do the costs in an urban area of additional development outweigh the added benefits? In other words, at what level of urban size are the marginal costs equal to the marginal benefits?” Economists John McDonald and Daniel McMillen pose this question and conclude that:

> …the research has not yet reached any clear conclusions. It is fair to say that we do not know the optimal size for urban areas, and it is also not likely that a general answer exists. A more meaningful way to ask the question is whether there is an

[8] The United Nations Population Division, 2018.

> optimal size for an individual urban area that performs a particular set of economic functions.[9]

In fact, it is a worldwide fact that most cities do not stop growing. Some experts, for example, predict that the urban areas in the Eastern U.S. running from Boston down to Washington, D.C. will merge by the mid-century. There is even a name prepared for this future urbanized area: BosWash[10].

4.2 The Environmental Impact of Urban Sprawl

Urban sprawl represents a development pattern that "spreads out from established urban areas, converting woodlands, wetlands, agricultural lands, and natural habitats to urbanized uses"[11]. The market failures caused by sprawled development are caused by the leapfrogging process, when lands are skipped between existing urban areas and new suburban housing and commercial districts.

The two driving forces behind the leapfrogging process are:

1. lower price of land at the outskirts of an existing urban area: sprawled development occurs because it is cheaper to build on a pristine parcel of land rather than trying to squeeze a new building into the narrow spaces of the existing city;
2. **open space amenities**: households are increasingly willing to reside in the green areas marked by appealing views and better air quality, farther from the disamenities of urban life.

Although attractive for newly arriving households and businesses, leapfrogging can be detrimental for the environment because ever larger areas are being consumed by encroaching houses, roads and strip malls, accompanied by the deterioration of air and water quality and an increase in soil pollution. The adverse environmental effects represent a significant market failure. As noted by the eminent economist William Fischel, "the open land left behind by suburban sprawl is typically not useful as an environmental amenity or as an ecological resource", with animal and plant species unable to survive in the fragmented green areas such as town parks and small conservation areas scattered between housing units and roads.[12]

Further exacerbating environmental pollution, the need to commute to an urban employment center from the surrounding suburbs increases traffic, consuming more woodland for road construction, leading to more paved surfaces and more automobile-miles driven. Some experts support the sprawling pattern of development, arguing that high-density areas represent a great opportunity for mass transit options and citing the positive European experience. Unfortunately,

[9] McDonald and McMillen, 2011.
[10] The name was suggested at a presentation at a 2005 conference conducted by the Lincoln Institute for Land Policy in Hartford, Connecticut.
[11] Burchell and Shad, 1998.
[12] Fischel, 1995, p.80.

well-developed European networks of railways and bus routes were often carefully planned and put in place before the subsequent housing development took place. In the sprawled environment in the U.S., however, it is prohibitively expensive to create the infrastructure for public transit after the area has been already built up. Thus, instead of being public transit system friendly, urban sprawl in the U.S. results in greater use of automobiles. A 1997 empirical study estimated that in the United States "automobile use is growing twice as fast as the population", whereas "prime agricultural land, forests, and fragile lands encompassing natural habitats are decreasing at comparable reciprocal rates."[13] Most economists consider the sprawled pattern of suburban development economically inefficient, with excessively high suburban population densities and artificially high land prices.

Along with large cities, sprawled suburban areas pose elevated risks for the environment. A natural question to ask is: what type of land use would be environmentally friendly and socially healthy? Unfortunately, there is not always a good alternative: rural land uses are not as benign as some people might think. In the following section, we will briefly examine three major adverse impacts of rural land uses on the environment and human health.

4.3 The Environmental Impact of Rural Land Uses

The adverse impacts of rural land uses include clearing wooded areas for farmland, leading to an increase in soil erosion and reduced absorption of carbon dioxide by the trees; excessive application of pesticides and herbicides in agriculture resulting in groundwater contamination and serious health risks; and soil degradation due to exhaustion of the fertile soil layer due to unsustainable agricultural practices.

4.3.1 The Impact of Deforestation on Climate Change

One of the major drivers of the large-scale deforestation of tropical forests is conversion of forested areas to agricultural fields[14], with about "80% deforestation worldwide occurring to make way for farmlands"[15]. The massive clearing of forested areas for farming activities is especially profound in tropical zones of South America, Africa, and Indonesia, where the slash-and-burn approach is used to clear shrubbery and trees for agriculture. Cleared this way, land is planted with cash crops such as bananas or palm trees.

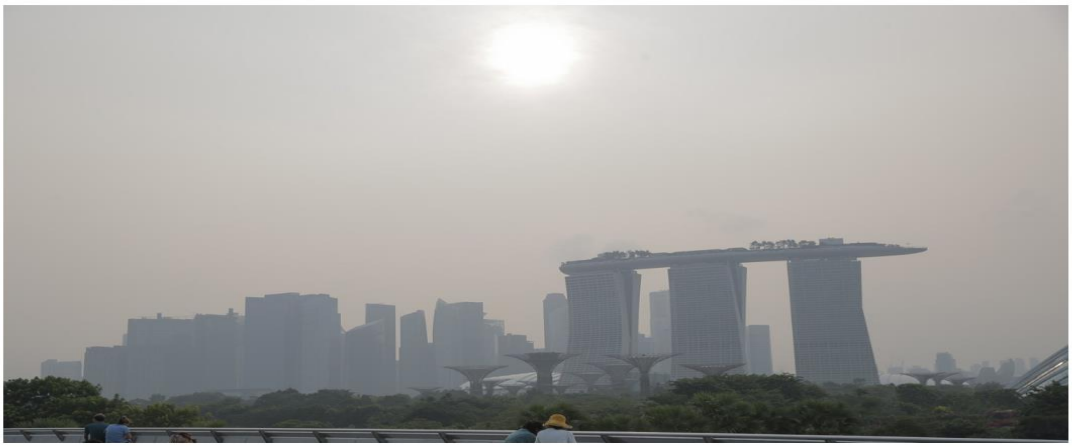
Environmental damage from deforestation is significant. Trees are known to absorb carbon dioxide from the atmosphere, a process known as carbon sequestration, so cutting down forests is one of the major contributors to ongoing climate change. According to the World Future Council, deforestation is responsible for 18 percent of greenhouse gases emissions, with global forested land area reduced by almost a third from its preindustrial levels.

[13] Landis, 1997, cited in Burchell and Shad, 1999, p. 15.
[14] See, for example, Foley, et al., 2005; DeFries and Pandey, 2010.
[15] Vicky Wright, "Deforestation in the United States." https://greenliving.lovetoknow.com/United_States_Deforestation.

The smoke from burning tropical forests has reached a substantial level during the last decade and often crosses national borders. Over the past several years, for example, the haze from burning the jungle for palm pulp and oil plantations in Indonesia has been drifting to neighboring Singapore, "raising concerns about public health and worrying tourist operations and airlines", and exacerbating the dispute over cross-border forest fires and emissions of soot and carbon dioxide that cloud "the skies over much of the region" [16].

The photo in Figure 6 shows the haze coming across the South China Sea to the financial district in Singapore from the burning forests in the neighboring Indonesia.

Figure 6. *Haze over Singapore's financial district caused by burning forests in Indonesia*



The financial district and the Marina Bay Sands hotel are seen shrouded by haze in Singapore. Photo: EPA-EFE

Source: South China Morning Post, 14 September 2019. https://www.scmp.com/news/asia/southeast-asia/article/3027263/singapore-haze-reaches-worst-level-three-years-indonesian

Recent covid-19 pandemic further raised awareness of ecological and public health benefits of rainforests. For example, in the June 2020 issue of the Scientific American, the Editors conclude that "destroying [rainforest] habitats makes viruses and other pathogens more likely to infect humans… the more we clear the more we come into contact with wildlife that carries microbes well suited to kill us—and the more we concentrate those animals in smaller areas where they can swap infectious microbes, raising the chances of novel strains."

Deforestation is not limited to the tropics. It represents a serious issue in the economically advanced countries, too. In the United States, for example, the area occupied by forests was abundant at the time of the first English settlers, but by 2015 the area occupied by the virgin forests had shrunk by 75 percent, from about 46 percent in the mid-17th century to only 34 percent of total land.[17] The main causes of deforestation in the advanced economies are urban

[16] "Singapore haze reaches worst levels in three years as Indonesian forest fires rage," South China Morning Post, 14 September 2019, https://www.scmp.com/news/asia/southeast-asia/article/3027263/singapore-haze-reaches-worst-level-three-years-indonesian

[17] Vicky Wright, "Deforestation in the United States." https://greenliving.lovetoknow.com/United_States_Deforestation.

sprawl and encroaching farmland, as well as invasive insects and plants. This pattern has become increasingly ubiquitous with the globalization of economic activities and tourist flows. In the face of accelerating deforestation governments in the advanced economies have taken measures to protect pristine lands and conserve forests. The conservation of land is further discussed in the section on *Land Use Regulation and Policy.*

4.3.2 Effect of Agricultural Land Use on Climate

While the negative environmental effect of conversion of tropical forests to agriculture is widely publicized, much less evident is the irreversible damage to the environment and climate caused by agriculture itself. According to the World Future Council, agricultural activities occupy about a third of the planet's land surface and are responsible for 14 percent of total greenhouse gases emitted into the atmosphere. For about a century and half, according to soil scientists at Ohio State University, "476 gigatonnes of carbon has been emitted from farmland soils due to inappropriate farming and grazing practices, compared with 'only' 270 gigatonnes emitted from burning of fossil fuels."[18]

One approach to climate-smart agriculture that is gaining momentum is **carbon farming**—the techniques of putting carbon released by unsustainable agricultural practices back into the ecosystem, potentially sequestering it in soil. For example, a significant amount of carbon is released from soil during plowing. The new no-till approach to agriculture replaces tillage by diverse crop rotation that increases nutrient accumulation in soils and minimizes the need for fertilizer[19]. Carbon retention by soil can be increased by adopting agroforestry, whereby trees and crops are planted together in order to lessen soil erosion and increase carbon retention,[20] reforestation and grassland restoration. The combination of these techniques is called "regenerative agriculture", which has a goal of fixing and improving farming techniques to reduce greenhouse gases.

4.3.3 Environmental and Health Risks from Toxic Chemicals Used in Agriculture

Unsustainable farming practices include overuse of pesticides and herbicides, which has increased substantially over the last two decades, especially in large-scale farming and even in domestic gardening. While the application of toxic chemicals helps farmers to increase yields and make crop management in large-scale farming easier by killing invasive weeds, insects and pests, it is overshadowed by the concomitant increase in negative environmental and health effects. For example, the notorious toxic herbicide Agent Orange, used by U.S. troops in Vietnam during the Vietnam War, had devastating effects on the ecosystem and human health.[21] Similarly, growth in agricultural productivity due to the application of the herbicides Roundup and Ranger Pro has been accompanied by significant adverse effects which spread over the entire ecosystem, from groundwater to soil and bees. For instance, research shows that exposure to

[18] The calculations of Professor Rattan Lal, Ohio State University at World Future Council, https://www.worldfuturecouncil.org/.
[19] Tallman, 2012.
[20] Velasquez-Manoff, 2018.
[21] Nhu, Dang, et al. 2009.

glyphosate changes the composition of microbes residing in the honeybee gut, making the bees more susceptible to colony collapse.[22]

There is convincing statistical evidence of birth defects caused by prenatal exposure to the toxic chemical glyphosate used in manufacturing herbicides in Argentina.[23] U.S. cases of childhood cancer due to herbicide exposure have been documented in California.[24] A recent public victory over the corporate interest vested in herbicide manufacturing is described in Box 5.

BOX 5: THE MONSANTO TRIAL: THE FINAL BLOW OR A MOSQUITO BITE?[25]

Despite the burgeoning literature on harmful effects of glyphosate on health and the environment and the fact that it was linked to cancer by the World Health Organization and the International Agency for Research on Cancer, the powerful herbicide manufacturers, including the transnational Monsanto Corporation, continued to play down its hazardous effects, deceiving farmers, households, and regulators with "bad science", so that glyphosate use grew by 637 percent between 2005 and 2014.[26]

The situation began to change in 2018, when "expert testimony" introduced at the Monsanto trial in a California court "established a significant causal link between Roundup and non-Hodgkin's lymphoma" and ordered Monsanto to pay $289 million in punitive damages to the school district groundskeeper who contracted the deadly type of cancer due to his career-long exposure to glyphosate. For the first time in history, it has been shown in courts that Monsanto's Roundup and Ranger Pro products were "a substantial factor" in causing incurable injury to the plaintiff.

Unfortunately, Roundup was not banned and glyphosate content continues to exceed the maximum residue limits in Cheerios, beer, wine, oats and many other processed foods, representing potential harm to children and adults.[27] Moreover, the role of glyphosate has expanded from being a weed-killer to becoming a widespread helper in harvesting crops such as wheat, barley and oats, by killing the crop that is getting ripe and allowing farmers to dispense with the need to cut it using traditional crop mowers. This unsustainable and toxic practice is popular with farmers in the United States, where the average farm size is 443 acres and such a large farm size makes it especially difficult and time-consuming to use traditional mowers to harvest crops.[28]

[22] Motta, et al., 2018.
[23] Pressly, 2014. .
[24] Reynolds, Peggy, et al.,2002.
[25] Based on https://audetlaw.com/roundup-lawsuit-verdict/?gclid=CjwKCAjw-ITqBRB7EiwAZ1c5UyUKPcoNenk7UuIccS99VZrt-CEhoRP2KKMfs41Isihl0p0tURdHxxoCq8UQAvD_BwE
[26] Benbrook, 2016; Hart, 2018.
[27] The maximum residue limits have been established through experiments on rats and dogs fed by herbicides and set the maximum residue limits for humans which reflect the largest concentration of herbicides on food crops that is safe for human consumption.
[28] Data for 2018, USDA(2019).

The unacceptable degree of exposure to deadly chemicals used in agriculture and domestic gardening is not just a failure of the commercial manufacturers of the harmful products, it is a widespread social and market failure. On the positive side, with the rise of public awareness about health risks from pesticides and herbicides, more households choose organically-grown products and more farmers, "especially those with large farms, appear willing to adopt practices that contribute to clean water, biodiversity benefits, climate stabilization, and long-term soil fertility."[29]

4.3.4 Soil Degradation and Food Security

Soil quality represents a major land attribute determining the productivity of farmland and the quality of vegetation grown on it. In addition to natural forces such as wind and precipitation, the adverse chemical changes caused by human-induced soil erosion destroy the structure and functionality of soil by detaching its particles. Unsustainable agricultural activities, such as excessive tillage, may lead to thinning of the fertile level of soil, especially on intensively cultivated farmland. The excessive use of synthetic fertilizers, toxic herbicides and pesticides, as well as deforestation and acid rain, lead to irreversible chemical changes in the composition of soil with negative effects that include a decline in the amount and diversity of nutrients and microelements in soil, soil acidification, and groundwater contamination. Higher acidity implies lower agricultural yields and lower nutritional value of crops, including a lower protein content of grain.[30]

Employing environmentally friendly technology may help to alleviate the problem of acidic and contaminated soil, but recovery is not guaranteed. Whether "ecosystem acidification is reversible"[31] will depend on the region-specific structure and chemical composition of the soil: if the environment is characterized by elevated acidity to begin with, as in the Northeastern U.S. states, it will require more time for soil to return to the original level of chemical balance, because the acid-absorbing capacity of the soil is already exceeded.

According to *The IPCC Report on Climate Change and Land*, soil degradation may lead, in the long run, to elevated food insecurity[32], as well as to malnutrition, social injustice, and water scarcity. The erosion of topsoil rich in nutrients is especially notable in the developing countries, where farmland obtained by burning the jungle is used only for a year or two, until the productivity of the soil declines. After the land becomes infertile, it is used for small-scale grazing or even completely abandoned. Such devastating farming techniques have been labeled *transient farming*, characterized by the long-term detrimental impact on soil.[33]

[29] Robertson et al., 2014.
[30] Kazmin, 2016.
[31] Likens, et al, 1996.
[32] Intergovernmental Panel on Climate Change, August 2019.
[33] Butler, Rhett. 2012. "Subsistence agriculture and deforestation," https://rainforests.mongabay.com/0804.htm

One of the most important factors making transient farming possible is the *lack of economic incentives* in maintaining good soil quality. Such incentives could only be provided if the people and corporations engaged in farming have long-term confidence in the security of their property rights. We turn to the topic of property rights and their role in the economic uses and distribution of land in the following section.

5. LAND INSTITUTIONS AND PROPERTY RIGHTS

5.1 The Role of Land Ownership and Property Rights

Formally, **property rights** are rules establishing how land and property can be used and traded, including the right to sell, the right to develop, the right to use land in certain ways, the right to exclude others from using it, and the right to inherit it. Private ownership of land, typical for market economies, is associated with the potential transfer of property rights through a legitimate market transaction. Such transactions reveal the market value of land, in principle based on the approach previously discussed in the section on land rent.

In countries with state ownership of land resources the market value of land remains undefined: after all, when economists discuss the value of land as an asset, they call it a market value, implying that land can be traded in an existing market. The extent of market transactions is far less significant in countries in transition from state ownership to a market economy, compared to that in advanced market economies. The relatively "thin" land market in the transitional economies results in the inconsistency of land prices, which can contribute to the possibility of corruption and land grabbing (described in the following section).

In the developing economies markets for land, even if present in some form, may be extremely insecure due to the lack of strictly defined property rights and **tenure to land**—the right to hold the land in perpetuity after an individual or a household works on it for a while. The absence of well-defined rules governing the ownership and tenure status removes the incentive to maintain land in good condition by temporary landlords and leads to the deterioration of soil quality and agricultural productivity. This is the case in many African countries, where land ownership is not guaranteed and subject to political instability.[34]

The first scholar who formalized the notion of property rights in economic theory was Nobel Prize winner Ronald Coase. In his 1960 article "The Problem of Social Cost", Coase suggested that if property rights are assigned in a way that maximizes total social net benefit, the need for a costly government intervention to improve economic efficiency is minimized. For example, if property rights to farmland were assigned to the farmers who work on land for a specific period of time, they would have had a stronger incentive to maintain the quality of their land in the indefinite future, rather than using it until the valuable soil nutrients are completely exhausted. If this were the case, the need to use public funds to restore the soil quality would be reduced or removed.

[34] Bell and Bowman, 2008.

Thus, clearly defined property rights to land are associated with an increase in the economic value of land, whereas insecure property rights will be reflected in a lower value of land because investing in such land is accompanied by the considerable risk of losing ownership. Property rights to land play a critical role in the economy, because they include mineral, timber, and water rights, and are associated with spatial market power due to the unique location of each parcel of land. Unclearly defined ownership and property rights to land are associated with the lack of incentives to put land in its highest value use, from a social perspective. This is particularly problematic for land that is not subject to private ownership. We next consider land that is held as a common property resource.

5.2 Land as a Common Property Resource

The lack of clearly defined property rights may produce economic and legal dilemmas. Even in the developed market economies, the property rights system may lack transparency. In the United States, "24% of the land area and $1.8 trillion of the [total land] value is held by the federal government"[35]. This implies that all the property rights to these public lands belong to the national government as opposed to private landowners. The government then has full discretion on the use of the public lands. For example, in the Western states local farmers are allowed to use vast tracks of publicly owned land for grazing their cattle. Unfortunately, the farmers, lacking the ownership right to these lands, lack the incentive to use the grazing land sustainably and efficiently. Overgrazing cattle on public lands is a common issue in the Western United States and is a manifestation of the "tragedy of the commons" dilemma. This dilemma represents the problem of the mismanagement of common property resources because of the gap between what would be considered sustainable and economically efficient management by the society at large and by the actual users of the land who do not own it.

A typical example is when many groundwater users own land located over a common groundwater aquifer: their property rights to the groundwater may not be well defined. Each user has an incentive to withdraw as much water as possible, while the supplies last. As a result, the withdrawal rates may exceed the recharge rates, leading to depletion of the groundwater aquifer, accompanied by land subsidence and other environmental degradation.

Another example of the problems with common property is land which provides access to shale gas. If a landowner leases the right to extract shale gas to a drilling company, the important question regarding legal property rights and the liability for ground water contamination from chemicals used in hydraulic fracturing is: "who should be held liable for potential groundwater contamination and the loss of valuable farmland to gas-drilling paths – the landowner or the leasing company?" The answer is not always readily apparent.

[35] Larson, 2015.

5.3 Indigenous Land Rights

A relatively large share of lands in public or tribal ownership is often associated with vague land transactions, corruption and unfair impingement on the property rights of the poor and indigenous people. The violation of indigenous people's property rights to their lands is contentious and now considered a global institutional failure because indigenous people occupy at least a quarter of the world, and, according to some estimates, hold and manage "50 to 65 percent of the world's land." [36]

Despite this presence, indigenous communities generate a minimal impact on the environment[37] because "indigenous people tend to live a more natural oriented life, valuing nature to its full extent and tend to not corrupt the area they inhabit."[38] However, because indigenous tribes are typically spatially dispersed and politically unorganized, governments recognize "only 10 percent of the world's land as legally belonging to these groups, with another 8 percent designated by governments for the communities."[39] Ignorance towards the property rights of indigenous people makes encroaching into the indigenous lands a common practice by "governments, corporations, loggers, *campesino* farmers, cattle-ranching companies and many others [who] still covet their land and resources, and continue to find ways to acquire them."[40]

The lack of formal recognition of their rights to land not only generates economic and environmental losses but also leads to the relocation of indigenous people, often making them homeless. A report by the United Nation suggests that:

> As the world runs out of resources, due to increased cultivation and harvesting of natural resources, many big corporations have started to target the areas inhabited by indigenous people. Using high-paid lawyers to make transactions of land possible, these corporations may unethically acquire land even if the indigenous people do not agree to selling off their land.

Due to the sheer scale of the violation of the property rights of indigenous people, the issue has come under scrutiny by academic economists[41] and governments[42]. It has been estimated that "the modest investments needed to secure the [indigenous people's] rights will generate billions of dollars in returns – economically, socially and environmentally—for governments, investors and communities,"[43] resulting in a productive collaboration between indigenous people and

[36] Veit and Ding, 2016.
[37] Garnett, et al.,2018.
[38] The United Nations Report, 26 April, 2017, "Indigenous People and Nature: A Tradition of Conservation." https://www.unenvironment.org/news-and-stories/story/indigenous-people-and-nature-tradition-conservation
[39] Veit and Ding, 2016.
[40] Mowforth, 2014.
[41] See the reports by the MIT's Susskind and Anguelovski, 2008, and the report by the Harvard Law School, 2007.
[42] See the 2014 report by the EPA advocating the environmental justice for indigenous tribes in the USA and the "Indigenous Advancement Strategy" by the government of Australia.
[43] Rocha, 2016.

governments that "would yield significant benefits for conservation of ecologically valuable landscapes, ecosystems and genes for future generations."[44]

Recent cost-benefit analyses conducted in several countries in South America found that overall ecosystem net benefits on lands owned by indigenous people exceed those on lands where the indigenous rights to land are limited or not respected.[45] In the same spirit, research by the World Resources Institute concludes that: "when indigenous peoples and communities have secure rights to land, deforestation rates and carbon emissions are often significantly reduced."[46]

International organizations such as the United Nations, as well as governments in Australia and the European Union, have taken significant steps towards prioritizing policies to improve the rights of indigenous people and raise international awareness: "disputes over indigenous rights to land and resource development can jump from the local to the world stage because the questions at the heart of such disputes are fundamental - social, environmental, and human rights issues that cut across national economic interests."[47] Founded in 2019 as a global human rights organization, the International Work Group for Indigenous Affairs (IWGIA), promotes the goals stated in the United Nations Declaration of Rights of Indigenous People. The IWGIA comprehensive report summarizes the situation with indigenous people in more than 70 countries worldwide and is concerned with the rapid increase in discrimination and even criminal acts against indigenous tribes[48].

The closely related global issue of the lack of clearly defined property rights and strong public institutions governing land resources is so-called land grabbing, described in the following section.

5.4 Global Land Grabbing

One of the important issues related to the security of property rights to land concerns **global land grabbing** – a contentious issue of large-scale land acquisitions by governments, multinational corporations, and wealthy individuals, with the purpose of using it for monocultural agriculture, unsustainable conversion of forests and farmland to short-term profit uses, and financial speculations. An increase in global land transactions has been especially prominent in agricultural lands:

> In the last few years alone, numerous investment banks, private equity firms, family trusts, investment advisory firms, sovereign wealth funds, and even governments (China, India, Qatar, Egypt) have been buying heretofore out of mind farmland in developing countries at astronomical rates as part of what is now referred to as "land grabbing." With land selling at $25,000 an acre in Iowa and $500 per acre in

[44] Garnett, et al., 2018.
[45] Veit and Ding, 2016.
[46] Rocha, 2016.
[47] Behrendt and Strelein, 2001.
[48] https://www.iwgia.org/en/resources/indigenous-world

> Guinea, the potential for an upside will attract price gap arbitrage and speculators. In other words, in the advent of globalization, the potential value of land in Guinea is much higher and more of the world will probably be fed with food from Guinea.[49]

The lack of clearly defined property rights, being a major cause of global land grabbing, is due to "a general lack of regulation on the land markets"[50] in developing and transitional countries that allows infringement on the rights of indigenous people and local communities, often supported by national governments. In countries where land grabbing is not considered to be objectionable by national laws, it is often based on coercion, intimidation and corruption and leads to concentration of control over land resources in the hands of a few entities, transferring the rights to economically valuable land to wealthy nations and transnational corporations. Wealthy individuals and powerful corporations have the advantage in "grabbing" the best lands, which leads to "a systematic transformation in the pattern of land ownership"[51] with "huge inequalities in land ownership" contributing to environmental degradation, increased social inequality and enervated economic growth.[52] Even when land grabbing is legal, it may not be legitimate: "it may not go against national legislation but it certainly violates human rights… grabbing is another example of the commodification of nature, motivated by a growing world population and limited resources."[53]

Land grabbing is not limited to the developing and transition economies. Transnational corporations based in the advanced economies also play a significant role in the increase in the worldwide scale of land grabbing. Box 6 highlights the contentious issue of recent investments by major U.S. universities in global farmland purchases.

BOX 6. THE WORLD'S MAJOR FARMLAND INVESTMENTS INVOLVE ENVIRONMENTAL DESTRUCTION AND IMPINGEMENT ON HUMAN RIGHTS

According to Bojin, et al (2016), a controversial example of a global "land grab" is a purchase of a large tract of forestland in Romania in 2004, involving Harvard University's investment fund and the world's largest furniture maker IKEA. The purchase has been challenged by the Romanian courts. According to reports, Harvard University "through its investment arm" has paid more than $100 million for 33,600 hectares (83,000 acres) of forested lands in Romania, "despite longstanding rumors of corruption":

> Forest restitutions grew out of Romania's turbulent history in the last century, when the Communist regime nationalized private property nationwide and many people

[49] Barlowe 2014, p. 332.
[50] Baker-Smith and Miklos-Attila, 2016, p.8.
[51] Green and Hanna, 2018.
[52] Stiglitz, 2005.
[53] Baker-Smith and Miklos-Attila, 2016, p.6.

> lost land that had been in their family for decades. After 1989, new laws in the post-Communist Romania allowed former owners and their relatives to seek restitution for their lost properties. Unfortunately, these same laws created opportunities for fraud. Crooked businessmen and dirty politicians seized the moment, forging documents and claiming forests that had never belonged to them or to their ancestors. In many cases, fake relatives armed with piles of forged paperwork claimed some of the last standing old-growth forests in Europe and quickly sold them to foreign companies who poured tens of millions of dollars into such deals hoping for great returns.[54]

Moreover, around the time that the deal was exposed in the news, Harvard sold the land "for two-thirds of what they had paid in cash" to the Swedish furniture manufacturer IKEA.[55] Interestingly, Harvard University is also one of the biggest foreign owners of farmland in Brazil, although its "involvement is not obvious because the Ivy League university's ownership is concealed behind a company managed by its local associates."[56] This example of massive purchases of farmland is not a problem in and of itself, but it highlights the poor management of the acquired lands and violation of local people's rights that constitute a very controversial issue:

> [Brazilian local] community was cut off from the lands they had depended upon for generations to feed their families and started suffering from new health problems caused by pesticides that have been aerially sprayed onto the farms and blown into homes. The pesticides also destroy their crops and pollute local water sources which now means that rivers and springs once abundant with fish, are now drying up because of deforestation and irrigation on the plantations… Harvard's Brazilian farmland holdings are just one piece of a much larger puzzle that is hidden behind an opaque web of companies buying up farmland on behalf of the University around the world. Our investigations revealed that, over the past decade, Harvard used multiple company structures to acquire vast farmland in Brazil, South Africa, Russia, the Ukraine, New Zealand, Australia and the United States. Shielded from public scrutiny, the University's endowment fund quietly accumulated into one of the largest farmland portfolios of any financial company in the world in less than a decade.[57]

Harvard University is by no means the only corporation involved in controversial land deals around the world. The table lists the 8 top U.S. universities' endowment funds investing in global farmland purchases.

[54] Bojin, D., Radu, P., Strandberg, H. 03/03/2016 "How Ikea and Harvard Got Tangled in a Corrupt Romanian Land Deal." The Huffington Post. http://www.huffingtonpost.com/entry/harvard-ikea-corruption-romania_us_56d86cbbe4b0000de4039509.
[55] GRAIN and Network for Social Justice and Human Rights, https://www.farmlandgrab.org/post/print/28387 09/03/2018; Bojin, D., Radu, P., Strandberg, H. 03/03/2016 "How Ikea and Harvard Got Tangled in a Corrupt Romanian Land Deal." The Huffington Post. http://www.huffingtonpost.com/entry/harvard-ikea-corruption-romania_us_56d86cbbe4b0000de4039509.
[56] https://www.farmlandgrab.org/post/print/28387
[57] https://www.farmlandgrab.org/post/print/28387

Endowment	Assets under management ($bn)	Current allocation to natural resources ($mn)	Farmland locations
University of Texas Investment Management Company	40.3	4,978	Australia, Latin America
Harvard Management Company	36	4,644	Africa, Oceania, Latin America, US
Princeton University Investment Company	21.7	3,625	Unknown
Stanford Management Company	29.1	2,301	Unknown
Yale University Endowment	25.4	2,007	Unknown
University of Michigan Endowment	9.7	700	Unknown
Emory University Endowment	4.6	642	Unknown
University of Pennsylvania Endowment	10.7	642	Unknown

Source: Perqin, August 2017, *http://docs.preqin.com/reports/Preqin-Special-Report-Natural-Resources-Top-100-August-2017.pdf;* accessed at https://www.farmlandgrab.org/post/print/28387 on January 27, 2020

5.5 Land Takings via the Power of Eminent Domain

Another controversial issue concerning land ownership and the economics of property rights is the **taking of land** by governments using the power of **eminent domain**. Eminent domain refers to the Constitutional right of the government to take private property and convert it into public use.[58] According to the Fifth Amendment of the U.S. Constitution, the government must pay the market value of the seized property to compensate the owners, described in the law as just compensation, and so the important question for economists is to determine what constitutes the fair market value. It remains a controversial subject. For example, it is not clear whether it should include cultural values that indigenous people may associated with land. Because the value of land can be attributed, at least partially, to public projects implemented by the government using public funds, should the owner be compensated for the portion of the property's value that was not there when he bought the land? The famous 19th century philosopher Henry George suggested that landlords must pay a 100% land tax on all the increments in their land value that result from public action and not from the landowner's personal effort. George even argued that such a tax would be sufficient to finance all societal needs, so that all the other taxes, such as income or import taxes, could be eliminated. Hence, when a public action such as highway construction infringes upon private property (e.g., farmland), should it be considered a taking requiring just compensation or an improvement in public transportation that increases the value of the private property?

[58] The definition by the Legal Information Institute of the Cornell Law School, https://www.law.cornell.edu/wex/takings.

6. LAND USE REGULATION AND POLICIES

When land markets fail to achieve economic efficiency and social justice, the government may use an array of policies to improve the situation. Existing government regulations typically address the following broad issues:

1. Inefficiencies arising due to the negative externalities generated as a result of particular uses of land;
2. The failure of the land market to recognize the amenity value of open space and farmland, leading to rapid loss of forests and agricultural land at the urban fringe;
3. Suboptimal patterns of regional economic growth such as insufficient density or, to the contrary, excessive density of land development;
4. Unsustainable agricultural land practices that represent health hazards and cause environmental degradation.

In this section, we will examine the principal economic and policy tools that can be used by local and national governments to mitigate some of these land-use problems, with the focus on the advantages and limitations of such policies. The policy tools examined in this section include land-use zoning, farmland preservation through conservation easements and differential land taxation, growth controls, and government subsidies.

6.1 Mitigating Spatially Adjacent Negative Externalities: Land Use Zoning

Some unsustainable land use practices may affect the quality of the environment and, in turn, the quality of human life and health. Some detrimental side effects of certain land uses have been long recognized and the attempts to mitigate them began with enacting **zoning regulations** in the early 20th century.

Zoning represents a formal rule (also called a zoning ordinance) specifying the permitted or prohibited uses of land. The central idea of land-use zoning regulations is to separate the conflicting land uses such as landfills and residential areas.

One of the economic benefits of zoning is that it does not require monetary expenditures by the government, since it only involves creation of a legal rule that spatially separates the externality-generating land uses from residential and recreational areas. Since zoning involves no pecuniary (i.e., monetary) efforts, it can be considered cost-effective if thoughtfully applied. Because the objective of zoning policies is to mitigate or even eliminate pollution and other externalities, properly designed zoning regulation can be considered an efficiency-enhancing policy.

Unfortunately, zoning policies may involve some unintended side effects, which casts doubts on whether the social benefits of zoning always outweigh its costs. For instance, a typical drawback of land-use zoning is that it may not take into account the external effect of the policy itself on neighboring areas. For example, zoning that places an externality-generating land use at the

border of the community may create a negative environmental spillover effect in the adjacent community. This practice has become so commonplace that it has earned a formal name in economics, the interjurisdictional spillover effect of land-use zoning, whereby it "dumps and industrial parks … are located too frequently on community boundaries."[59] To prevent such interjurisdictional externalities, zoning rules must consider the full socioeconomic cost of their implementation. One way of achieving this goal could be delegating zoning to a higher level of government, such as from local or regional zoning authorities towards the state or even national level. Unfortunately, "the state and national governments are apt to overlook local problems" and shifting zoning authority to them may result in a loss of the informational advantages of local zoning.[60]

6.2 Density Zoning as a Tool for Growth Control

Suboptimal patterns of regional economic growth, such as suburban sprawl, are associated with insufficient density of land development. It leads to the widespread loss of ecosystem balance and biodiversity and impedes the development of public transit. On the other hand, excessive density of land development results in congestion and elevated exposure to health risks from concentrated pollution.

Zoning can be used to correct the suboptimal density by imposing legally binding restrictions on features such as the minimum lot size or the maximum height of buildings. The primary objective of the minimum lot size regulation is to achieve a lower population density to reduce traffic, avoid overcrowding of local schools, and mitigate health risks associated with urban life. For example, in a typical suburban area in the northeastern United States, 0.5- and 1-acre minimum lot size regulations are common. A maximum height limit can be imposed to achieve more seismic safety or, as in the case of the minimum lot size policy, to lower population density. For example, although San Francisco has some very tall buildings, in some districts zoning laws limit the maximum permissible building heights to 40 feet, which corresponds to the height of a 6-story building.

While the positive impacts of density zoning are well documented, the excessive use of zoning regulations may result in socially undesirable effects. For example, the power to regulate the minimum lot size can be used by local authorities to discriminate against low-income households. The larger the requirement for the minimum lot size, the more likely that poor families will not be able to afford such a large parcel of land and will be automatically "zoned out" of the community. The large minimum size is typically associated with higher household income, on average. For example, the minimum lot size requirement is 5 acres in the town of Simsbury, Connecticut. The median annual household income in Simsbury is $109,823, whereas the U.S. median is $53,482[61].

[59] Fishel, 1995, p. 61.
[60] Ibid.
[61] Data are from www.bestplaces.net, accessed on 29 March 2020.

The maximum height limit policy also has been harshly criticized. It has been blamed for artificial housing shortages and consequently higher housing prices. A recent State Senate Bill proposes to "solve California's housing crisis by encouraging denser, taller housing near transit" in San Francisco[62]. It is very unlikely, however, for this Bill to be favored by the current San Francisco property-owners: existing zoning limits on heights favor the current residents because they increase housing and land values beyond what the market forces of demand and supply would normally generate.

The types of zoning that result in regional gentrification are known as *discriminatory zoning*. They favor the existing land and homeowners, preserving the wealthy status of the community and keeping the house prices high, along with maintaining a environment of low-density charm. Higher property values imply a larger property tax base, creating an additional reason for wealthy localities to over-restrict the minimum lot size in the continuing chase after fiscally beneficial tax bases.

6.3 Open Space Preservation

Some of the social benefits of farmland are marketable in that they have a market price and can be traded in markets, such as agricultural products. On the other hand, the numerous aesthetic and ecological benefits of farmland, called open space amenities, are not marketable in a conventional sense. Rustic views of farmland, open space and pedestrian paths in public parks all help to increase well-being but do not have a price tag attached. Therefore, open space amenities can be endangered in the face of rapid regional economic development: the urban uses of land, highly valued by the real estate markets, will lead to the conversion of forests and farmland to urban uses. The amenities, highly valued by society at large, but "invisible" to the market, may be irreversibly lost: the opportunity cost of rural land conversion is represented not only by the market value of the foregone farm produce but also by the non-marketed value of the lost amenities and ecological functions.

The problem is that amenities are not explicitly included in the opportunity cost of open space conversion because they are not directly traded in markets. As a result, the cost of development seems to be lower than it really is, resulting in an excessive, economically inefficient rate of conversion of open space and farmland into urban uses. The rapid loss of open space and farmland is especially significant at the urban fringe, where the development pressures are high and landowners have a strong incentive to convert their land to the urban uses that generate a higher return per acre of land.

Technically, the amenity values represent a positive externality because the aesthetic benefits of open space and farmland are not reflected in the market value of these lands. Because markets do not recognize the value of externalities, the amount of open space provided by markets will be insufficient from a social perspective.

[62] San Francisco Examiner, "Senate Bill 827 could raise height limits throughout SF, transform city" by Joe Fitzgerald Rodriguez, February 18, 2018. https://www.sfexaminer.com/news/senate-bill-827-could-raise-height-limits-throughout-sf-transform-city/

In the United States, for example, efficiency-enhancing open space and farmland preservation is increasingly implemented by local, state, and national governments, as well as by private and public land trusts. A thorough cost-benefit analysis of each proposed policy determines whether the benefits outweigh the costs of preservation, including the administrative costs of monitoring and implementing the conservation program.

The drawback of preservation efforts subsidized by public funds is that it may fail to consider existing policies, often resulting in counterproductive efforts and a waste of taxpayers' money. For example, agricultural economist JunJie Wu estimates that, "for every 100 acres of cropland conserved under the Conservation Reserve Program, 20 acres of non-crop lands are being converted to crops.[63] Therefore, despite the obvious successes, the effectiveness of the implementation of open space and farmland preservation remains questionable.

Next, we briefly discuss two major policy tools employed in open space and farmland preservation: conservation easements and differential taxation.

6.3.1 Conservation Easements

The owners of land enrolled in conservation programs give up the cultivation or development rights in exchange for monetary compensation sponsored by public funds.[64] The restricted use of the enrolled farmland is supposed to maintain its agricultural and environmental benefits that could be lost otherwise.

Conservation easement transfer represents an increasingly popular approach to farmland preservation. A **conservation easement** represents a cultivation or development right that can be voluntarily transferred from the farmland owner to either a government agency or nongovernmental organization such as land trust, that becomes the holder of the easement, either temporarily or permanently.

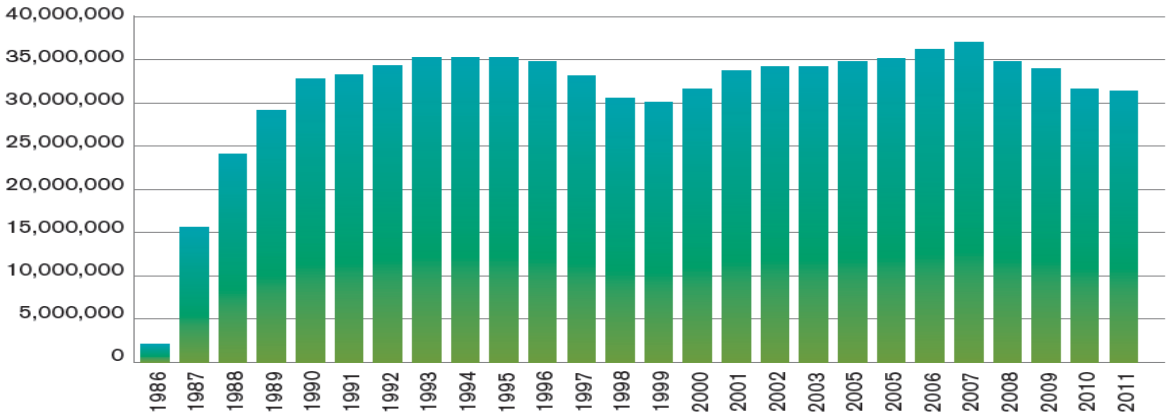
Enrolled agricultural land in conservation easement programs reduces the supply of farmland, and thus affect the price of agricultural land. Of particular interest to economists is the direction and magnitude of the changes in the price of the enrolled farmland and surrounding lands. On the one hand, the value of the enrolled land tends to decrease due to the fact that a certain bundle of rights has been detached from it. On the other hand, the value of the surrounding land typically increases due to the reduced supply of developable land and the protected amenity value of the enrolled farmland, which exhibits "positive spillover effects on neighboring property values."[65] Given that the restriction of the use rights on the enrolled farmland reduces its value, while boosting the value of the neighboring properties, the net effect on the aggregate value of land in the region depends on the relative magnitudes of these two adjustments. In the longer term, the

[63] Wu, 2012.
[64] Plantinga, 2007, p. 90.
[65] Plantinga, 2007, p. 96.

aggregate land value is expected to rise in the presence of the conservation easements, "as higher amenity levels attract new residents who bid up property values and increase the tax base."[66]

In the United States, the largest program utilizing the easement approach is the Conservation Reserve Program (CRP), with about 37 million cultivated farmland acres enrolled (Figure 7).[67] The benefits of the CRP from reduced soil erosion and enhanced recreational and aesthetic amenities are estimated to be $963 million annually.[68] The amount of land enrolled in the program has fluctuated between 30 and 37 million since 1990. The most recent data indicate that enrollment has been declining since 2007.

Figure 7. *Conservation Reserve Program: Cumulative Enrollment by Year (Acres).*



Source*: USDA, 2012.*

6.3.2 Differential Taxation

Another powerful tool for open space preservation is provided by the **differential taxation** of land, whereby a lower tax rate is imposed on farmland and private open space and a higher tax rate is imposed on land in urban uses.

The differential taxation approach is especially useful at the urban fringe areas characterized by rapid farmland loss, providing an incentive for a landowner to keep land in agriculture or as a green space despite development pressures. If farmland is eventually converted to urban uses the landowner may be required to pay a penalty and the difference in taxes for all the years that the farmland has been taxed at a lower rate.

Although differential taxation provides a clear motive for maintaining farmland in its current rural use, is that it is difficult to predict how much land will be preserved: it will depend on the difference between the expected financial gain from a lower tax rate and potential profit from converting farmland to urban uses.

[66] Plantinga, 2007, p.97; King and Anderson, 2004.
[67] Plantinga, 2007, p. 91.
[68] Wu, 2012.

6.4 Subsidies as a Tool for Correcting Market Failure

An important component of the broader range of policies that attempt to mitigate the externalities and public good features of land is government subsidies. For example, subsidies implemented in the US and EU include payments for agricultural services enhancing amenity benefits generated by farmland, such as attractive rural landscapes. Subsidies also finance services that reduce the negative impacts of agricultural production, such as soil erosion.[69] In the US, subsidies encourage more forestland conservation, which is increasingly administered by private land trusts.

While subsidies intend to correct for existing externalities, they need to be implemented with caution since they utilize public funds (i.e., taxes) to compensate farmers for their efforts to adopt more sustainable farming practices. For example, the significant subsidies provided to biofuel producers in the European Union have led to more farmland allocated to biofuels production. However, the policy is generally considered to be inefficient as biofuels have an extremely low net energy ratio: it requires more energy to grow biofuel crops than can be subsequently generated by burning them.

7. SUMMARY AND CONCLUSION: THE FUTURE OF LAND ECONOMICS

This module highlights the importance of land as the most fundamental resource and the need for a more complex approach to the analysis of land resources. However, after years of treating land as a secondary resource on a par with other types of capital, economists now recognize that a multidisciplinary approach to studying land resources can be successfully utilized in resolving market failures by guiding government regulation and finding "more appropriate balances between public and private ownership".[70] Traditional economics textbooks have ignored the important aspects of land as a scarce natural resource and its role as a driving force behind the global accumulation of wealth, but the impacts of land on social welfare and economic growth in modern economies is difficult to overestimate.[71]

Environmental, economic, social, and health issues faced by cities and rural areas are directly linked to the way we manage land resources. Even on the international arena, many political conflicts originate because of the inherent characteristics of land as a common property resource, along with the natural resources within it such as large transboundary rivers. The market failures and inefficient uses of land are attributed to the tendency of adjacent land areas to generate negative externalities and to spatial monopoly power associated with the unique location of each land parcel.

[69] Baylis et al., 2008.
[70] Barlowe, 2014, p. 332.
[71] Josh Ryan et al., 2017.

As shown by recent experiences throughout the world, solving the dilemmas related to the inefficient and unjust use of land resources represents a complex issue. To make it even more difficult and controversial, government policies themselves can cause land use externalities and violation of the basic human rights to land. As we have seen throughout this module, "policies may accomplish their goals rather efficiently and effectively, but if the goals are misdirected or fail to center on the problems to be solved, the policy effort will ultimately fail,"[72] especially when the policies enacted by the various levels of governments overlap in unexpected or irrational ways. The effective management of land resources calls for a broader economic and policy approach, one that would provide "due emphasis to ecological and ethical considerations"[73].

[72] Gary G. Bryner, 1998.
[73] Barlowe, et. al., 2014, p. 334 – 335.

DISCUSSION QUESTIONS

1. What are the principal economic forces behind the urbanization trends observed worldwide? Do the benefits of agglomeration of population and economic activities always outweigh the costs? Explain.

2. Provide an example of land regulation that is likely to generate deadweight loss. What is the primary source of inefficiency in implementing this policy?

3. Which land use is the most destructive for the environment: large cities, suburban sprawl, or large-scale agriculture based on monoculture? Provide your reasoning.

4. In which ways do conservation easements impact land markets?

WEBSITES

1. The World Future Council https://www.worldfuturecouncil.org/

2. The Intergovernmental Panel on Climate Change https://www.ipcc.ch/working-group/wg2/?idp=132

3. "Free, Prior and Informed Consent of Indigenous People." UN Human Rights Office of the High Commissioner. http://www.ohchr.org/Documents/Issues/IPeoples/FreePriorandInformedConsent.pdf

4 "The Great Land Grab: Rush for World's Farmland Threatens Food Security for the Poor." The Oakland Institute. http://www.oaklandinstitute.org/great-land-grab-rush-world's-farmland-threatens-food-security-poor

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KEY TERMS AND CONCEPTS

Capitalization – automatic adjustment of land and property values associated with the improvements in the local environment, public services and infrastructure

Carbon farming – the techniques of putting carbon released by unsustainable agricultural practices back into the ecosystem, potentially sequestering it in soil. Carbon retention by soil can be increased by adopting agroforestry and no-till approach to agriculture.

Conservation easement – a cultivation or development right that can be voluntarily transferred from the farmland owner to either a government agency or nongovernmental organization such as land trust, that becomes the holder of the easement, either temporarily or permanently.

Contingent valuation – the most common stated preference technique that directly asks the question about the willingness to pay of respondents for conserving. It is the only method that can be used to estimate indirect use values.

Differential taxation – approach to land and property taxation whereby a lower tax rate is imposed on farmland and private open space and a higher tax rate is imposed on land in urban uses. The differential taxation approach is especially useful at the urban fringe areas characterized by rapid farmland loss, providing an incentive for a landowner to keep land in agriculture or as a green space despite development pressures.

Gentrification – spatial segregation of poor and wealthy neighborhoods, leading to environmental inequity whereby environmental degradation and social inequality tend to exacerbate each other.

Global land grabbing – large-scale land acquisitions by governments, multinational corporations, and wealthy individuals, with the purpose of using it for monocultural agriculture, unsustainable conversion of forests and farmland to short-term profit uses, and financial speculations.

Hedonic price method – valuation technique typically used to estimate the value of environmental and natural resource amenities. For example, the method uses data on housing and land prices to estimate marginal willingness to pay for improvements in local air and water quality.

Human footprint index – a quantitative measure of overall human impact on the environment across the globe. Represents an index measured on a scale of 0 to 100 for each terrestrial biome, with a score of 1 indicating the least and a score of 100 reflecting the maximum human influence in a given biome.

Land rent – income per period that can be earned by using or renting a parcel of land. The definition has been introduced by the 19th-century political economists Thomas Malthus and David Ricardo.

Land takings power of eminent domain – the Constitutional right of the government to take private land and property and convert it into public use, with the compensation paid to the owners. The compensation should be estimated according to the market value of land.

Land tenure – the right to hold the land in perpetuity after an individual or a household works on it for a while. The absence of well-defined rules governing tenure status removes the incentive to maintain land in good condition by temporary landlords and leads to the deterioration of soil quality and agricultural productivity, which is typical situation in some developing countries in Africa.

Market failure – the failure of land markets to put a land parcel to its highest-valued use.

Market value – the present value of the stream of all the expected rental income flows generated by a land parcel. The market value is also called the annualized or asset value of land and equals to the sum of the present values of a parcel over the foreseeable future.

Nonmarket valuation – estimation of the value of goods and resources that are not commonly traded in markets. In particular, the method establishes the value of environmental and natural resources in monetary terms and can be subsequently used in cost-benefit analyses.

Open space amenities – additional land value generated by appealing views and better environmental quality in the green areas of suburbia as opposed to the pollution and congestion disamenities of urban life.

Present value – the current value of a future stream of income calculated using a specified rate of return called the discount rate. It indicates how valuable a future income is from the perspective of the present. The higher the discount rate, the lower the present value of the future income.

Private ownership of land – a legal type of land ownership by individuals, households, and non-governmental legal entities which is associated with the potential transfer of property rights through a legitimate market transaction. Such transactions reveal the market value of land making possible the market for land to exist. Besides private ownership of land, some lands are owned by the state entities (i.e., national lands) or groups of individuals or non-governmental entities.

Property rights – rules establishing how land and property can be used and traded, including the right to sell, the right to develop, the right to use land in certain ways, the right to exclude others from using it, and the right to inherit it.

Revealed preferences techniques – use market prices of related goods and services to infer values for natural resources.

Stated preferences techniques – valuation method that utilizes surveys to directly ask respondents about the values they place of different goods and resources, using hypothetical scenarios.

Travel cost method – valuation technique based on the premise that the time and travel cost expenses that people incur to visit a conservation area or recreational park represent the implicit "price" of access to the site and can be used as a proxy for the unavailable market price of parks and wetlands.

Urban sprawl – spatial development pattern caused by excessive converting farmland and natural habitats to urbanized uses, typically associated with such market failures as environmental pollution and traffic congestion.

Zoning – a formal rule (also called a zoning ordinance) specifying the permitted or prohibited uses of land. One of the economic benefits of zoning is that it does not require monetary expenditures by the government, since it only involves creation of a legal rule that spatially separates such conflicting land uses as landfills and residential areas.