

ISSUE 3: FOREST LOSS AND FRAGMENTATION

Forest loss and fragmentation are distinct but related occurrences. Forest loss is the conversion of forestland to some other land use, while fragmentation is the process by which large continuous tracts of forestland are broken into smaller, disconnected units. Forest loss was greatest in the early 1900s due to agricultural conversion, but continues today most often from development and surface mining. The loss of forest acreage during fragmentation may not be great, but the impacts can have major implications for forest ecosystems, forest health, and forest sustainability.⁶⁴

Fragmentation typically results from road construction, urban development, utility corridors, agriculture, and other human development or disturbance, as shown in Figure 17. As these non-forest patches expand over time, the forest is reduced to disconnected islands. The surrounding non-forest land uses threaten the function, health and value of the forest that remains.



FIGURE 17 – FOREST FRAGMENTATION OVER TIME
(Source: University of Connecticut Center for Land Use Education and Research)

Fragmentation can be further classified as temporary or permanent. Temporary loss can result from fire, natural disasters, or timber harvesting. Permanent fragmentation occurs when forestland is converted to a new and relatively permanent land use. It can also occur naturally through fire, ice storms, hurricanes, tornados, and landslides, or through human activities such as clearing for agriculture, surface mining, urban development, or the construction of highways, power lines, and pipelines. Natural fragmentation is usually less frequent, localized, and temporary, while human-caused fragmentation is usually permanent. This is not always the case. However, much of the eastern portion of Kentucky was either logged or cleared for agriculture, and has since been reclaimed by natural forest regeneration since the mid-twentieth century.

Parcelization, the dividing of forest property ownership, is a cause of fragmentation. Through inheritance, the division of large tracts into small units, or subdividing for development, the result can be the same: An increased number of forest landowners. Parcelization can lead to forest fragmentation, which complicates management and preservation of large forest tracts.

A. Current Status of Fragmentation and Loss in Kentucky

Kentucky's forests show signs of both fragmentation and loss. Rates of forest loss vary over time, but recent rates have increased slightly from past decades, as shown in Figure 18. From 2010 to 2016, 31,160 forested

acres, or approximately 0.1% of the forests of Kentucky, were lost. From 2010 to 2016, an estimated 12 acres of forest were lost every day in Kentucky due to conversion.⁶⁵

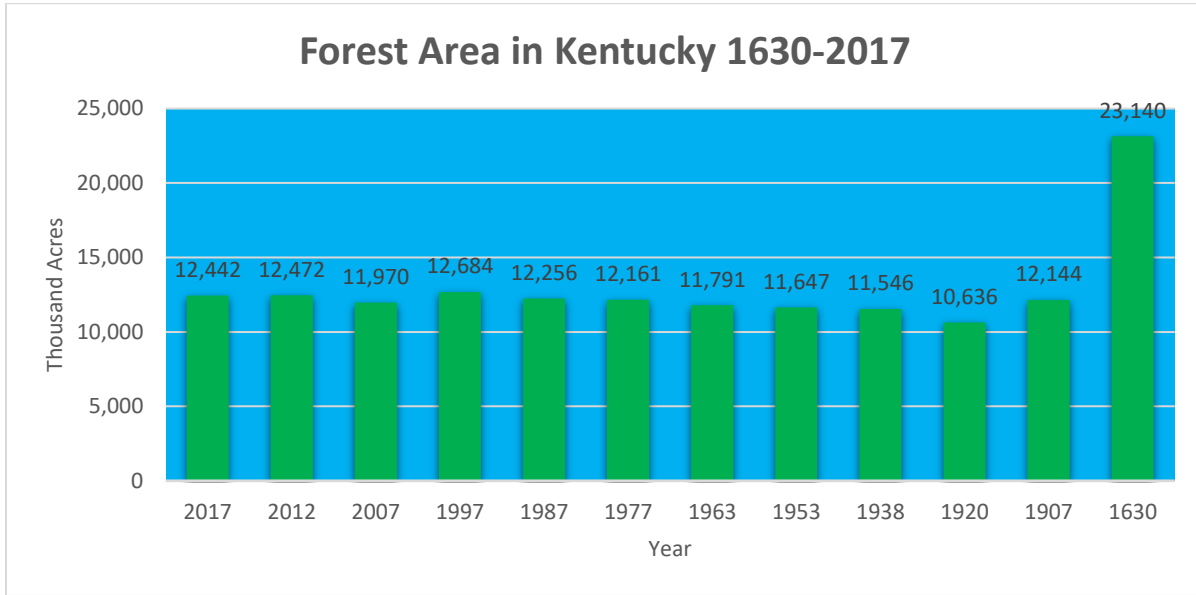


FIGURE 18 – FOREST AREA OF KENTUCKY

The areas of non-forest and the fragmentation patterns are strongly correlated with the physiography of Kentucky, as shown in Figure 19. In the Mississippi Embayment and Mississippi Plateau physiographic regions of the state, the amount of forestland is less an indication of loss rather than the geology and the historic dominance of prairie and wetland in these regions. However, in the eastern coalfield region and the Inner and Outer Bluegrass regions, the impacts of forest loss due to agricultural, urban, and mining land conversion are more apparent as this land was historically forested.

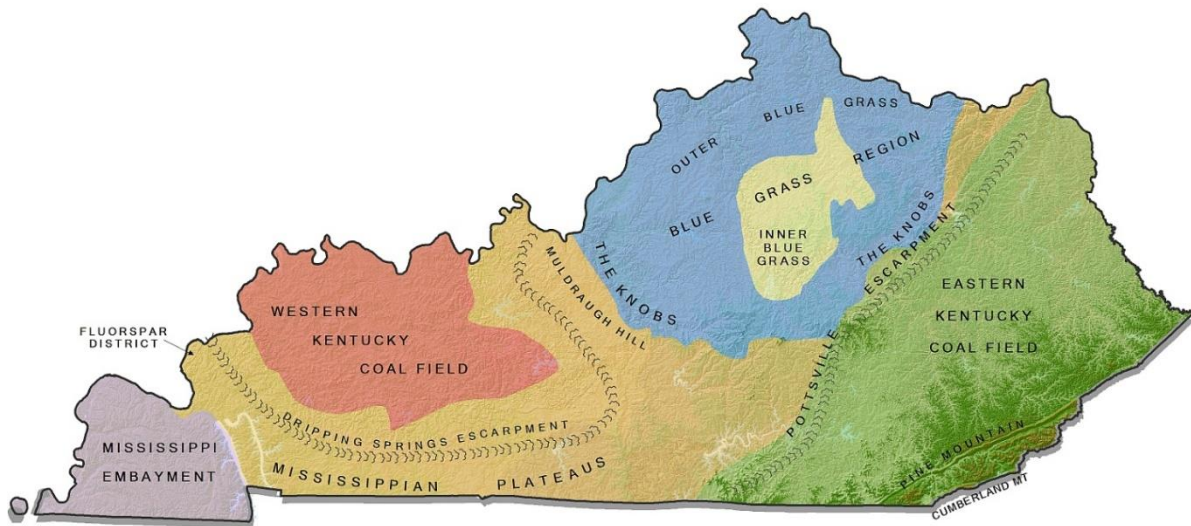


FIGURE 19 – PHYSIOGRAPHIC DIAGRAM OF KENTUCKY

In the Bluegrass Region, Western Kentucky Coalfields, Mississippi Plateau, and Mississippi Embayment, forests exist mostly in small patches except for protected areas such as wildlife refuges, wildlife management areas, recreation areas, and state parks. These small forestland patches resulted from the clearing of uplands for agricultural or urban development, and are usually narrow tracts that follow the path of streams and rivers. In the mountains of eastern Kentucky, however, the fragmentation pattern is reversed. Upland and high elevation areas remain heavily forested because of steep slopes. Forest loss and fragmentation mainly occurs along the bottomlands and stream borders where the land is flat enough to build roadways and small communities. Other sources of fragmentation and loss in this eastern region include wide-scale surface mining and urban and agricultural land conversion. Because of terrain and accessibility, most of the large tracts of interior forest are located in eastern Kentucky.

B. Key Conditions

The make-up and location of the forest are key factors in considering the effects of fragmentation and loss. The loss of forestland containing old-growth trees, endangered species populations, a high level of diversity, or stands of high quality timber has a higher impact than younger, small parcels of forest. The location of the resource is also important for recreational use as well as ecological or wildlife benefits. Forests near an urban area may be considered more desirable for recreational use and aesthetics than one in a remote area. Forests located along riparian zones can provide better water quality benefits than those on an upland slope.

The benefits provided by forests, however, are often dependent on the size, shape, configuration, slope, relative abundance of forest cover, and the resource benefits.⁶⁶ In general, the relative value of forest patches is higher on larger tracts with greater interior area, and in greater connectivity and proximity to other tracts.

1. Edge and Interior

Edge habitat is the margin where two or more different habitat types meet, and in natural areas, often occurs in a gradual transition from one habitat to another with a diversity of plants of differing heights and ages. When humans cause fragmentation and loss, forest edges are often abrupt. The potential wildlife value of edge habitat depends on the width, species diversity, and diversity of vertical structure in that habitat.⁶⁷

2. Forest Size, Connectivity, and Relative Abundance

The relative size of a forest patch is important because larger forest patches contain greater interior area. Larger forest patches can also support a greater diversity of plant and animal populations. Small forest patches remain important, however, particularly when they are close to or connected to other small forest patches.

The importance of forest size, abundance, and connectivity extends beyond wildlife, and can include urban greenway connectivity, carbon storage, air quality and other human health effects, and timber harvesting economics. Forest management techniques that focus on maintaining large patches of forestland or expanding them through reforestation or restoration, are increasingly important as climate changes and populations expand.

C. Direct Threats and Contributing Factors

1. Effects and Threat of Forest Loss and Fragmentation

Forest loss and fragmentation are significant threats to forest health in Kentucky. When a roadway, power line, or pipeline dissects a large, forested landscape, for example, the disturbance can cause loss of interior forest habitat, barriers to plant and animal movement, increase in invasive species, reduction in water quality, and loss of diversity and health of the remaining forest. As interior forest habitat is fragmented, warmer and drier conditions can result. Windier and sunnier conditions change the decomposition rates of the ground leaf layer, decrease growth rates for shade-tolerant plants, and alter the habitat and gene distribution of plants, soil invertebrates, small mammals, amphibians, ground nesting birds, and other interior forest species. Fragmentation also provides an avenue for the introduction of exotic, invasive plant species, which can have long-term effects on the health and composition of forests.⁶⁸

Conversion of rural to urban land use generally impacts both agricultural and forested areas. Since numerous fauna of Kentucky use the forest as their sole habitat, forest loss facilitates removal of that fauna from the environment. The forest also serves as a carbon sink, as trees absorb carbon dioxide through photosynthesis. Forest loss removes this avenue of carbon sequestration and negatively impacts the carbon balance in the atmosphere. Forests also absorb rainfall and help prevent flooding and soil erosion. Finally, forest loss contributes to the loss of overall biodiversity.

D. Opportunities

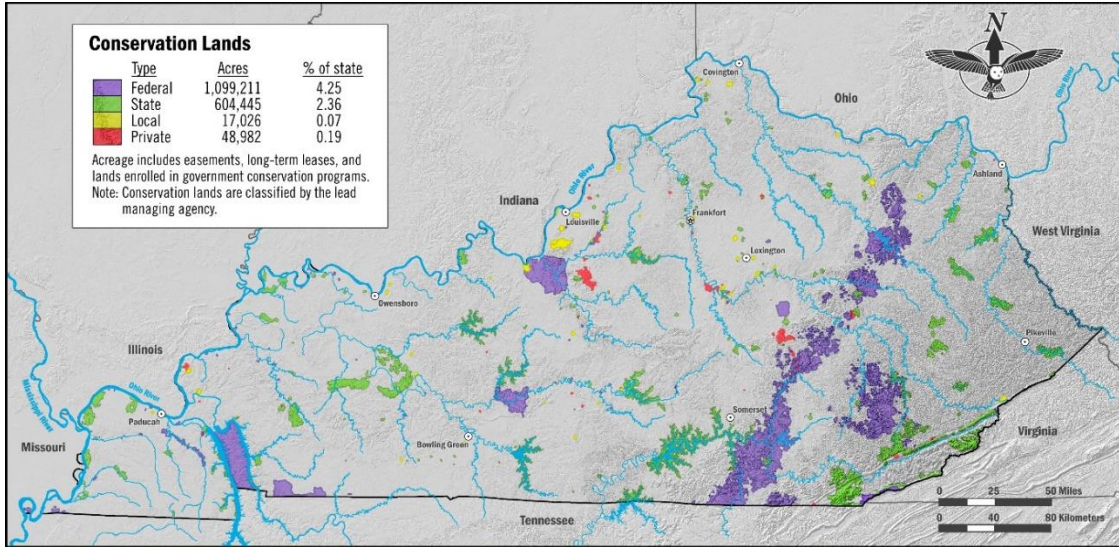
The two primary ways to mitigate forest loss and fragmentation are through prevention and restoration strategies. Prevention focuses on maintaining current large forested tracts, while restoration seeks to improve connectivity between forested areas, and to convert or restore other land uses into forest. Opportunities may focus on maintaining current public lands, acquiring additional lands, public education, smart growth policies, green infrastructure planning, climate change mitigation planning, or financial incentives to decrease fragmentation and loss in the state.

1. Publicly and Privately Owned Forest Lands

Forestland makes up approximately 48% of Kentucky's land area. Currently, federal, state, or other public institutions own 12% of Kentucky forests, as shown in Figure 20. Comparison of protected lands in the state with the large forested tracts reveals that state and national forests, national recreation areas, national parks, wildlife management areas, and nature preserves contain many of the largest contiguous blocks of forest. Approximately 88% of Kentucky's forestland is privately owned, and many large forested blocks are held in private ownership. Two conservation programs provide avenues for additional private land acquisition and management.

a. The Kentucky Heritage Land Conservation Fund

The Kentucky Heritage Land Conservation Fund (KHLCF) is the primary source of state funding for the purchase and management of natural areas. The KHLCF is used to purchase land for nature preserves, state parks, state forests, wildlife management areas, environmental education areas, wild rivers and wetlands. Revenue for the fund primarily comes from the sale of Kentucky nature license plates, unmined mineral tax on coal, and environmental fines. Since its establishment in 1990, over 90,000 acres of land have been conserved through the KHLCF.

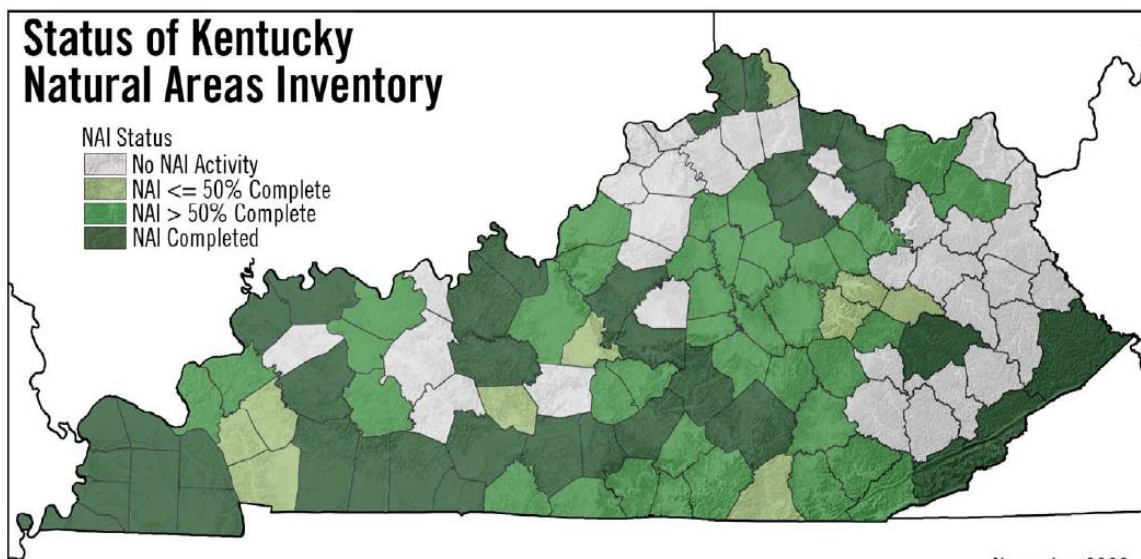


(Source: OKNP, 2010)⁶⁹

FIGURE 20 – CONSERVATION LANDS OF KENTUCKY

b. Forest Legacy Program

The Forest Legacy Program (FLP) is a conservation program administered by the U.S. Forest Service in partnership with state agencies to protect privately-owned forestlands through land purchases or conservation easements. Managed by Kentucky Division of Forestry, the FLP allows for the purchase of forestland from private individuals with the goal of maintaining forests on the land. Through the FLP, the U.S. Forest Service will provide up to 75% of the purchase price of a property, and the State of Kentucky is required to match at least 25% of the cost. To qualify, private landowners must have a Forest Stewardship Plan for a property that is at least 75% forested and at least 25% within the designated forest legacy area. The first FLP Assessment of Need (Appendix 3), approved in 2003, was developed with public input to identify environmentally important forestlands for protection from conversion to non-forested uses. Landowners receive gains associated with the sale or donation of property rights and also benefit from reduced taxes. To date, Kentucky has received \$ 13.1 million in FLP funding, which has been used to acquire the 1,540 acre Knobs State Forest and WMA in Bullitt County, the 1,955 acre Marrowbone State Forest and WMA in Metcalfe and Cumberland Counties, and the 6,725 acre Big Rivers State Forest and WMA in Union and Crittenden Counties. The priority areas developed as a result of this assessment will serve as new priority areas for the FLP. Since 1990, the FLP has conserved over 10,220 acres of land in Kentucky.



(Source: KNP, 2010)

FIGURE 21 – STATUS OF KENTUCKY NATURAL AREAS INVENTORY

2. Office of Kentucky Nature Preserves

The Office of Kentucky Nature Preserves (OKNP) was established in 2018 with the consolidation of the Kentucky State Nature Preserves Commission, the Kentucky Heritage Land Conservation Fund, and the Kentucky Wild Rivers System into one agency. OKNP seeks to protect the best remaining natural areas in the state, not only to preserve Kentucky's natural heritage, but also in recognition of the dependence of our well-being on healthy ecosystems. To identify and conserve those natural areas, OKNP participates in an international network of programs that monitors biodiversity, and acquires and preserves land by using species inventories, ecological analyses, and conservation planning. Currently, OKNP has assessed approximately 50% of the state, as shown in Figure 21. By using the forest patches data in conjunction with an inventory of plant and animal communities of Kentucky, criteria has been developed to prioritize both regions and blocks within regions for both restoration and protection. The HLCF or other funding sources can be used by OKNP in the purchase and maintenance of these critical areas.

3. Accredited Land Trusts

The following land trusts are accredited through the Land Trust Accreditation Commission, an organization that provides independent verification for land trusts to meet the high standards for land conservation, stewardship, and non-profit management. Many additional land trusts and conservation organizations exist throughout the state in addition to these accredited land trusts:

a. Bluegrass Land Conservancy

Bluegrass Trust and Limestone Land Trust merged to create Bluegrass Land Conservancy (BLC), which protects land in the Bluegrass Region through permanent conservation easements. Their work is accomplished through education and promoting the preservation of land for agriculture, historic and cultural heritage, wildlife habitat, natural resources, water quality, and scenic open space to sustain a high quality of life. BLT has protected over 21,000 acres throughout the Bluegrass Region.

b. Kentucky Natural Lands Trust

Kentucky Natural Lands Trust (KNLT) is a statewide land trust that works to protect, connect and restore wildlands, large forest tracts and migratory corridors through private, governmental, non-profit and corporate partnerships. KNLT's Pine Mountain Wildlands Corridor is the largest landscape-level project ever undertaken in the state, which aims to create a contiguous corridor from Virginia through southeastern Kentucky to Tennessee that can provide both suitable migration corridors and carbon sinks through forest preservation and conservation. KNLT has helped purchase and protect over 25,000 acres of wildland.

c. Louisville and Jefferson County Environmental Trust

The Louisville and Jefferson County Environmental Trust protects land for future generations through voluntary cooperative programs in parks, natural areas, greenways, historic sites and farmland. The Trust assists landowners, organizations, elected officials, developers, government agencies and the business community by helping them understand land preservation management options.

d. River Fields

River Fields protects, preserves and enhances natural and cultural resources, including agricultural and scenic resources, for the benefit of the public. River Fields has worked successfully with landowners and supporters to preserve more than 2,200 acres of open space, farms, woodlands and wetlands along the Ohio River Corridor through conservation easements and fee simple ownership.

e. Woods and Waters Land Trust

Woods and Waters Land Trust permanently protects forests and streams in the Lower Kentucky River Watershed to promote thriving natural lands and to connect large forest blocks to the Kentucky River and its tributaries. The Trust has protected over 30,000 feet of stream frontage through conservation easements.

4. Other Conservation Organizations and Initiatives

a. The Nature Conservancy – Kentucky Chapter

The Nature Conservancy (TNC) has identified the Central Appalachian Mountains, including Kentucky, as home to globally important forests and North America's most resilient and important corridor for wildlife and source water protection. The Conservancy's Working Woodlands program focuses on climate change strategies, wetland restoration efforts to help improve waterways, and the Green Heart Project, which studies urban greening to quantify the value of nature in communities and its relation to human health. TNC has helped protect over 50,000 acres of private and public land across Kentucky.

5. Financial Incentives for Maintaining Forestland

While acquiring forestland may ensure long-term protection against fragmentation and loss, short-term protection may be provided through monetary incentives to private landowners.

Changes in property and estate taxes may incentivize landowners to keep tracts of forestland intact. Inconsistent property valuation methods can be a driver behind fragmentation. Because property taxes are often lower on forestlands than in urban areas, individuals may be driven to develop remote areas. However, as property values increase, heirs to these rural forestlands often sell or subdivide inherited land in order to pay property taxes.⁷⁰ The fluctuation in properties' values and taxes can therefore lead to an increase in fragmentation of land over time. A more consistent approach to property valuation may lead to decreased fragmentation.

Opportunities for financial gain from forestland interest may aid in the stabilization of property values and taxes. Low quality and waste wood has a market for use as woody biomass for energy production. Additional funds might be obtained by leasing hunting rights, recreational uses, or timber harvesting.

6. *Wildland-Urban Interface*

Although the goals of natural resource management and urban expansion are often conflicting, the two land uses need not be mutually exclusive. Through the use of green infrastructure, proper planning, and low impact development techniques, the impacts to forest resources may be minimized and the benefits of these resources enhanced.