



Southeastern Forests and Climate Change Illinois Supplement

This Illinois supplemental document is intended to accompany the Project Learning Tree *Southeastern Forests and Climate Change* Secondary Environmental Education Module (Monroe and Oxarart 2014). It is intended for educators who are teaching their students about climate change with a focus on the forests of Illinois and it gives a general background on the state's forests, forest products, projected impacts of climate change, and forest pests and pathogens.

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Illinois Forest Background (for general use and with activities #1, #3, #5, and #13):

Illinois was once a place where native warm season grasses and forbs dominated the landscape — covering nearly 61% of the state. Forests, prior to European settlement, were scattered widely throughout Illinois’ borders, dominating an additional 38% of the landscape. Despite a massive loss of original prairie and forest habitat post European settlement, the percentage of forest land in Illinois has continued to expand every decade since 1924 (Bretthauer and Edgington 2002).

Today, forests cover approximately 4.97 million acres, or 14% of Illinois’ land cover (Crocker et al. 2013). These forests are generally concentrated along river and streams, and they are concentrated in the more heavily forested regions of north-western, western, and southern Illinois. An estimated 177,000 woodland owners and other private groups control and manage over 4.1 million acres (83%) of Illinois’ forest resource (Crocker et al. 2013).

Illinois is approximately 390 miles long and roughly 210 miles wide, which means our state is home to a diverse number of forest types and tree species. Five major forest types are observed in Illinois: Oak-Hickory, Elm-Ash-Cottonwood, Maple-Beech-Birch, Oak-Gum-Cypress, and Oak-Pine. The Oak-Hickory forest type dominates the landscape, comprising 68% of all forest land. The Elm-Ash-Cottonwood forest type, located chiefly along our rivers and streams, comprises an additional 23% of our forest land (Crocker 2015).

Illinois is home to twenty species of oak and 10 species of hickory. From a lumber and veneer standpoint, the state’s most valuable hardwood species include black walnut, black cherry, red oaks, white oaks, hickory, basswood, yellow-poplar, ash, hard maple, soft maple, sweetgum, blackgum, cottonwood, and sycamore.

According to the most recent US Forest Service data, Illinois forests contain over 2 billion trees with diameter measurements greater than 1-inch in diameter (Crocker 2015). Unfortunately, this estimate also includes unwanted non-native and exotic tree species. Approximately 54% of all trees growing in Illinois forests are over 61 years of age (Crocker 2015). Excluding hybrids and most plant varieties, Illinois is host to approximately 183 native tree species (Mohlenbrock 2002; Robertson n.d.; Iverson et al. 1989; Hayek 2013).

The forests of Illinois provide countless environmental and economic benefits: ecosystem services including carbon storage, biodiversity, wildlife habitat, flood mitigation, birding, recreation, hunting, and fishing — combined, these benefits add billions of dollars to Illinois’ annual economy (US Dept. of Interior et al. 2011).

Major issues facing Illinois woodland owners and the forest resource include invasive species, oak regeneration failures, forest fragmentation and parcelization, land-use change, forest health (insects and disease), lack of active forest management, soil and water conservation, a rapidly declining logging and wood products sector, shortage of technical forestry assistance, and state forestry agency staffing shortages.

Table 1. Years Required to Produce Sawlog-size Wood Products from Common Illinois Trees.

| Tree Species | Number of Years to Reach Economic Maturity Depending upon Site, Soils, and Management |
|--------------------------|---|
| Ash (green, white, blue) | Sawlogs and veneer logs generally require 40-60 years (min. diameter inside bark of 12 inches). |
| Black Walnut | Sawlogs and veneer logs generally require 40-80 years (larger logs require more time to grow). |
| Black Cherry | Sawlogs and veneer logs generally require 40-60 years (larger logs require more time to grow). |
| Hickory | Sawlogs and veneer logs generally require 60-100 years (larger logs require more time to grow). |
| Maple, Silver, and Red | Sawlogs and veneer logs generally require 40-60 years (larger logs require more time to grow). |
| Maple, Sugar | Sawlogs and veneer logs generally require 60-100 years (larger logs require more time to grow). |
| Oak (red oak family)† | Sawlogs and veneer logs generally require 40-80 years (larger logs require more time to grow). |
| Oak (white oak family)* | Sawlogs and veneer logs generally require 60-100 years (larger logs require more time to grow). |
| Yellow-poplar | Sawlogs and veneer logs generally require 40-60 years (larger logs require more time to grow). |
| Cottonwood & Sycamore | Sawlogs and veneer logs generally require 40-60 years (larger logs require more time to grow). |

† Includes: black, blackjack, cherrybark, northern pin, northern red, Nuttall, pin, scarlet, shingle, Shumard, southern red, and willow.

* Includes: bur, chestnut, chinkapin, overcup, post, swamp white, swamp chestnut, and white.

The Trees and Products of Illinois Forests (for use with activities #3, #5, #12, and #13):

Illinois’ soils grow some of the finest hardwoods in the world. Our fertile soils give rise to high-quality black walnut, cherry, white oak, red oak, hickory, maple, yellow-poplar, and other fine hardwood species that are frequently exported to markets across the globe.

Hardwoods are the most dominant species type in Illinois — over 98% of the state’s forests consist of native hardwoods. The remaining 2% of forest land, or 80,300 acres, consists of planted pine plantations of eastern white pine, red pine, shortleaf pine, and loblolly pine. Not surprisingly, over 98% of all timber sold and harvested in Illinois is of the hardwood variety (Table 1).

As unlikely as it may seem, Illinois just so happens to boast a \$23 billion forestry and forest products industry (Table 2). Illinois woodland owners, over the last 10 years, have received nearly \$250 million from the sale of timber on their lands (Hayek 2016).

Table 2. Total annual forestry and forest products output for the state of Illinois (Henderson and Munn 2012).

| Total Forestry Industry Output (2010 data) | | |
|--|--------|-----------------------|
| Sector | # Jobs | Total Industry Output |
| Pulp & Paper | 90,425 | \$17.6 billion |
| Furniture | 20,267 | \$2.83 billion |
| Solid Wood | 18,316 | \$2.59 billion |
| Urban Forestry | 5,214 | \$521.53 million |
| Logging | 1,190 | \$122.1 million |
| Miscellaneous | 965 | \$110.9 million |

The harvest of timber in Illinois is extremely sustainable — in fact, more trees succumb to natural mortality (i.e., old age, insects, pathogens, drought, and flooding) than to the chainsaw by the hands of our skilled loggers and members of the forest products industry (Table 3). According to data from the IL Dept. of Natural Resources and Southern Illinois University Carbondale, there are approximately 381 licensed timber buyers in the state (P. Deizman, pers. com., Feb. 2016) and 70 sawmills (Hollzmueller and Jensen 2013). Unfortunately, nearly 51 production sawmills have shuttered their operations since 2005.

Table 3. Relationship between tree removals, tree mortality, and net tree growth (Crocker et al. 2013).

| Attribute | Cubic Feet (millions) |
|-----------------------------------|-----------------------|
| Removals* (harvesting & firewood) | 66.1 |
| Mortality | 91.8 |
| Net Growth | 220.1 |

* Trees removed via land-use change (conversion to agriculture, commercial development, subdivision, roads, and other infrastructure) account for 29% of annual “removals” from Illinois forests.

Potential Impacts of Climate Change on Illinois Forests (for use with activities #4, #5, #8, #13, and #14):

Natural climate change, along with anthropogenic induced global warming, undoubtedly will impact the future productivity, composition, structure, health, and management of our forests. Climate change also impacts plant phenology, which can cause unintended consequences to our pollinators (Burkle et al. 2013).

Of particular interest to foresters in Illinois is the concept of “assisted migration” of native tree and shrub species (Pedlar et al. 2012; Williams and Dumroese 2013). Essentially, this concept looks at moving selected southern Illinois plant species to further upstate locations in order to determine the southern species’ tolerance to our soils, weather, and changing climate. For example, several central and northern Illinois foresters are currently incorporating a very small percentage of southern Illinois oak species, such as swamp white oak, overcup oak, cherrybark oak, willow oak, Nutall oak, and Shumard oak, into their reforestation practices. Assisted migration will not only be needed to combat future climate change, but it will also be needed to combat the rapid expansion in infrastructure (e.g., roads, subdivisions, schools, commercial development, etc.) to accommodate the world’s growing economy and population.

Forest ecosystems are the largest terrestrial carbon sink and the state of Illinois is no exception — carbon stocks in Illinois forests have increased significantly over the last 20-30 years (Crocker et al. 2013). Carbon in forest ecosystems is stored primarily in the stem, branches, roots, and leaves of living trees and shrubs; however, forest soils also store a tremendous amount of labile and recalcitrant carbon. According to computer models and science-based allometric equations, Illinois forests contain approximately 309.4 million tons of carbon (Crocker et al. 2013). Live trees represent the largest carbon pool (142.5 million tons), followed closely by the amount of carbon held in our forest soils (122.8 million tons).

The majority of Illinois' carbon stocks are found in younger forests between the ages 41-80 years old (Crocker et al. 2013) because this forest age class dominates throughout the state.

Additionally, Illinois weather can be quite unpredictable. Take precipitation for example: Rainfall amounts during May-July 2015 were the wettest months on record, whereas May-July 2012 rainfall amounts resulted in the third driest period on record. Prolonged droughts and severe precipitation events may very well become the new normal in the Midwest and across the country and these weather and climate related events will undoubtedly have a negative impact on forest resilience, forest health, and forest management in the very near future.

Pests and Pathogens in Illinois' Forests (for use with activities #3, #4, and #14):

Illinois' forests have been subject to insect and disease outbreaks for millennia. Illinois has witnessed a variety of damaging pests due to weather pattern changes and more severe weather related events such as droughts and floods. However, population growth, the global economy, international free trade, lack of active forest management, and climate change has lead to a variety of foreign pest invaders to encroach upon our borders, forests, and city trees.

According to Illinois' latest forest health report, the following insects and diseases pose the biggest threats within the borders of Illinois: Emerald ash borer (EAB), thousand cankers disease (TCD) of walnut, oak wilt, bur oak blight (BOB), gypsy moth, rapid white oak mortality, Verticillium wilt, Asian long-horned beetle, bacterial leaf scorch, pine wilt disease, hickory decline, eastern white pine decline, and spruce decline (Miller 2015).

Emerald ash borer was first detected in Illinois in 2006 (Poland and McCullough 2006). Over the last decade, this

highly invasive beetle has marched throughout the entire state decimating millions of ash trees. Over 145 million ash trees are scattered throughout Illinois — in forests, parks, cities, and backyards. Based on the latest information from the IL Dept. of Agriculture, over 60% of Illinois' 102 counties have confirmed EAB infestations. As a direct result, the IDOA has lifted the internal state EAB quarantine (IDOA 2015).

Of particular interest and concern to foresters is TCD in walnut, i.e., death by a thousand cankers. This fungal infection (*Geosmithia morbida*) is spread by the walnut twig beetle (*Pityophthorus juglandis*) and has the potential to destroy Illinois' most valuable timber species — black walnut. Projected economic losses to woodland owners, loggers, sawmill operators, and exporters impacts could exceed \$100 million a year. Fortunately, TCD has yet to be found in Illinois.

Oak wilt, unfortunately, is found in every county and it causes a significant amount of mortality to tree species in the red oak family (Miller 2015). Dutch elm disease, a vascular wilt disease, continues to infect American and slippery elms throughout the entire state. Bur oak blight, a potential serious leaf disease, has only been found on a handful of bur oak trees located in the northern stretches of Illinois (Miller 2015).

The loss of native tree and shrub species, such as ash, walnut, oak, and elm, can have profound negative impacts on forest composition, biodiversity, mast production for wildlife, financial returns to woodland owners, and pollinators.

Invasive and exotic plant species are arguably one of the biggest pests, or threats, to Illinois' forests. Most invasive plant species can out-compete and displace our native flora, which can ultimately lead to significant changes in species composition, forest stand architecture, desirable tree-shrub regeneration, forest health and resilience, and above and below ground carbon pools. Therefore, we must make a concerted effort to allocate more resources to combat and manage these pests and pathogens!

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