



*Pathogens such as the fungi that causes beech bark disease are killing American beech trees in states north and east of Kentucky. The fungi and the scale insect that transmits the fungus first appeared in Nova Scotia in 1890. Threats like this to individual species are mounting and can reduce the diversity of tree species in our forests and impact wildlife, timber, and recreational opportunities.*

# Woodland Health

*Photo courtesy: Jeff Stringer*

*by Diana Olszowy and Jeff Stringer*

**T**ime changes everything and Kentucky's woodlands are no exception. Recent ice and wind storms have brought significant attention to the condition of our woodlands, raising the question: Will they recover? In most cases, the answer is yes. However, the bigger question is whether they are healthy. Healthy woodlands include healthy trees and a diversity of species that work together to respond and recover from environmental stresses. A disturbance due to a natural disaster, wildland fire, or even insect and disease outbreaks will cause a change in a woodland. How it responds to that change defines how healthy it is. Steps can be taken to help your woodlands withstand all kinds of disturbances. The first step is to determine the health of your woodlands.

## Determining Woodland Health

Many factors contribute to woodland health, and to compound the problem, woodlands are constantly changing. This change is normal and expected. Trees die, and new ones are constantly regenerating. So the old adage "If a tree falls in the forest and no one is around to hear it, does it make a sound?" should probably read "If a tree falls in the forest, what will grow back in its place?"

Woodlands go through several developmental stages as different trees become established, grow, compete with each other for space, water, nutrients, and sunlight, and eventually die. The process is referred to as succession and is ongoing throughout the life of the woodland. We've all seen abandoned fields in the process of converting back into a woodland, and the many stages of plant growth that occur over many, many years are the different successional stages. Early successional species such as woody shrubs, eastern redcedar, and pines make way for fast-growing hardwoods such as yellow-poplar, maple, and ash; eventually, oak, hickory, and beech will seed into the site if there are nut-bearing trees close by. Oak, hickory, and beech will not magically appear in the woodland, and a successional stage with yellow-poplar, maple, and ash could easily remain dominant for many years.

During any of these successional stages, a disturbance can alter the hierarchy and encourage fierce competition at all woodland layers, from soil organisms to the understory tree species to the dominant canopy trees. Healthy woodlands have the ability to continue to regenerate native species, even when stressed by natural disturbances, and maintain a natural assemblage of species in the understory, midstory, and overstory.

## Characteristics of a Healthy Woodland

Although many disturbances such as wind and ice storms can damage our woodlands both monetarily and aesthetically, most woodlands, if they are healthy, have the ability to bounce back. Being able to assess and determine the health of a woodland and the potential risks that it might be subject to is invaluable to a woodland owner. Gauging the condition and health of a woodland and making a reasonable assessment of risks allows one to plan for the future and start to take actions that help restore the woodlands to a healthy state where it will have the capacity to respond well to disturbances. Although there are many indicators of woodland health, some indicators that can easily be determined, especially for second-growth woodlands, include:

- Diversity of native overstory species having full, well-balanced crowns.
- Diversity of native herbs, shrubs, and understory tree species.
- Trees of the proper age and vigor to produce abundant seed crops and sprout from root suckers or stumps.

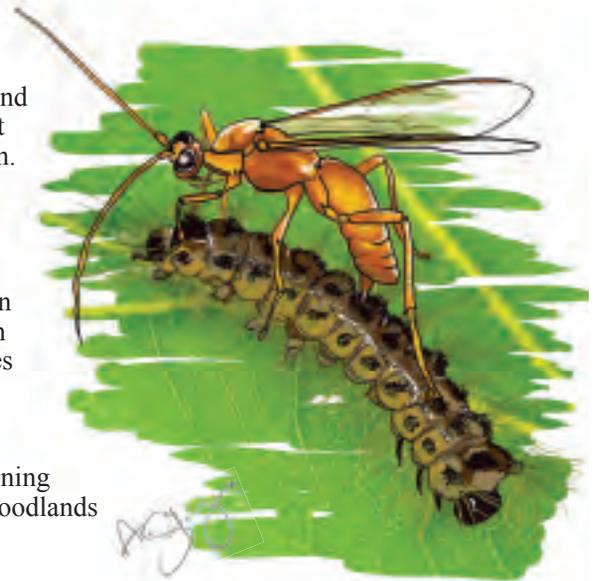
Several of these indicators emphasize “diversity” and “native.” Our woodlands are naturally diverse. Maintaining diversity allows the woodlands to adapt to disturbances over the long run. For example, if a woodland is dominated by one species and an insect or disease enters the woods that kills that one species, it will open the woodlands up to significant invasion. If nonnative exotic species are present in or around a woodland, it can be at serious risk from invasion that may eliminate native species. Unfortunately, there are several examples of a native species being functionally wiped out of our woodlands. The most notable example is the American chestnut. A European disease, the chestnut blight fungus was introduced in the United States and spread throughout the natural range of the American chestnut, wiping out a very important species. Other more recent examples include the hemlock woolly adelgid, which has entered Kentucky and is threatening to kill all or a significant number of eastern hemlock trees in stands where it has cropped up. The emerald ash borer is poised to enter Kentucky from the north and will threaten our native ash species. Maintaining diversity means that there will be enough species present to occupy the woodlands if one species collapses.

If you were a woodland owner in the 1930s and had a significant number of American chestnut in the woods, this loss would seem catastrophic. Fortunately, at that time in the United States, there was limited pressure from invasive exotics and enough native species around that eventually regenerated and filled the niche left by the loss of the American chestnut. Could the same be said today? Certainly, the situation has changed significantly as to the numbers of invasive species that have become established in the United States and developed sufficient populations poised to take advantage of any opening or disturbance in a woodland.

It should not be surprising that invasive species are at the top of the list of threats to woodland health. In many instances, the woodland ecosystem has not evolved or adapted to deal with species from the other side of the world. Our woodlands have adapted to deal with some wildfire, the destruction of scattered overstory trees, and the occurrence of native insects and diseases. However, the onslaught of invasive plants, insects, diseases, and, in some cases, animals has occurred so quickly that the woodland system and our native species have not had time to adapt and develop countermeasures to deal with this invasion. Some of these invaders have already taken their toll. However, a significant number of these threats have already spread quietly throughout Kentucky and are waiting to erupt. Some invasive species are expected to have marginal but important impacts, while others are predicted to be catastrophic.

Invasive species can take advantage of natural or manmade disturbances that could normally be overcome and establish themselves, initiating a long-term debilitating blow to the woodland ecosystem. This single fact has changed the nature of woodland management in the United States. Without the threat of invasive exotic species, woodlands could be maintained in a less healthy state or we could ignore our wood-

*Invasive understory plants can establish themselves to the point of hindering the natural regeneration of native trees as is shown in this picture of a thick carpet of Japanese stilt grass stunting the development to regeneration in a shelterwood harvest.*



*Overtime insect and disease threats to our woodlands can potentially be moderated using biological control, like wasps that lay their eggs in gypsy moth caterpillars. However, many of these controls are not yet sufficient enough to stop most exotic insect and disease threats.*



Photo courtesy: Chris Oswalt



*Defoliations naturally occur in Kentucky. The white oak tree above was totally defoliated by native insects. These types of stress inducing problems can normally be overcome by a healthy tree when there is time for the tree to recover before another stress occurs. If multiple stresses occur, like those caused by a defoliation and then a drought, tree mortality can quickly become apparent.*

lands altogether (a situation now termed as managing through benign neglect), and they would, in most instances, be able to fend for themselves. However, this is no longer the case.

Attention and some degree of management are required to ensure that woodlands have the qualities listed above that will allow them to have a fighting chance. Even then we often have to intervene to assist woodlands that are under a barrage from invasive exotic species. Woodlands must be able to adequately regenerate a diversity of native species. This is why a healthy woodland is recognized as having trees that are of the proper age and vigor and are capable of producing abundant seed crops or vigorous sprouting. The continuous development of seed from a variety of species and rootstocks that can sprout are necessary to naturally regenerate after a disturbance (either natural or manmade). If there is a limited capacity to regenerate, the woods are losing diversity and may be subject to a higher degree of invasion.

## Disturbances

Disturbances are common to Kentucky's woodlands, including those caused by humans, those that are natural, and those that are a combination of the two. Some types of disturbance can be very destructive from an economic standpoint and can result in a reduction or short-term loss of woodland health but are not so harsh that a woodland cannot eventually recover. For example, over 90 percent of the wildfires in Kentucky are caused by humans. They are the result of debris burning, unattended campfires, and, unfortunately, intentionally set arson fires. When a wildfire burns a tree, it not only damages the economic value of the tree, it also provides an entry point for opportunistic insects and diseases. With the tree and the woodlands already under stress from fire damage, this secondary attack can lead to tree mortality. At this point, the health

of a woodland is not good, but it generally still has the ability to recover over the long-term as long as other disturbances don't compound the problem. This is why natural resource professionals can advocate the proper use of prescribed burning and at the same time denounce arson-caused wildfires.

There are other manmade disturbances that woodlands can recover from even though recovery can take a long time. A case in point is the widespread timber harvesting that occurred throughout Kentucky prior to and during the industrial revolution. Woodlands that were cut very heavily were often subject to burning at the same time. Woodlands that developed from these events were different from the original relatively undisturbed woodlands. They may currently have tall overstories of native species, but it will take several hundred more years for some of the herbaceous layers and understory plants and animals to fully reestablish. This can happen as long as a woodland is not subjected to other disturbances for which it has little or no defense. Unfortunately, multiple disturbances can and do occur, and invasive species are poised to capitalize.

Each disturbance reduces the health and resiliency of our woodlands. A poorly planned timber harvest reduces species diversity, and multiple unplanned selective harvests can leave old low-vigor trees present in the overstory. Couple this with a wildfire, late spring frost, defoliation by a native insect, drought, and the presence of an invasive species or two, and the stage is set for a negative long-term reduction in woodland health and maybe even a loss of a woodland dominated by native species.

## Our Aging Woodlands

One issue that is normally raised when woodland health is discussed is the aging of our woodlands. A significant percentage of our overstory trees developed from abandonment of agricultural land or from the regeneration and growth spurt associated with initial widespread and intensive logging in the late 1800s and early 1900s. These events caused the development of a generally even-aged overstory that in some cases has not been harvested or has been "selectively" cut several times in the late 1900s. The selective cutting usually left trees of low commercial value; this included species that were not commercially valuable or individual trees that had bad timber form or were hollow. Regardless, there has been a continued aging of overstory trees, and many species that have relatively short life expectancies such as black oak, scarlet oak, cottonwood, and black locust have died or are starting to die off. Further, as other species age, they are more susceptible to mortality. Generally, this mortality occurs when droughts or defoliations stress these older trees. This is natural, expected, and is a part of the process of our woodlands turning from an



even-aged woodland to an uneven-aged one. Even though this is natural, it can impact the look and value of our woodlands and can lead to the establishment of invasive exotic species. This is why aging is often discussed as a critical element to woodland health. This aging will not lead to a loss of woodlands, but it will lead to changes that can cause serious concerns about long-term woodland health if other disturbances manifest themselves in these aging woods. This is why something as simple as allowing a second-growth woodland to develop into an old-growth woodland must be planned for and managed.

### Managing for Woodland Health

To help improve or maintain a healthy woodland, you must be aware of the risks and understand the current condition of the woodland and gauge its health relative to its ability to withstand disturbance. Consulting with a forester or wildlife biologist is one of the best ways to get an idea of the health of your woodlands. For example, it is relatively easy to determine the age of the overstory trees and whether they are healthy with full, vigorous crowns. Are there invasive species currently in your woodlands or directly adjacent that should be dealt with?

It is also possible to accurately predict the regeneration potential of your woodland and what species will regenerate if a natural or manmade disturbance kills or removes a portion of the overstory trees. There are certainly acute disturbances such as ice storms and droughts and long-term disturbances from global climate change that are beyond our control. They have occurred in the past and will continue in the future. Although you cannot stop these, you can understand how your woodland will respond and start to conduct management practices that improve the health and resiliency of your woodlands.

*Some insects like the hemlock woolly adelgid are invading Kentucky. Large areas and tens of thousands of hemlock trees growing around streams and rivers are at risk, reducing overall biodiversity and negatively impacting stream life.*

Timber stand improvement work and improvement harvests can be used to remove exotics and reduce overcrowding of native species. Regeneration harvests using appropriate regeneration methods such as group openings, shelterwood harvests, or, in the case of an extremely degraded stand, a small clearcut can be used to develop an appropriate age class distribution in your woodland. Regardless of whether active management is used or not, scouting for invasive exotics is a practice that is required for most woodlands. In all cases, this work should be done with an eye to maintaining species diversity, providing for the capacity to regenerate now or in the future, and eliminating exotic species that are present. Ultimately some degree of management is needed to properly care for woodlands and ensure long-term health and resiliency.

---

#### About the Authors:

*Diana Olszowy is Stewardship and Education Branch Manager with the Kentucky Division of Forestry. She is also an editor of the Kentucky Woodlands Magazine. Kentucky Division of Forestry, 627 Comanche Trail, Frankfort, KY 40601; E-mail: [diana.olszowy@ky.gov](mailto:diana.olszowy@ky.gov); Phone: 502.564.4496; Fax: 502.564.6553.*

*Jeff Stringer, Ph.D. is a hardwood extension specialist at the University of Kentucky and is responsible for continuing education and research in hardwood silviculture and forest operations. He is also an editor of the Kentucky Woodlands Magazine.*

*Cooperative Extension Service, Department of Forestry, University of Kentucky, 213 Thomas Poe Cooper Building, Lexington, KY 40546-0073; E-mail: [stringer@uky.edu](mailto:stringer@uky.edu); Phone: 859.257.5994; Fax: 859.323.1031.*