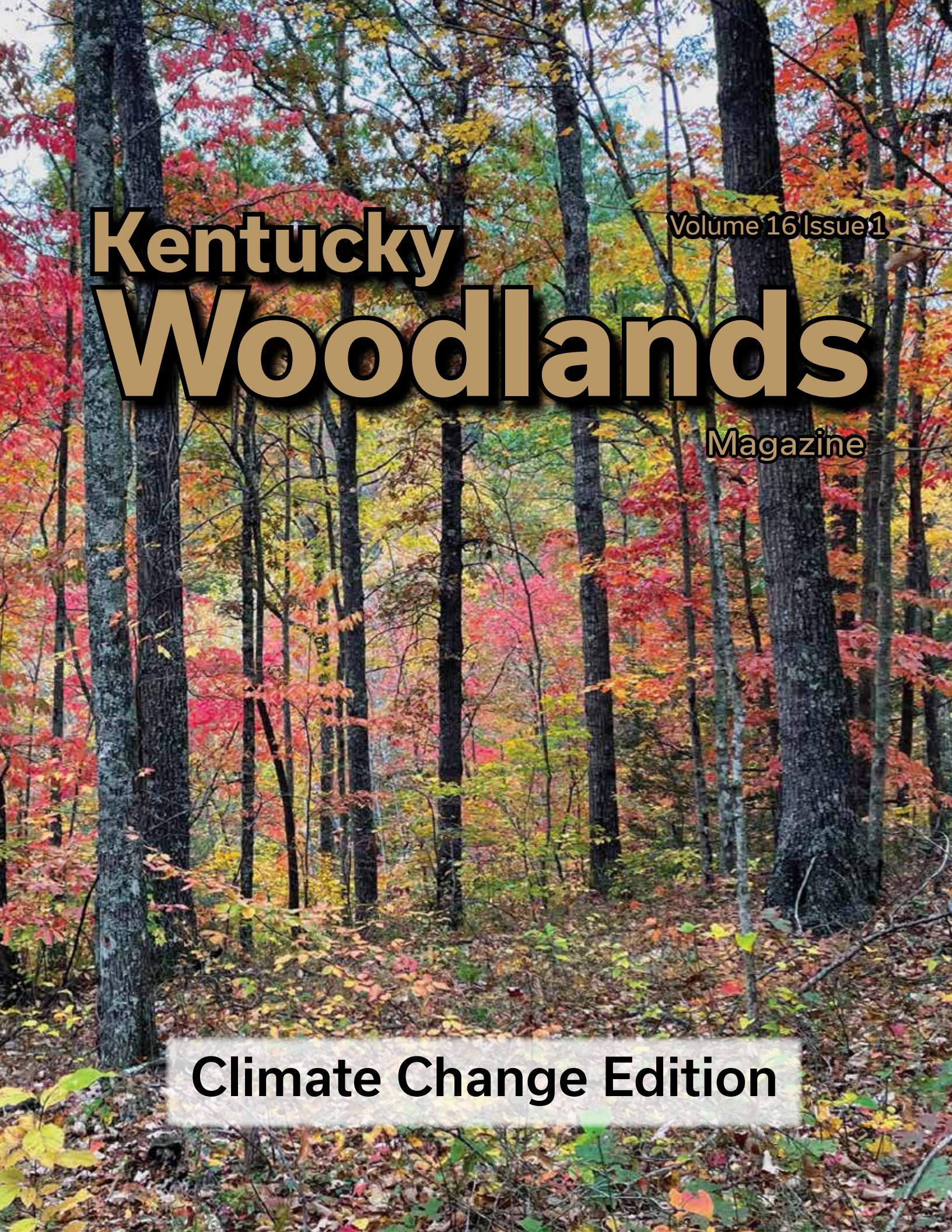

Kentucky Woodlands Magazine

Volume 16 Issue 1

Climate Change Edition

Kentucky Woodlands Magazine

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Volume 16 Issue 1

Cover photo courtesy: Jacob Muller

From the Editors of the Kentucky Woodlands Magazine:

The woodlands of Kentucky truly are a special place! As stewards of the land, it's important that we do everything we can to protect (and enhance) this resource long into the future. Typically, this includes managing the woodlands to promote growth, regeneration, and health while also considering all the things that might limit our ability to meet our goals and objectives for the land. Often in Kentucky, this means anticipating and responding to disturbances and disruptions to the ecosystem, from invasive plants, pests, and pathogens to severe weather events, wildfires, and a changing climates. In this issue of Kentucky Woodlands Magazine, we highlight several articles by researchers and Extension specialists here at UK discussing some of the ways that climate change may impact woodlands here in Kentucky while also helping us understand what we can do to prepare and protect our own woodlands. Additionally in this issue, we are happy to share some of the activities and resources that managers and woodland owners are taking part in across the state from our incredible partners at KDF and NRCS. And as always, thank you for being a part of the Kentucky Woodlands community and we hope you enjoy this issue!

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The White Oak Initiative:

Landowners for Oaks Series is Guiding Forest Landowners to the Basics of White Oak Management

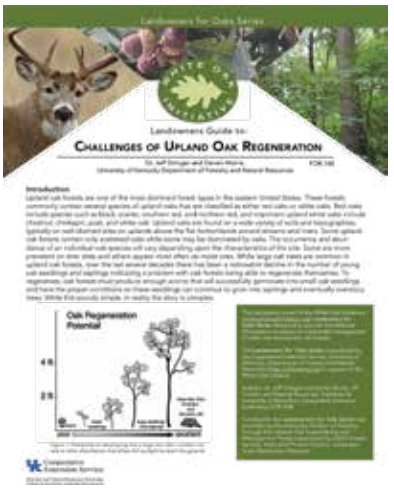
by Darren Morris and Jeff Stringer

White oak (*Quercus alba*) is considered a cornerstone species of upland oak forests. Different species of oaks have similar issues and respond likewise to common oak-management techniques. Therefore, it is important to understand that oak-management practices that focus on this keystone species produce results that benefit other oaks and improve the overall health and diversity of forest ecosystems.

The natural range of white oak is vast, making up over 100 million acres of forest across the eastern United States. In addition to white oak, seven other important oak species are also commonly found within these ecologically important upland oak forests. Of these eight upland oak species, white oak ranges the widest, nearly encompassing the other upland oaks entirely within its range. For these reasons, it becomes apparent that proper white oak management is key in creating and maintaining healthy upland oak ecosystems and the wildlife habitat, recreation, water resources, economic impacts, and many other benefits they provide.

Ownership of forests may be categorized mainly as public or privately owned. Public lands are mostly federal, state, and locally owned, while private lands are mostly corporate or private family owned forests. Across the range of white oak, private family owned forests dominate all other categories, making up 53%. However in Kentucky, well over 70% of all forests greater than 10 acres are private family owned forests.

Consequently, forest landowners have a huge impact on the health and diversity of white oak and upland oak forests. It is important for forest landowners to have access to basic oak-management issues and concerns when considering forest management options. As a guide for landowners to learn more about oaks and oak management, the White Oak Initiative: Landowners for Oaks Series publications were created. Eight publications reference identification and characteristics of upland oaks. These guides to identification and characteristics of white oak and seven other important oaks common to upland oak forests provide details on species identification as well as site location, uses, and other important information. Three publications provide landowners with the basics of white oak management. These publications inform forest landowners of the overall importance of white oak as a cornerstone species of our upland oak forests. Also included is a basic explanation of regeneration and recruitment issues that are a concern with white oak and upland oaks as well as an introduction to the 10 management practices developed to create and maintain healthy upland oak forests.



The White Oak Initiative: Landowners for Oaks Series is produced by the Cooperative Extension Service, University of Kentucky, and Department of Forestry and Natural Resources in support of the White Oak Initiative. All publications can be viewed and downloaded at www.whiteoakinitiative.org or http://forestry.ca.uky.edu/woi.

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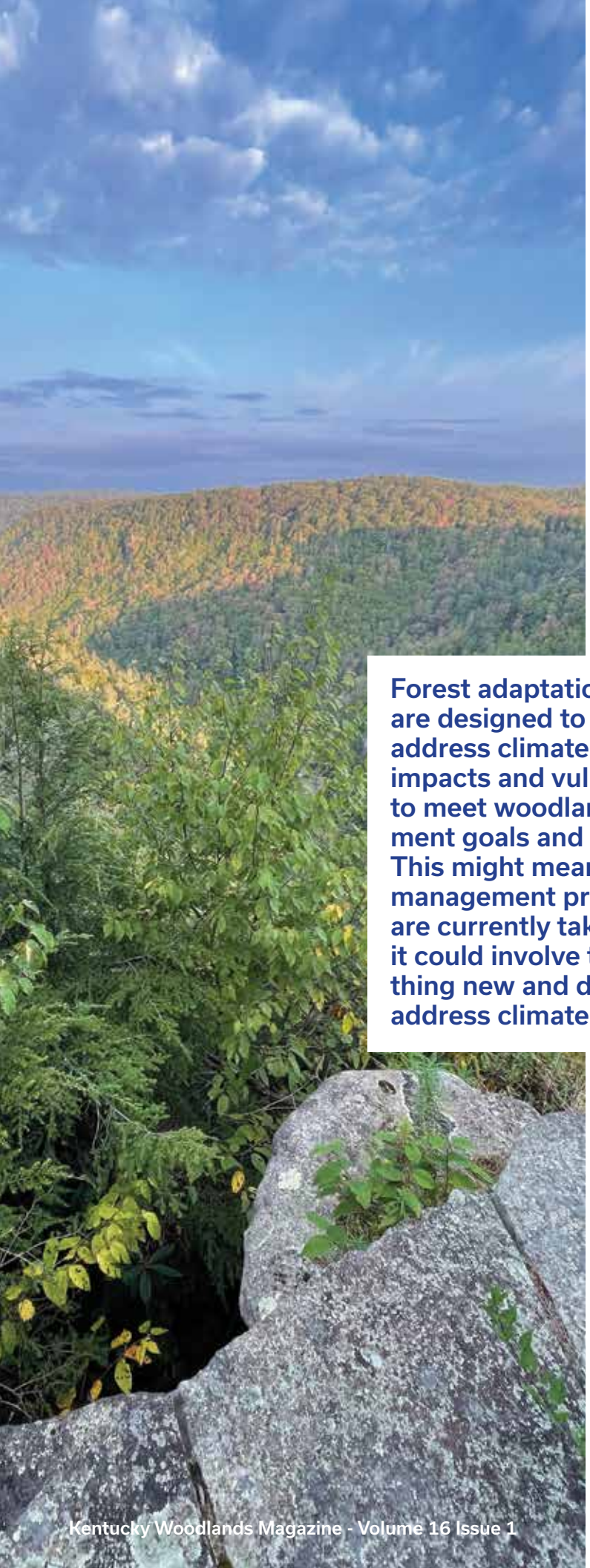


Adaptive Silviculture for Climate Change:
Managing Woodlands in a Changing World

by Jacob Muller and Logan Baker

As woodland owners, we typically want what's best for the land and we select management goals that align with our interests and values. We also want practical solutions to problems that arise in the woodland: invasive plants, regeneration failures, lack of merchantable trees, and more. To address these problems we need a roadmap, or as foresters like to call them, a "forest management plan". A forest management plan can align our values and interests to manage the forest while troubleshooting any issues that may limit our abilities to achieve our management goals more sustainably. Many woodland owners manage for a range of opportunities and resources including water, wildlife, timber, or recreation. To achieve those things, we prescribe silvicultural activities that manipulate the forest in one way or another to create favorable growing conditions.

Forest adaptation actions are designed to specifically address climate change impacts and vulnerabilities to meet woodland management goals and objectives. This might mean continuing management practices that are currently taking place, or it could involve trying something new and different to address climate change.

Silviculture is the art and science of controlling the establishment, growth, composition, health, and quality of forests and woodlands to meet the diverse needs and values of landowners and society such as wildlife habitat, timber, water resources, restoration, and recreation on a sustainable basis.

But what about managing in the face of change - things like environmental and climatic changes that may be outside of our control as woodland owners? To counter those challenges, we need to create a condition in the woodland that promotes long-term sustainability. We can use silvicultural approaches to help the woodland adapt to changing conditions. Adaptive management, and more specifically, adaptive silviculture, is an emerging forest management approach that aims to build resiliency into the forest. Whatever the future holds, whether that includes longer growing seasons, increasing risk of invasive plants, more frequent and severe fires, or more intense droughts and flooding, it is important we understand the risks and vulnerabilities and take action to respond. Adaptive silviculture aims to help managers and woodland owners add silvicultural "tools" to our "toolbox" and create practical solutions to these challenges.

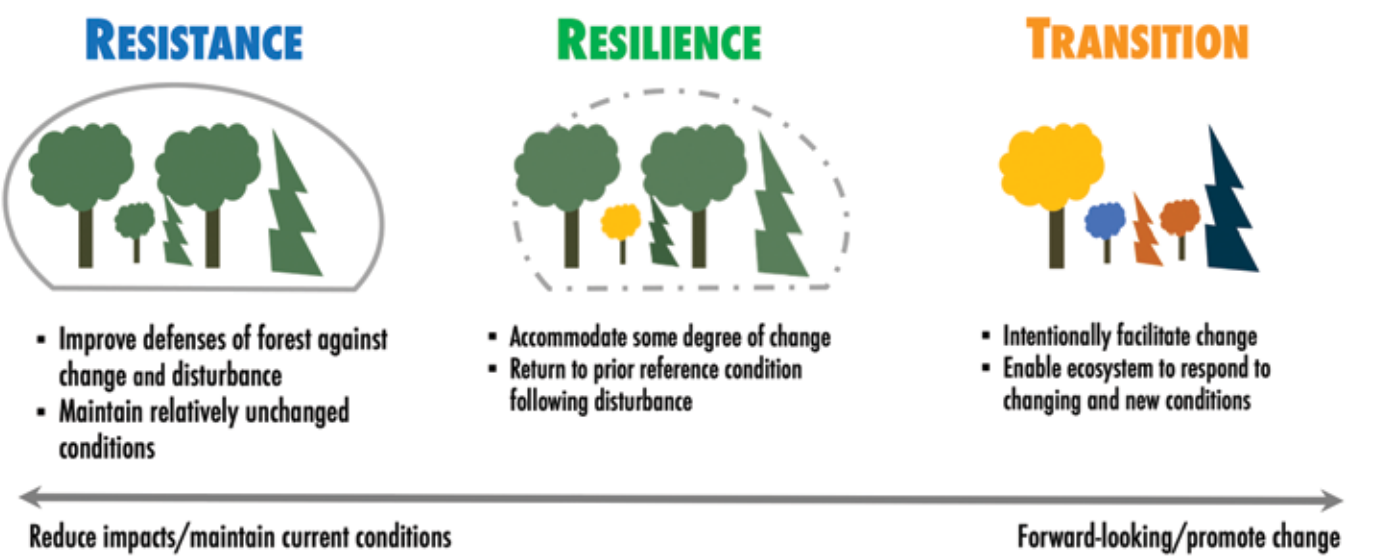
Clearly stating your goals through a forest management plan is a critical first step toward climate adaptation. This

sounds simple, but it is a fundamental planning step to begin evaluating the risks that climate change may present to your woodlands. If your goal is to maintain the current conditions in your woodland, which may include the current suite of species and forest functions, you may opt for a defensive strategy designed to resist change - at least for the short term. This adaptation option is called "**resistance**", and it may be a suitable option in situations where you have a high-value woodland and your intention is to maintain the conditions. If your goal is to create a healthy woodland that can tolerate a wider range of future conditions, you may decide to place a greater emphasis on diversity and forest health. This option is called "**resilience**", which encourages some flexibility in the woodland's ability to adapt to change while remaining mostly the same. These first two options are what we would call "persistence" approaches; they work to encourage the current conditions to persist into the future. If your goals place a greater emphasis on sustainably maximizing production and function in the future, you may opt to plant (or promote) species that are expected to be more productive under future climate conditions. This option is called "**transition**" and aims to deliberately promote change in the woodland to reduce the long-term risks. These options are intentionally designed to help managers and landowners act using practical silvicultural tactics, whether your management includes planting future-adapted species, forest stand improvements, harvesting to create gaps and unique structural conditions, or simply aggressively removing invasive plants. When it's all said and done, it always comes down to your values, and thus goals, as a woodland owner.

> "Resilience is the ability of a forest to absorb disturbances and re-organize under changing conditions to maintain similar functions and structure.
>
> Adaptation is simply the adjustment of the forest (and the ways that we manage the forest) to allow it to be better suited to future conditions."

As woodland owners, we will naturally have different perspectives on weighing climate change risks. These adaptation options aren't a one-size-fits-all approach to forest management. Additionally, there is a significant amount of uncertainty about what future climates will look like, the ways it will impact our forests, and how forests will respond to an adaptive management approach. There's no way to sugarcoat it; there is a lot that we don't know.

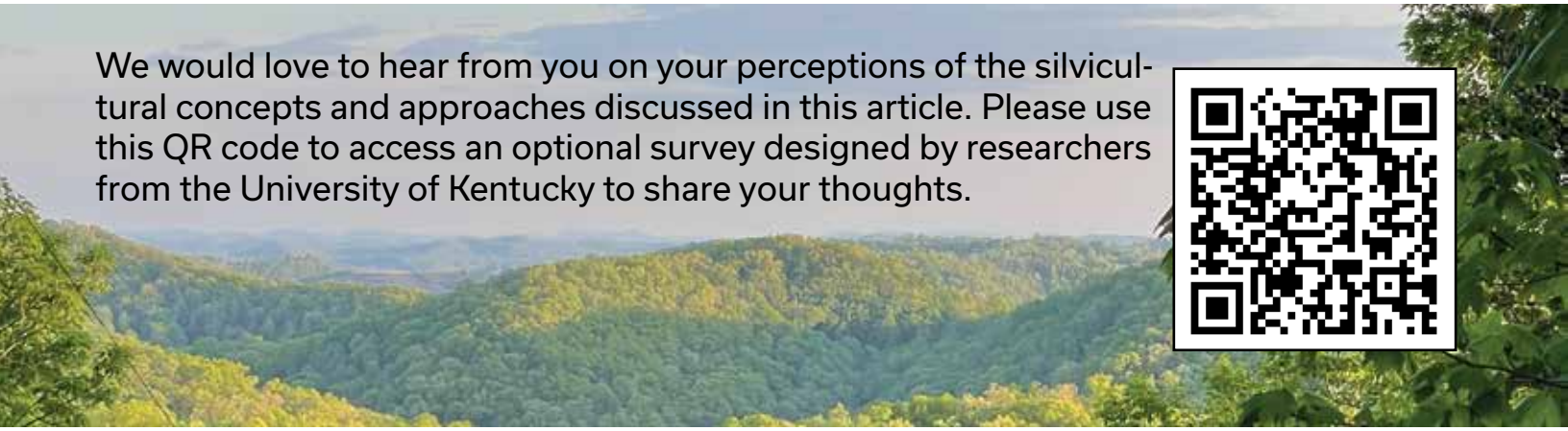
To help us address this knowledge gap the Adaptive Silviculture for Climate Change (ASCC) Network, a relatively new project that spans forest types across North America, was created to address future challenges and uncertainties surrounding climate change impacts on forests and natural resources using the three adaptation options as a framework. The ASCC Network is a collaborative effort between researchers and managers working together to establish experimental trials across a network of diverse forest types to test adaptation approaches at large operational scales, often exceeding 400 acres in size. The newest ASCC trial is currently being implemented on UK's Robinson Forest in eastern Kentucky. This effort is being led by UK Department of Forestry and Natural Resources, along with partners from the Kentucky Division of Forestry, USDA Forest Service, and Kentucky forest industries, and will test adaptation approaches relevant to forests in Kentucky. The Robinson Forest ASCC site is a significant opportunity for researchers, managers, and woodland owners to help address these uncertainties associated with climate change. It will help us all better understand how



modified from Nagel et al. 2017

the different approaches (resistant, resilience, and transition) might promote adaptation while focusing on meeting our management goals like supporting Kentucky's forest industries through sustainable timber supplies, maintaining and enhancing wildlife habitat, promoting forest health and protecting water resources.

The woodlands across Kentucky are such incredible and important natural resources for so many reasons. We know that changing future conditions will create challenges (and perhaps some opportunities), but we are actively studying and learning ways that we can help you sustainably manage your woodlands whatever the future holds. We look forward to sharing more information about the Robinson Forest ASCC site with you as the site is further developed.



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KDF Corner

by Pam Snyder

Forty-eight percent of Kentucky is forestland—that is 12.4 million acres of forests. The Kentucky Division of Forestry (KDF) mission is "to protect, conserve and enhance the forest resources of the Commonwealth through a public informed of the environmental, social and economic importance of these resources." The division offers a variety of programs and services for landowner assistance in forest health, forest management, and wildland fire protection. KDF staff are trained and prepared to respond quickly to various types of emergencies and natural disaster situations that could potentially impact Kentucky.

This past year, Kentucky has been devastated by extreme weather patterns that caused multiple tornadoes in Western Kentucky (December 2021) to historical flooding (July 2022) in Eastern Kentucky. The state was in various degrees of drought conditions by late October 2022 (Drought Index Map). The division responded to each of these natural disasters.

Over an 11-day period, forty-six KDF employees helped with tornado response and cleanup. The catastrophic flooding event in Eastern Kentucky occurred July 27-28. Ninety employees were deployed for on-the-ground assistance with debris removal as saw crews and ten employees coordinated response efforts at Kentucky's Emergency Operations Center. By early November, all division employees were engaged in fighting wildland fire activities and the KDF Fire Mobilization Plan was initiated. The division requested assistance from out-of-state fire resources from five states (VA, PA, MS, TX, and AR). It was the first time in six years that the division had mobilized for fire and requested assistance from other states. It was an unprecedented year for natural disasters in Kentucky, and the division-deployed personnel to assist Kentuckians after each disaster.

Photos courtesy: Pam Snyder

KDF crews work diligently to extinguish fires.

Extreme weather patterns are often associated with climate change. The definition of climate change includes long-term natural changes based on solar cycles or human causes, such as burning fossil fuels. Many factors affect climate change, and it is important to understand how trees play a vital role in mitigating or capturing carbon dioxide.

Trees capture carbon dioxide from the atmosphere through photosynthesis, and it is locked within their growth rings or wood fiber. Forest ecosystems or forested stands act as carbon sinks. Trees reduce carbon emissions by sequestering the emissions. Carbon sequestration allows for trees to aid in the process called "climate adaptation." The adaptation process allows for minimizing or lowering the impacts of climate change incrementally. Examples are planting trees (riparian buffers, shelterbelts, orchards, and afforestation projects) to sequester more carbon or landowners managing their forestland sustainably for long-term purposes creates vigorous, healthy forests. Natural resource professionals can utilize climate adaptation and resiliency principles while developing forest management plans for landowners. Again, it is important to understand the vital role trees play in mitigating climate change and properly managed forests are the key element in the process.

About the author: **Pam Snyder,** is the Forest Management Chief with the Kentucky Division of Forestry and works on a variety of forest management needs for private landowners, farmers, and governmental agencies. She is one of the editors of the Kentucky Woodlands Magazine.

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FOREST HEALTH

healthywoodsapp.org

Wetter Weather? Expect more Fungal Diseases.

by Ellen Crocker

It's no secret that fungi love wet weather! But did you know that high moisture levels can also promote fungal disease on your trees? Future climate projections for Kentucky suggest that we will experience warmer, wetter weather in the future, which will likely promote various diseases. Most of these are minor leaf issues that can look bad but typically aren't considered serious threats. However, some of these diseases can stress trees and may present bigger threats over time. Here are some current tree diseases that are promoted by wet weather:

Anthracnose:

If you are noticing brown, crumpled leaves and thinning tree canopies in the late spring, anthracnose may be the culprit. This native fungal disease makes its annual appearance when humidity is high. In the past, anthracnose was considered only a minor issue for trees in our region and damage was typically restricted to the spring due to the wet conditions then. However, this disease appears to be becoming more problematic, with wetter weather creating conditions that favor disease for more of the year.

Above: Thinned canopy of a sycamore with severe anthracnose. Left: Shoot dieback symptoms of anthracnose in sycamore.

Photos courtesy: Ellen Crocker, University of Kentucky

Species that are highly susceptible to anthracnose, like sycamore, seem to be experiencing disease of greater severity for a longer period of time. Because of anthracnose, sycamore canopies may be very thin in the late spring and early summer. While trees tend to drop affected leaves and put out a new flush in the summer if needed, this damage likely stresses trees. In addition, anthracnose in sycamore, dogwood, and several other species can infect twigs and branches as well as leaves. This causes cankers and shoot dieback and is more harmful to the health of the tree long-term.

In most cases, no management is needed for anthracnose and trees will recover. However, in severe cases (or for landscape trees) there are a range of management options, including fungicide treatments, pruning to increase air circulation, and pruning out branches with cankers.

Other fungal leaf issues:

There are many other foliar issues that are promoted by wet weather. While these might look bad, most are minor problems and not serious threats to the health of trees. It is important to monitor trees and distinguish these from more harmful threats.

Maple leaf blister looks bad but isn't a major concern.

Photo courtesy: Alicyn Ryan, University of Florida, Bugwood.org

Photo credit: Steven Katovich, Bugwood.org

Photo courtesy: Ellen Crocker

Left: Maple tar spot increases under wet conditions but doesn't harm trees. Right: Many different rust species can be promoted by wet weather.

Root rot:

There are a wide range of different root rots (mostly caused by fungi) that can impact trees. Although you typically can't see them, since the damage they cause is underground or under tree bark, you may notice dieback in a tree's canopy and reduced vigor. Most of the time, healthy trees can defend themselves and outgrow damage. But, extensive decay can result in a stressed tree and an increased likelihood of tree failure.

There are many different factors that impact root rot severity including species, damage to trees, site condition, and weather. If a tree is growing in a spot that holds moisture, it may experience more problems. Trees growing in sites that previously were drier, now may need to contend with increased root rot.

There is no treatment that can undo the damage caused by rots so preventing damage to begin with is the best management strategy. Wounding or compaction to a tree's root zone invites future issues so care should be taken to protect remaining trees from damage during harvests or other management. In addition, any actions that promote general tree health will better enable the tree to defend itself.

Some common rots include:

- Armillaria root rot: Also called shoestring root rot because of the string like threads this fungus makes as it grows through wood. This fungus produces mushrooms in the fall called "honey mushrooms"
- Ganoderma: There are several different species of Ganoderma fungi that can cause decay to the roots and base of trees, stressing trees, decreasing their value, and reducing their structural integrity. Hard, shelf-like mushrooms are occasionally produced by the fungus.

Ganoderma fungi can cause decay to the roots or base of trees.

Photo courtesy: Ellen Crocker

Decline:

Decline is a general term used for the progressive dieback and eventual death of trees due to many compounding stressors. This includes a combination of predisposing issues (things like site, tree age, and species), inciting stress triggers (things like drought), and contributing factors that can act as a nail-in-the-coffin for stressed trees. While tree decline isn't new, our changing weather seems to be causing new patterns of decline throughout the state. In some places, the increased precipitation has likely changed site conditions enough that trees, previously growing in more ideal locations, are now more off-site. For example, soils in some sites may be wetter now than they were when trees first started growing there years ago. If this change doesn't match up with the needs of the tree, this can result in a tree that is always stressed, susceptible to other problems, and less adapted to the site.

Bleeding cankers like this one can be caused by many different pathogens.

Photo courtesy: Ellen Crocker, University of Kentucky

Bleeding cankers:

Have you noticed dark patches on your tree's trunk or branches with sap oozing out in spots? These could be bleeding cankers, another issue that can be promoted by wet weather. Under the bark, the pathogen is causing a dead patch (canker), killing the bark and outer wood tissue. Bleeding cankers can cause decline over time, stressing trees and making them susceptible to other issues.

Several species can cause bleeding cankers in trees, particularly water molds in the group Phytophthora. The spores that spread Phytophthora cankers live in the soil and thrive in wet environments, spreading up to the trunk of trees in splashing rainwater. While there are treatment options for bleeding cankers, these typically are not feasible in forest settings due to cost but may be a good option for landscape trees.

In conclusion:

Our changing climate will likely result in a wide range of changes to the health of our trees, both direct (increased moisture and warmer temperatures) and indirect (like the diseases mentioned here). How this plays out will depend on many things. For example, many of the fungal leaf diseases mentioned here are promoted by cool wet spring weather. But this may not be what we experience in the future if instead increased precipitation comes in fewer major weather event. There's no crystal ball for predicting what the future has in store but promoting the health of your trees in general will help them defend themselves against future stresses.

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Climate Change and Kentucky Wildlife

by Matthew T. Springer

In this issue of Kentucky Woodlands Magazine, several potential impacts of climate change on our forests have been covered. Those issues will have direct or indirect impacts on Kentucky wildlife populations and distributions. As is the trend with climate change, impacts will be species-dependent and could vary greatly.

As wildlife biologists, we monitor several categories to help us understand the status of populations and the potential impacts of habitat, harvest, disease, etc. Outside of hunting or trapping seasons, activities managing wildlife usually fall within one of the three overarching habitat components: food, cover, and water. Reproductive and thermal requirements fall within that broader cover category. Other activities play roles in management to lesser extents: for instance wildlife health monitoring for disease and parasite issues, useful indicators for the overall health of populations. This particular activity may become especially important if a new disease or parasites enters a system and its impacts to populations are unknown. More on why this may be more important in the future of wildlife management under the context of climate change a bit later in the article.

Usually wildlife populations thrive if all or most of those categories are present to meet the needs of the species. For example, when there are enough snags of sufficient size and decay category present within a forest stand to support woodpecker foraging and nesting needs, or those snags also meet the daytime resting sites for Indiana bats then we would expect there to be healthy population levels in that stand. However, how climate change becomes an issue for wildlife is when the species we are managing for has evolved to deal with temperatures, water cycles, or plant communities that may no longer be the norm for those areas or lost completely. Let's go into how the predicted climate variations may impact our Kentucky wildlife species in both negative and positive manners.

Diseases and Parasites

Diseases and parasites are an often overlooked group that will likely become more of an issue moving forward. Ticks and tick-borne disease are predicted to increase in prevalence and abundance as winter temperatures become warmer, increasing their overwinter survival. Ticks usually do not cause individuals to perish on their own, but add another stress to that individual potentially resulting in reduced reproductive success. However the new invasive species to Kentucky, the Asian Longhorn tick, can be the exception to that rule. Along with aiding tick survival, the changing environmental conditions will potentially allow diseases to be present temporally within the year or occurring more frequently or new novel diseases may be introduced. A prime example may be EHD/Blue tongue in deer, which occurs every five to 10 years when we have droughts helping to increase populations of the midge that transmits the disease, may be something that occurs annually with new weather patterns.

Higher Temperatures, Drought, and Extreme Weather Events

Overall temperatures are predicted to increase across the state, with western parts being a bit more impacted than eastern parts. Temperature can have varying impacts on wildlife species as physiologically each species has a thermal zone they can thrive and survive in. Species that have a harder time regulating their own body temperature or those that are cold blooded and

Species like the black and white warbler and wild turkey may be at higher risk of impacts from climate change than others like the bobcat due to their annual cycles being tied to insect emergence and abundance. Alternatively, ticks and related issues will increase in abundance and duration they are active as the climate remains warmer longer.

are regulated by the environment will be the most impacted, but many of our species in the state are not at the extremes of their temperature ranges and the increase predicted will not push them over the edge.

Indirect impacts from higher temperatures may have a larger impact on wildlife in Kentucky. Many of the predictions for our region involve varying precipitation patterns which will include slightly more rain but falling in ways that will create micro droughts and extreme weather events like floods or tornadoes. Water is a major factor in the survival of wildlife especially those that either reproduce directly in it, salamanders, frogs, toads, as well as just being able to acquire drinking water from freestanding sources, which can have major impacts on species of bats and others that do not necessarily acquire water through metabolic sources.

Wildlife have evolved with flooding, ice storms, tornadoes, wildfires, and other extreme weather that occasionally occurs within our state. Models predict these events to be more common occurrences in the future. Larger or more mobile species can relocate themselves easily to areas sheltered from these events while some will either find ways to survive them or unfortunately their local populations will take a hit. The bigger concern may be the rates at which these events occur. If they become more frequent it would give local populations less time to recover from them and eventually push localized extirpation. On the positive side, these disturbance events and may create early successional habitat which is lacking within Kentucky.

Phenology and Food

Many of our wildlife have evolved to time life history events alongside key resource abundances. For instance, songbirds will migrate to Kentucky at the time when leaves are budding and insects are becoming more abundant on the landscape. The opposite side of the spectrum, waterfowl migrate to Kentucky from the north when wetland seed resources are available and water bodies are still unfrozen. The timing of these resource pulses can be vital to adults feeding young enough for them to develop at rates needed to survive the upcoming fall and winter. With insects and many plants being more responsive to earlier growing windows and warmer temperatures, those food pulse timings may be earlier and disrupt wildlife depending on them. Those species would spend more energy to forage and feed their young, resulting in less young being produced or surviving, lowering population's overtime. Conversely, some herbivores like deer or elk could benefit from earlier growing seasons and be in better physical condition when it is time for them to have their young.

Summary

As with habitat alterations that regularly occur in our landscapes, there will be winners and losers as our climate shifts. Those species that are more generalized in their habitat, food, reproductive, or other physiological requirements will most likely respond in favorable ways. Those animals that have specialize behaviors or habitats may be more vulnerable and could see population declines or distributions altered. That could especially be true for those that are linked to vegetation that may be reduced or lost completely with the new climates. We may also even see new species call our state home as their climate allows for them to survive, think the now more commonly seen armadillo in western and southern Kentucky.

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Kentucky Natural Resources Conservation Service

Supporting Woodland Owners in a Changing Climate

by Jon Shultz, NRCS Kentucky Forester, USDA's Natural Resources Conservation Service; Jon.Shultz@usda.gov

Climate change and carbon sequestration are terms used regularly these days. Eastern hardwood forests have been identified as one of the best forest types to sequester, or store, carbon in the United States. Carbon sequestration is the ability of living plants to absorb carbon dioxide from the atmosphere during photosynthesis, and then store the carbon in their biomass such as leaves, trunks, and roots. Once this carbon is stored in the plant, it is "locked up" during the plant's life and sequestered. The lush and productive forests of Kentucky, covering approximately one half of the state, are at an advantage to help in the fight against climate change and can sequester massive amounts of carbon, much more so than the large amounts they already do. Many common forestry practices, supported by the Natural Resources Conservation Service or NRCS, promote good forest stewardship and can also drastically increase the potential for Kentucky's forests to store more carbon. Healthy forests with an abundance of long-lived trees can provide an economic, wildlife, water quality, and carbon-sequestration benefit.

The first step in working with NRCS to improve and conserve forests for any landowner's goal is to work with one of our partners or consulting foresters to write an NRCS-approved forest management plan. Currently, partners who can provide this service include the Kentucky Division of Forestry, the National Wild Turkey Federation, and the Ruffed Grouse Society. Consulting foresters who are certified by NRCS as a technical service provider can also write forest management plans. Getting a plan written by a technical service provider

is an NRCS practice that can be cost-share eligible through the Environmental Quality Incentives Program, or EQIP. Working with one of the many great Kentucky forestry experts will set the groundwork for conservation projects in your forest.

The most common practice that NRCS supports to modify forest composition to increase carbon sequestration is the forest stand improvement practice. By utilizing forest stand improvement to remove less desirable and shorter-lived tree species and promoting more long-lived and economically viable species, carbon sequestration can be enhanced greatly. By leaving removed trees to decay naturally in the forest, carbon can be added back into the soil and stored in the downed material. Leaving trees to decay on the forest floor and leaving snags standing in the forest also increases the quality of the forest as wildlife habitat for many cavity dwelling birds and mammals. After doing a forest stand improvement project, the longer-lived tree species can then sequester more carbon from the atmosphere. When given room to grow and thrive, their ability to store carbon is increased. Finally, if the trees are eventually harvested, species that will be used for durable building materials, furniture, and many other uses will continue to store the sequestered carbon for generations to come, long after the life of the living tree is over.

This tree was treated with hack and squirt method to improve the forest stand.

Another practice NRCS supports is tree and shrub establishment. By planting trees on open land that was previously forested or promoting natural regeneration on land that can grow larger long-lived trees, carbon stored per acre is drastically increased. Planting and enhancing previously disturbed lands that were cleared for pasture or cropland, the active restoration of wetlands, and even planting trees on abandoned mine lands that currently do not support trees are all opportunities to increase the amount and quality of forestland in Kentucky. Working with a forester who will be able to suggest trees that are adapted to your land and sourcing tree seedlings or prescribing the steps on how to get natural regeneration of long-lived species, is a critical first step to getting a jump start on the next generation of healthy forests.

Depending on management objectives, felled trees may be left to naturally decay or used for firewood.

All photos courtesy: NRCS

Riparian forests along streams and rivers can be the best forest sites within a watershed. By paying special attention to these areas utilizing the riparian forest buffer practice, carbon sequestration can be increased above any other forest type. In areas where the riparian zone has been cleared or modified, planting trees along the stream edge is a way to both restore the function of the stream system and increase carbon sequestration. Riparian forests also improve water quality by filtering pollutants and decreasing water temperature. Wildlife habitat for many aquatic and terrestrial species is created or enhanced as well. Riparian areas are often subject to invasion by non-native invasive brush and tree species. By treating these areas and removing the invasive species utilizing the brush management practice, the health and function of the riparian forest is improved.

NRCS supports many other practices that can be used in your woodlands to increase the health, growth, composition, and sustainability. If you are interested in working with NRCS and would like more information on how to get started, please take some time to visit your local NRCS Service Center and speak with one of our great conservationists about the steps you can take to start your forest conservation journey. Perhaps you already have a forest management plan and would like more information about how to do more conservation work in your forest. An NRCS conservationist will be able to help you with many programs, such as EQIP, that are available now. Together we can continue to improve Kentucky's forests that provide clean air, water, wildlife habitat, and sequester carbon, giving us a chance in our fight against climate change.

KWOA

Kentucky Woodland Owners Asociation

www.kwoa.net

Kentucky Woodlands of Tomorrow

by Doug McLaren, Past President of Kentucky Woodland Owners Association (KWOA)

During my career as a professional forester, I have had the good fortune to visit numerous woodlands owned by enthusiastic owners. Each of these properties differ due to landowner objectives, market accessibility, geographic location, species composition, and past and future management practices of harvesting, timber stand improvement (TSI), or some pre-commercial thinning project. The woodlands resulting from these factors create the great diversified forests found in the Appalachian Mountains of today. The future objectives of the woodland management plan are always emphasized, but one feature of eastern deciduous hardwood forests that is usually not fully discussed in the plan is the history explanation of how these forests developed, over time.

Today's woodlands and forests, nationwide, are often the result of previous events that lie beyond the landowner's control. Chestnut blight over 100 years ago introduced a fungus eliminating the American chestnut from the forest landscapes. The chestnut tree was nearly one-fourth of the forest before 1900. More recently, the American ash was eliminated from the woodland landscape due to an insect. Central Kentucky woodlands presently are invaded by honeysuckle—a shrub—that prevents future reproduction of hardwood seedlings because they cannot find enough sunlight to grow. Gypsy moth, now known as "spongy moth," affected growth of oaks in northeastern United States fifty years ago and is regularly monitored on Kentucky's borders. America's early pioneers planted the American elm throughout United States as a community tree. These streets no longer have the picturesque trees of their former landscapes: A disease, the American Dutch elm disease, eliminated this species in the 1950s and 60s. The native hemlocks found primarily along streams of Kentucky helping to cool the waters are being threatened by the insect hemlock woolly adelgid. Our forests and woodlands of today have been altered throughout the past century due to forest health issues.

These numerous health threats altering our woodlands are consistently discussed by individuals in the forest community. Two issues that may change our forest management plans are carbon credits and climate change, which might alter our forests and plant communities. These "what if" scenarios should be taken into consideration by woodland owners for the development of a woodland management plan in Kentucky.

The Kentucky Woodland Owners Association, with its many facets of communication, continue to discuss this list of issues among Kentucky woodland owners and forest professionals. We invite you to become part of the forest health conversation. Visit, join, and experience KWOA. The professional forester provides decision-making information to woodland owners, guiding them to produce productive forests of tomorrow with the discussions and decisions made today.

For more information visit www.kwoa.net

Kentucky Tree Farm Committee Newsletter

The Kentucky Tree Farm Committee is responsible for administering the Tree Farm program in Kentucky. One of the most difficult but enjoyable responsibilities of the committee is selecting the annual Tree Farmer and Logger of the year award winners. Read on to learn about the most recent Kentucky Tree Farm Committee award winners.

Tree Farm Awards Presented at the KFIA Annual Meeting

The 57th Annual Meeting of the Kentucky Forest Industries Association (KFIA) took place in late March at the Embassy Suites Hotel in Lexington, KY. The state tree farm committee presented a number of awards for outstanding work related to forest management during the meeting. The 2022 Kentucky Tree Farmer of the Year award was presented to William Johnson, who manages a 153-acre tree farm near Olive Hill, KY. Johnson has treated all of his woodlands to increase the growth of existing trees and improve the health and value of his forest land. He also has treated and removed a wide range of invasive plants to prevent them from taking over sections of the property. In addition to all his management activity, he had a recent 70-acre timber harvest that left the area in great condition and supplied a source of income from the property. The property is also used as an educational tool to promote good sustainable woodland management by conducting field days. It also hosts educational events to encourage other woodland owners to improve their forests for a wide range of environmental benefits, including timber production and wildlife habitat.

The Kentucky Tree Farmer of the Year award was presented to William Johnson.

Photos courtesy: KFIA

Also honored was William Knott, who works as a service forester for the Kentucky Division of Forestry in Morehead, KY, as the Kentucky Tree Farm Inspector of the Year. Knott has spent his career working with woodland owners throughout Eastern Kentucky. He has made a major impact by advising and assisting private landowners by developing forest management plans to meet their goals, from increasing economic value to improving wildlife habitat and a wide range of other benefits from the woodlands. Knott has supported the Kentucky Tree Farm Program throughout his career and in the past year approved a number of new tree farmers into the program. He also followed up with existing tree farmers to update their management plans and keep them in the certified Kentucky Tree Farm Program.

The Kentucky Tree Farmer of the Year Inspector award was presented to Bill Knott.

The final award presented was the 2022 Kentucky Logger of the Year, presented to TNT Logging, which is a third-generation logging business located in Vanceburg, KY. The company is owned and operated by Tom Fetters, Jr., who works with his two sons, Jacob and John, who do outstanding work in properly harvesting and removing timber for landowners. TNT Logging operates a wide range of equipment, including dozers, skidders, trucks, knuckleboom loaders, and a cutoff saw to move the trees from the woods to the mill. The company works closely with the Kentucky Division of Forestry to make sure that all logging jobs are closed out to meet all state water-quality requirements and ensure that the landowner who sold the timber is completely satisfied with how the property looks when the logging is complete.

The Kentucky Logger of the Year award was presented to Tom Fetters, Jr.

The recipients were presented their awards at the KFIA luncheon during the annual meeting, which was attended by over 375 association members. All of the winners were given a plaque to show appreciation for their accomplishments and support of forestry in Kentucky. The Tree Farmer and Logger of the Year were also each presented a Stihl chainsaw, sponsored by Bryan Equipment Company, Loveland, OH, which is the Stihl distributor for Kentucky.

Carbon, Climate, and Forest Management

by Jacob Muller and Jordan Shockley

Forest carbon is a hot topic, but we probably don't need to tell you that. Family forest owners are increasingly interested in enrolling their forests in carbon credit programs, though many are unsure if a carbon program is right for them or if they are even eligible to participate. If you are eligible to participate, it's so important not to rush to sign any contracts until you know exactly what the terms of the contract mean for you and your land.

As we detailed in the article "Ins and Outs of Forest Carbon" in the last issue of Kentucky Woodlands Magazine, carbon sequestration is the process of carbon dioxide being pulled from the atmosphere by trees and stored as woody biomass. The carbon is only temporarily stored in the forest while the trees are alive and growing. Depending on the species of tree, this may range from 100 to over 300 years. Carbon is cycled through the atmosphere, soil, and forests, as trees continually gain and lose carbon through sequestration, respiration, and decay. Because of this, accounting for carbon must consider the losses and gains, which we call "total carbon."

Forest management alters the rate of carbon losses and gains. Climate-smart forestry and carbon-focused forestry aims to increase the amount of carbon gains to the forest. This means that management is focused on increasing the capacity of the forest to absorb and store carbon. Promoting healthy forests that are productive and long-lived is critical. This means that the ways we manage the forest and the species we promote matter. Removing unhealthy (dead and decaying) trees and creating more growing space for healthy trees is important. It's also important to manage for tree species that have longevity. This means tree species that are resilient to future disturbances and adapted to future climates.

Forests and climate are interlinked. Forests help moderate the climate by controlling the amount of carbon dioxide in the atmosphere. A stable climate helps forests grow and live longer by reducing the likelihood of extreme events and intense storms. However, this is a complex relationship and one that we still are learning about. There are many ways to look at climate-smart (and carbon-smart) forestry. Whether the focus is reforestation, stand improvement, or controlling pests and pathogens, the aim is to increase healthy forests and decrease unhealthy forests. But there must be something more to it, right? Well, yes, there are always tradeoffs. When you reforest an area, you may be losing valuable ag lands. When you manage your forests on a longer rotation, you may be delaying some economic returns through frequent timber harvest. And certainly, there can be additional costs when implementing non-commercial treatments to increase the health and resiliency of your forests. The goal for woodland owners must be to balance the costs and benefits, the losses and gains. Timber is an incredibly valuable resource here in Kentucky; we can't lose that resource in the name of carbon programs. However, we think it is possible to find a balance to climate-smart forestry, forest commodities, and carbon.

This article barely scratches the surface. In the coming months, we will be releasing a series of carbon Extension publications for landowners in Kentucky. We look forward to expanding on these topics (and many more) and sharing them with you!

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A Tribute to Cliff Taylor

by Jeff Stringer

Photos courtesy: Taylor Family

Cliff Taylor developed one of the most sophisticated woodland ownerships in Kentucky and garnered significant recognition in the Eastern United States. He has left a significant legacy for both his family and the multitude of woodland owners who will benefit from the example he provided.

As with many woodland owners, Cliff was open and interested in sharing his woodlands and knowledge with others. His career in forestry and agriculture Extension in both Kentucky and Florida, no doubt, contributed to his interest in educating others. He was progressive in his use of Farm Bill programs to improve his woodlands and built a strong relationship with Chris Will and Central Kentucky Forest Management, implementing advanced silvicultural practices, including the promotion of white oak regeneration.

The interest in educating others and opening his woodlands up to numerous field days and workshops has had a significant impact on forestry in the Eastern U.S. in ways that he could not have foreseen but are nonetheless attributable to him. The biggest and best example of this impact is the collaboration between the University of Kentucky (UK) and the DendriFund, affiliated with Brown-Forman, that led to the partnership with the American Forest Foundation and the formation of the White Oak Initiative. His use of advanced practices in white oak management spawned a field day at his woodlands for the Society of American Foresters. One of the family members of Brown-Forman attended, became enlightened about white oak management, and this resulted in subsequent partnering with UK that ultimately led to the formation of the White Oak Initiative in 2017.

Cliff's legacy lives on through this multimillion dollar, 17-state initiative to improve upland oak management. Cliff, along with his sons Scott and Steve, and with the aid of Chris Will, also established the first dual certified American Tree Farm and Forest Stewardship Council (FSC) family-owned woodland in Kentucky. This interest in certification, and the American Tree Farm certification through the Center for Forest and Wood Certification at UK led to the production of the first certified whiskey barrels produced in America. His certified white oak stave logs were used by Kelvin Cooperage in Louisville for barrels exported to Irish Distillers. Ultimately this led to the first release of Redbreast Whiskey's Kentucky Oak Edition, estate brand "Taylor Family Elk Cave Farm" in 2022. All bottles were snatched up quickly by buyers after its release in the U.S., and it was voted #2 most exciting whisky of 2022 by Whisky Advocate, no doubt due to the taste imparted by wood from Taylor's Elk Cave Farm.

As one might suspect, the Taylor farm and Cliff also garnered a number of accolades from more traditional sources, the most notable of these was being recognized as the 2017 Kentucky Tree Farmer of the Year and one of four nationally recognized Regional Tree Farmers of the Year in 2022. In typical fashion, the Taylors continue their interest in education and the advancement of forestry students at the University of Kentucky through the Taylor Family Forest Scholarship. All of this is a significant legacy resulting, from what I am sure Cliff would describe, as "business as usual," conducted with grace, charm, and humility. Thank you, Cliff!

The Maple Syrup Community Across Kentucky

by Billy Thomas

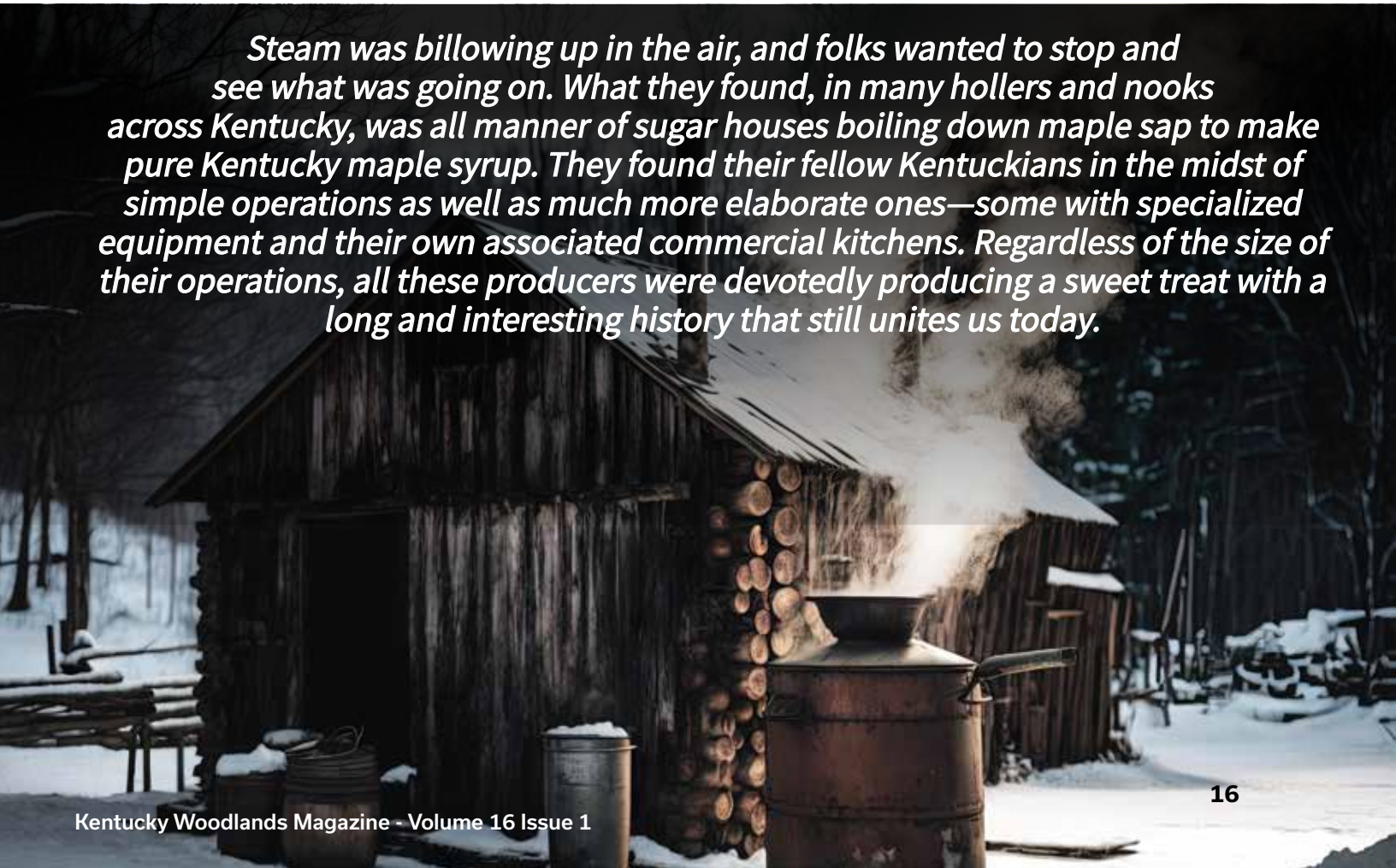
Trees connect us in so many ways. During the 2023 Kentucky Maple Day, this connection was made repeatedly across Kentucky. The 19 locations that opened their operations on the first Saturday in February experienced that connection between people and trees firsthand as nearly 2,000 visitors spread out across the state to sample and buy Kentucky maple syrup and related products. While visiting nearly every corner of the state, these Kentuckians were also able to learn about the process of making this unique, organic product right here in Kentucky. They were also able to learn a little about the growing Kentucky maple-syrup community.

Maple Syrup Demand and Production

Because demand for Kentucky maple syrup far exceeds supply, producers find it difficult to keep product on hand. This is a good and bad problem: It is good that maple syrup producers can sell all they produce, and it is bad because many Kentucky consumers are unable to get their hands on Kentucky maple syrup. This begs the question, "Why aren't there more maple-syrup producers in Kentucky?" The answer, as is often the case, is nuanced and complex. Some may not realize it can be made here in Kentucky, some may not be interested in trying another pursuit, and others may simply not know how to get started. This year's shorter-than-usual maple-tapping season in Kentucky is also a reminder that maple-sap flow for maple-syrup production is weather and climate dependent. Maple-sap flow is dependent on freeze-thaw cycles, where temperatures dip below freezing overnight and then rise above freezing the following day creating the pressure differential for sap to flow. Because of a changing climate, it should be noted that sugar maple is expected to be less abundant in its southern range, which extends just down into Tennessee. On the other hand, red maple, which often has less sugar in its sap but is readily tapped, is already the most abundant tree in Kentucky and its abundance is expected to greatly increase in the future. To learn more about how climate change may impact maple-syrup production as well as potential adaptive measures, visit https://www.fs.usda.gov/ccrc/topics/maple-syrup.

A Community of Maple-syrup Producers, Supporters, and Consumers

Fortunately, for those who may be thinking about try-



Steam was billowing up in the air, and folks wanted to stop and see what was going on. What they found, in many hollers and nooks across Kentucky, was all manner of sugar houses boiling down maple sap to make pure Kentucky maple syrup. They found their fellow Kentuckians in the midst of simple operations as well as much more elaborate ones—some with specialized equipment and their own associated commercial kitchens. Regardless of the size of their operations, all these producers were devotedly producing a sweet treat with a long and interesting history that still unites us today.

ing to make their own maple syrup there is a wealth of information available online and a welcoming community of Kentucky maple-syrup producers and others who are trying to work together to advance maple-syrup production in Kentucky. By working together, the hope is producers will be able to learn from one another while saving everyone the frustration and costs of mistakes that could be avoided with the right knowledge at the right time. The rest of us should benefit by having greater access to Kentucky maple syrup. Beyond those who are producing maple syrup, the Kentucky maple-syrup community has many more current and potential members. Woodland owners, whether they are syrup producers or not, are also important members of the community because they own the land where maple trees grow. Many producers enter into agreements with neighbors and others to access maple trees they may not have on their own property. Maple-syrup consumers are a crucial part of this community because their demand for a local, organic, sweet treat is helping to fuel the expansion of maple-syrup production across the state. Forestry, natural resources, and agricultural organizations are also a critical part of the maple-syrup community. Organizations such as the Kentucky Maple Syrup Association, UK Department of Forestry and Natural Resources, Kentucky Center for Agriculture and Rural Development, Kentucky Division of Forestry, Kentucky Department of Agriculture, and the Kentucky Natural Resources Conservation Service are some of the key organizations working to support Kentucky maple-syrup production and the producers.

Check out the recent 2023 Kentucky Maple Day video that highlights just a few of the Kentucky maple-syrup producers who opened their operations for the occasion. See this video at https://ky-maplesyrup.ca.uky.edu/ky-maple-day

maple-syrup community leaned in and helped many of these expanding producers by sharing lessons learned with the hopes of helping them to avoid common issues that might impact efficiency and the final product. It is true we have much to learn about maple-syrup production in Kentucky. It is also true that by working and learning together we will have the best chance to have a vibrant maple-syrup community that in turn supports sustainable woodland management, community engagement/development, and ultimately greater access to some of that sweet, pure, organic Kentucky maple syrup. A good place to start is to visit the Kentucky Maple Syrup Project at https://ky-maplesyrup.ca.uky.edu.

Maple sap is collected by inserting a tap into maple trees then using tubes, buckets or bag to collect the sap before boiling it down to syrup.

A maple syrup producer in northern Kentucky explaining the process of converting maple sap into maple syrup.

Getting Involved in the Maple-syrup Community

There is a growing Kentucky maple-syrup community and numerous opportunities for you to get involved as a producer, consumer, supporter, or all three. Many of the maple-syrup producers in Kentucky started out tapping a few trees in their yards before getting bit by the "maple bug," causing many to want to increase production. The

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Photo courtesy: Renee' Williams

FORESTRY 101

by Laurie Taylor Thomas

Kentucky Woodlands and Climate Change

As the impacts of climate change continue to affect our planet, it is important for woodland owners and land managers to understand how these changes will affect trees and woodlands. Fortunately, a variety of web applications and tools are available to help woodland owners and land managers make informed decisions and manage their land in a way that is sustainable and climate-resilient. One of the significant impacts of climate change on woodland management is the predicted change in forest-species composition. Let's take a closer look at this impact and how web applications can help woodland owners manage this change.

Change in Forest Tree Species Composition

Climate change is causing a shift in temperature and precipitation patterns across the planet. In Kentucky, these conditions are unlikely to substantially reduce the forest cover, but it will most likely influence changes in forest species composition. The climate shifts may lead to the migration of certain tree species to areas that are more suitable for their growth and survival. As temperatures rise, tree species that are adapted to cooler climates are expected to move northward or to higher elevations. Similarly, as rainfall patterns change, tree species that require more or less moisture are expected to migrate accordingly. The climate predictions for Kentucky include higher temperatures and increased annual precipitation as well as changes in periodic precipitation with reduced rainfall during the growing season.

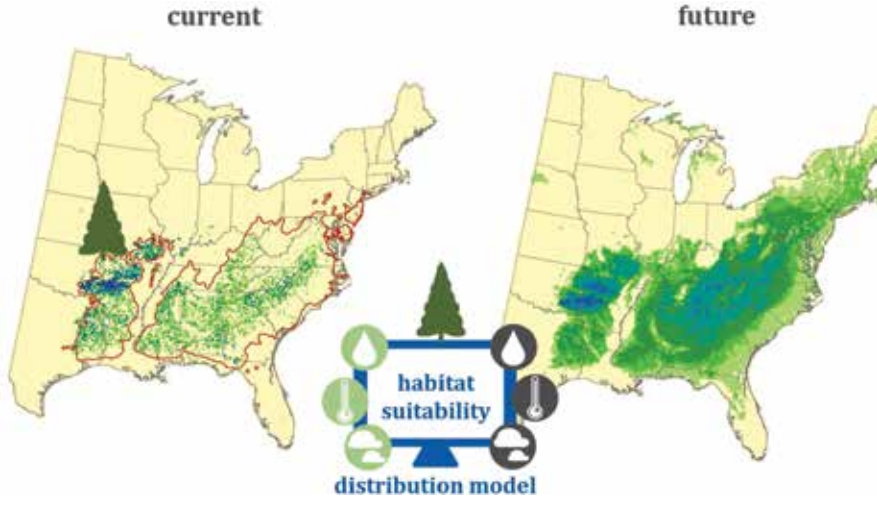
The changes in temperature and precipitation that may lead to changes in forest-species composition will have significant implications for woodland management. Woodland owners and land managers will need to consider how these changes will affect the composition and structure of their forests as well as the economic and ecological values of their land. For example, tree species that are currently being harvested for timber may no longer be suitable for growth in certain areas, while other species may become more abundant and valuable.

Web Applications for Understanding and Managing Changes in Forest Species Composition

Fortunately, there are several web applications and tools available to help woodland owners understand and manage for these predicted changes in forest species composition. Here are some of the most useful:

U.S. Forest Service Climate Change Resource Center
https://www.fs.usda.gov/nrs/atlas/tree/

The Climate Change Resource Center includes the Climate Change Tree Atlas. This interactive web application provides information on climate-change impacts across the United States. The Atlas can help answer a range of questions about the current and projected potential



The Climate Change Tree Atlas can be used to examine how tree species ranges may change in the future.

suitable habitat by the year 2100 for 125 tree species within eastern U.S. forests. The information the Atlas provides for each species includes species characteristics, life history and distribution and which factors such as temperature, elevation or soils that determine the species habitat. This type of information provides some guidance on species sensitivity to large-scale climate differences. The Atlas shows how each species' suitable habitat may change by the year 2100 under different climate models for both high and low emission scenarios. This information can help woodland owners identify potential risks to their land and make management decisions that support climate adaptation. The Atlas provides numerous tutorial videos including: An Introduction to the Climate Change Atlas: How Does It Work?; Adaptability Ratings: Understanding Biological and Disturbance Factors; and Regional Summaries. The following are two example tree species and their response to climate change as projected by the Tree Atlas:

Southern red oak *(Quercus falcata)*

Southern red oak is a widely distributed, relatively densely populated species based on Forest Inventory Analysis data. It is a common species across the southern U.S. but of relatively low importance. The model suggests a large increase in habitat throughout the South, but also a northeastern extension of its range especially under the higher emissions scenario. However, the Atlas' migration model largely limits those northern locations from being naturally colonized within 100 years. Southern red oak is rated as having a "high" adaptability and a very good ability to cope with changing climate.

Southern red oak leaf and acorns.

Photo courtesy: Vern Wilkins, bugwood.org

Eastern White Pine *(Pinus strobus)*

Eastern white pine is a widely distributed and relatively densely populated species based on Forest Inventory Analysis. It is an important northern pine species. The model projects little change in its suitable habitat by 2100. The Atlas points out that eastern white pine has some traits such as susceptibility to drought, fire and insects that reduce its adaptability rating to "low" to climate change. However, because of its high abundance, the model rates its capacity to cope with climate change as "fair."

Forest Adaptation Resources: Climate Change Tools and Approaches for Land Managers
https://www.fs.usda.gov/research/treesearch/52760

Forest Adaptation Resources is a comprehensive guide to climate-change adaptation strategies for forest managers. This web-based resource includes information on topics such as forest ecology, climate projections, and adaptive management strategies. It also includes case studies and resources for implementing climate-adaptation strategies on the ground. This tool can help woodland owners understand the science behind climate change and make informed decisions about how to adapt their management practices to support resilience.

Nature's Network
https://www.naturesnetwork.org

Nature's Network is a web application that helps woodland owners identify areas of high ecological value and connectivity across the northeastern United States. By mapping ecological values such as habitat quality, water quality, and biodiversity, Nature's Network can help woodland owners identify areas that are particularly important for conservation and management. This tool can help woodland owners prioritize areas for conservation or restoration and make decisions that support ecological connectivity and resilience. Nature's Network is a collaborative effort facilitated by the U.S. Fish and Wildlife Service Science Applications program that brings together partners from 13 states, federal agencies, nongovernmental organizations, and universities to identify the best opportunities for conserving and connecting intact habitats and ecosystems and supporting imperiled species to help ensure the future of fish and wildlife across the Northeast region.

Climate change is one of the most pressing challenges facing woodland owners and land mangers today. It is important to understand how species may respond to the impacts of climate change and to use that knowledge to make informed decisions to develop, adapt and carryout management practices to support forest resilience in the face of changing conditions.

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RESEARCH IN BRIEF

Research Supporting Woodland Owners and Management in Kentucky

Severity of Fire Influences the Competitiveness of Different Tree Species

by Scott G. Culbert, Mary A. Arthur, Jacob J. Muller, Claudia A. Cotton

In eastern U.S. forests, including those of Kentucky, oak (***Quercus spp.***) and yellow pine species (i.e. shortleaf pine, pitch pine, and Virginia pine) have historically dominated upland forest communities but are now experiencing challenges with regenerating and growing back into canopy-sized trees. These challenges largely stem from "Smokey the Bear" era fire-suppression policies that successfully eliminated nearly all burning in these forests from the early 1900s until about 1980. Prior to this, frequent burning caused forests to be less dense with more open growing conditions, which allowed for oaks and pines that thrive in high-light environments to acquire light and grow. Many of these oaks and pines also have adaptations to withstand fire—thick and rough bark that protects against fire damage, rapidly healing fire wounds, leaf litter that is more flammable, and the ability to resprout from roots—that allowed them to persist when fire would frequently burn through a forest. With fire suppression, species that lack these adaptations were no longer being killed by frequent burning and grew into increasingly dense forest midstories. These species include red maple (***Acer rubrum***), American beech (***Fagus grandifolia***), and yellow-poplar (***Liriodendron tulipifera***), among others. Now these species, which are also more shade-tolerant, tend to dominate forest midstories because they can stand the denser, more shaded conditions that prevent oak and pine seedling growth. If these conditions continue, oak and pine species in forest canopies will eventually be replaced by fire-intolerant species, which would have severe economic and ecological consequences.

Finding solutions to fix these challenges has driven land managers to reintroduce fire into our forests via prescribed burning, which are typically low-severity surface fires. These fires can be beneficial for killing understory maples and stimulating the growth of oak and pine seedlings, but since they are low-severity, they are ineffective at killing larger trees to create the light gaps that oaks and pines need to grow into larger sizes. However, might medium- or high-severity fire, with hotter temperatures and higher flame lengths, have a greater capacity to kill larger trees and create meaningful forest changes that benefit oaks and pines?

An accidental wildfire ignited in 2010 in the Daniel Boone National Forest, Kentucky, provided an opportunity to answer that question by monitoring forest vegetation response over 12 years (Figure 1). Forest

Figure 1. Aerial view of the wildfire that was studied.

communities changed along a gradient of burn severity, with areas that didn't burn at all to areas with nearly 100% mortality of forest vegetation. One year after the fire, there were abundant seedlings and saplings in the burned areas and researchers determined that increasing burn severity did reduce the amount of midstory and canopy-sized trees (Figure 2). By year six, many of those

Figure 2. Initial regrowth in an area that burned at high-severity, one year after the fire.

seedlings and saplings had grown into midstory sizes, but different levels of burn severity affected species differently. With increasing burn severity, the number of oaks and pines that grew into midstory sizes increased, but for fire-intolerant species such as red maple, increased burn severity did not change the rate of growth into midstory sizes. The more open conditions that were created by increasing burn severity, in combination with the growth-stimulating effects of the fire, created an

environment that made fire-adapted species more competitive. Unfortunately, higher burn severity was also strongly related to the influx of non-native invasive plant species, particularly Chinese silvergrass (***Miscanthus sinensis***), which was found in 19% of research plots and is known to suppress tree growth, alter litter decomposition rates, and increase flammability.

To see if these results persisted over time, we returned to the same site six years later and found results that were largely similar to previous years. At year 12 post-burn, there was substantial regrowth, with 154% more trees measured than six years before. Similar to year six, we found that the number of fire-intolerant species that grew into larger sizes did not change at different levels of burn severity. We also found that the pine trees that had grown into the midstory at year six were growing larger into sub-canopy sizes by year twelve and were doing so at higher rates in areas with higher burn severity. However, for oak trees, higher burn severity no longer had a relationship with growth into larger sizes, meaning that oak trees grew into larger size classes equally at all levels of burn severity; this was not the case at year six. This is due to the increased midstory density, which creates less open growing conditions. Aside from oaks and pines, when we considered all fire-adapted species together compared to fire-intolerant species, we observed that at low burn severities, fire-intolerant species were significantly more dominant, but at higher burn severities, fire-adapted species became more dominant (Figure 3). The burn severity at which fire-adapted species became more dominant (CBI = ~2.0) is noteworthy, as prescribed fires rarely exceed a CBI value of 1.5. This provides direct evidence that the severities of prescribed fires are not high enough to alter forest conditions in ways that increase the competitiveness of fire-adapted species relative to fire-intolerant species. Unfortunately, we still found that higher burn severity caused greater likelihood of invasive species: Areas with high-severity fires were 34.6 times more likely to have invasive species than low-severity fire (Figure 4). Likewise, Chinese silvergrass was now found on 73% of research plots.

Overall, these results suggest that a single fire with areas of increased severity can provide long-term benefits of altering forest compositions toward fire-adapted species, with yellow pines being able to respond to the fire and grow into sub-canopy sizes within twelve years. To promote oak species growth into larger sizes, it may be necessary to administer a prescribed burn or mid-story thinning treatment within six to 12 years following higher-severity fire. However, to safeguard some of the ecosystem benefits of increased burn severity, invasive plant monitoring and control measures must be put into place for several years following any fire, especially one that is high-severity.

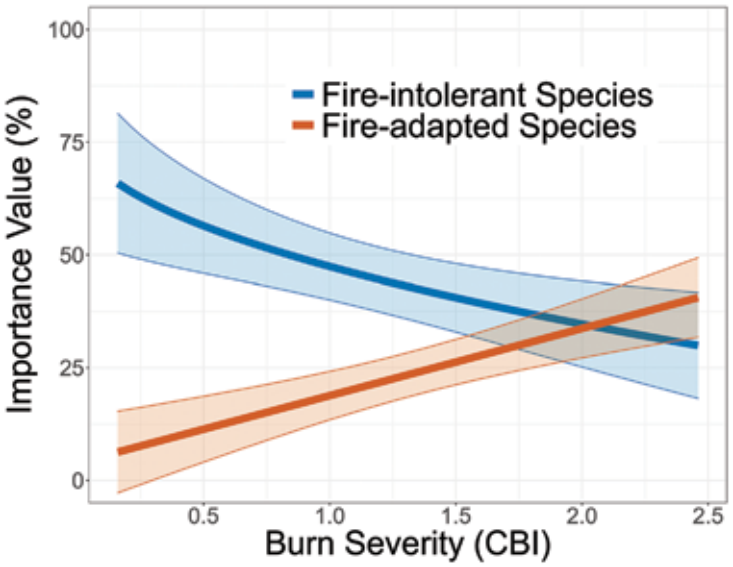

Figure 3. Importance values of fire-adapted and fire-intolerant species across a range of burn severities where low (CBI = 0) represents unburned and high (CBI = 2.5) represents near 100% mortality of vegetation. Importance is synonymous with dominance and is a combination of the number of trees and their size.

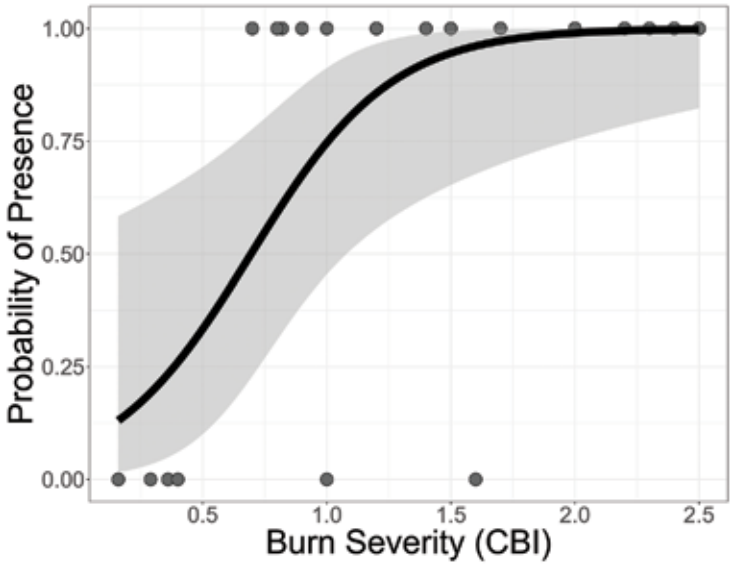

Figure 4. The presence and absence of invasive species at different levels of burn severity, where low (CBI = 0) represents unburned and high (CBI = 2.5) represents near 100% mortality of vegetation.

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Want to learn more about Kentucky's forests and wildlife? Check out these UK Forestry Resources:

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kentucky WOODLANDS

Bobby Ammerman Tribute

The Kentucky forestry and wood industry community lost a special person when Bobby Ammerman passed away at the end of 2022. Bobby was a long time employee of the University of Kentucky Department of Forestry and Natural Resources and was the Director of the UK Wood Utilization Center in Quicksand. He was the first employee of the University of Kentucky to be a board member of the Kentucky Forest Industries Association. Bobby was highly respected and valued, both within the University of Kentucky and among Kentucky's forest products industry. Since 1998, Bobby served as a Wood Products Extension Associate at the University of Kentucky where he earned tremendous respect from years of valued professional service working with the forest products industry. He was responsible for helping numerous forest product industries to remain competitive. He was a driving force behind the Ohio Valley Lumber Drying Association and through continuing education helped generate over $10 million dollars annually for lumber drying industries in the region. Bobby was manager of the forest industry section of the Center for Forest and Wood Certification, where he managed one of the largest groups of certified small forest products companies in the U.S. With his direct support, these companies sold $20 million dollars of certified products annually. Bobby's touch went well beyond the industries he was able to help. He will be most remembered by family, friends and those he worked with at the UK Department of Forestry and Natural Resources and at the Robinson Center for Appalachian Resource Sustainability where the new 80-seat lecture hall he designed bears his name. He was a respected professional, a warm and caring individual, and most importantly a friend, husband, and father that we all truly miss.

Kentucky Forest Sector Economic Contribution

Did you know that the Kentucky forest sector contributed more than $13 billion and nearly 50,000 jobs to the Kentucky economy? This annual analysis conducted by UK Forestry and Natural Resources includes: Annual Contribution Estimates, Delivered Timber Prices, Wood-Related Exports, Contribution of One Harvested Acre, the Economic Contributions by Congressional Districts and more. The most recent report highlighting the significant economic contribution of Kentucky's woodlands and the forest sector they support is available at https://forestry.ca.uky.edu/economic-report.

Upcoming Dates To Remember:

Dates:	*Event:*	*Location:*	*Contact:*
October 5, 2023	KY Tree Farmer of the Year Field Day	Carter County	https://forestry.ca.uky.edu/events
October 16, 2023	Maple Syrup Workshop	Boone County	https://ky-maplesyrup.ca.uky.edu/workshops
November 4, 2023	Kentucky Maple School	Madison County	https://ky-maplesyrup.ca.uky.edu/ky-maple-school
March 25-27, 2024	Kentucky Woodland Owners Association Annual Meeting	Madison County	www.kwoa.net
April 2-4, 2024	Kentucky Forest Industries Association Annual Meeting	Fayette County	www.kfia.org

NEWS TO USE

Maple Syrup in Kentucky

The Kentucky Maple Syrup Project partners have been busy gearing up for another maple tapping season. To help producers or those considering tapping into maple syrup production get ready a series of educational and fellowship opportunities have been planned. A (recorded) webinar kicked things off in early September followed by two in-person programs: a workshop on October 16th in Boone County and the 2023 Kentucky Maple School on November 4th at the Berea Forestry Outreach Center. The workshop is in partnership with the Ohio State University and the Maple School will feature maple syrup vendors and experienced producers along with maple syrup specialists to address your maple syrup production and marketing questions. You can register and learn more about these programs by visiting https://ky-maplesyrup.ca.uky.edu. If you are a current or aspiring maple syrup producer consider joining the Kentucky Maple Syrup Association (kmsa.kymaple@gmail.com) to connect with and learn from Kentucky producers.

Tree Week in Kentucky

The Urban Forest Initiative is pleased to announce the 6th annual Tree Week will take place October 6-15, 2023, a week-long celebration of the trees and greenspaces around us! Through a series of nature and tree-themed events, Tree Week strives to foster a deeper appreciation and understanding for the important roles nature and trees have in improving our quality of life. Tree Week 2023 is taking place in communities throughout Kentucky. To find activities near you make sure to visit: https://ufi.ca.uky.edu/treeweek

Kentucky Master Naturalist Program

The Kentucky Master Naturalist (KYMN) program trains dedicated volunteers who promote and support the conservation and management of natural resources and natural areas within their communities. Becoming a KYMN volunteer requires an initial training with 40 hours of combined classroom and field instruction and 40 hours of approved volunteer service. Currently there are more than 300 Kentucky Master Naturalists who have contributed thousands of volunteer service hours. To learn more about the program visit: https://naturalist.ca.uky.edu

From The Woods Today

Each Wednesday at 11 a.m. Eastern Time the UK Forestry and Natural Resources Extension team offers an online program called "From the Woods Today". The weekly program offers relevant and timely information about woodlands, wildlife and various related topics impacting Kentucky's woodlands, their owners, and those who depend on them. Each week we welcome UK specialists and partner organizations to share their vast knowledge of Kentucky's woodlands and the wildlife that calls them home. Make sure to join us or catch a recording of From the Woods Today by visiting http://www.FromTheWoodsToday.com.

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Join Us!

From the Woods Today is a weekly internet show presented by the UK Forestry and Natural Resources Extension team.

A link to the live shows and recordings of past shows are posted at www.FromtheWoodsToday.com.