



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

by Jacob Muller and Logan Baker

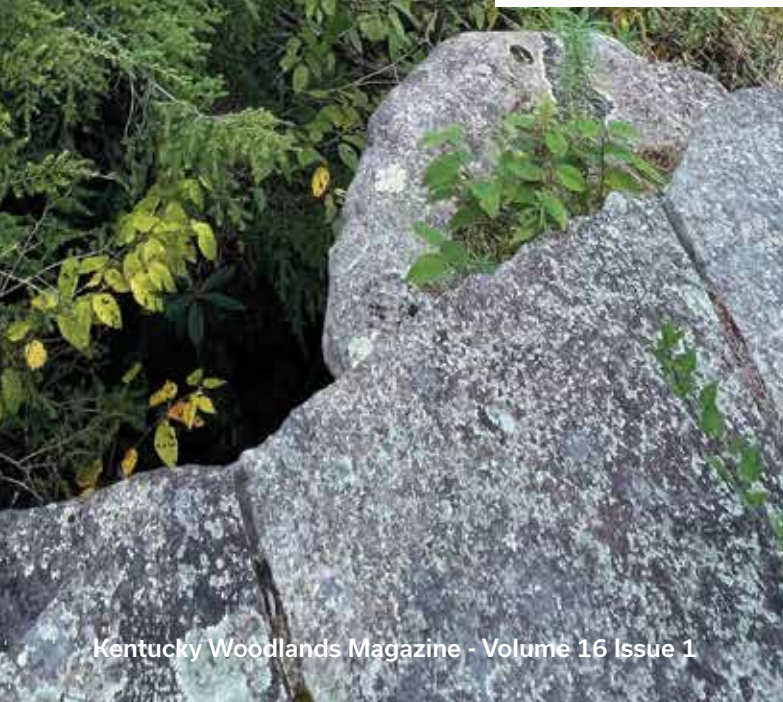
As woodland owners, we typically want what's best for the land and we select management goals that align with our interests and values. We also want practical solutions to problems that arise in the woodland: invasive plants, regeneration failures, lack of merchantable trees, and more. To address these 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

“ 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. ”

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.

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



Adaptation Options

RESISTANCE



- Improve defenses of forest against change and disturbance
- Maintain relatively unchanged conditions

RESILIENCE



- Accommodate some degree of change
- Return to prior reference condition following disturbance

TRANSITION



- Intentionally facilitate change
- Enable ecosystem to respond to changing and new conditions

Reduce impacts/maintain current conditions

Forward-looking/promote change

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.

We would love to hear from you on your perceptions of the silvicultural concepts and approaches discussed in this article. Please use this QR code to access an optional survey designed by researchers from the University of Kentucky to share your thoughts.



Nagel, Linda M., et al. "Adaptive silviculture for climate change: a national experiment in manager-scientist partnerships to apply an adaptation framework." *Journal of Forestry* 115.3 (2017): 167-178.

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