Integrating CLIMATE CHANGE into Your Work

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Foresters face increasing challenges in implementing sound, long-term management actions due to the increasing impacts of climate change in combination with other ecosystem stressors. The amount of information about climate change and forests is growing rapidly, but it can be difficult to keep up with new, complex information and incorporate it into management plans and activities. Fortunately, there are resources available to help foresters consider how climate change will affect their client's forests and address options for adapting forests to enhance resilience as conditions change.

FORESTS IN A CHANGING CLIMATE

The climate has always changed, and parts of the country were under miles of ice during the last glacial period, but the current rate of climate change is so great that trees would need to move at least 10 times faster than they did following the last glacial retreat to keep up with our current rate of warming. This is

more extreme than anything we've faced during the course of human civilization. While one or two degrees of temperature warming may not sound – or feel – like much in our daily lives, a small amount of warming has already triggered noticeable impacts across the country, such as rising sea levels, drought and extreme weather.

The effects of climate change vary across the country, making it impossible to predict exactly what climate change means for a particular location or forest. At the same time, a large body of scientific evidence points to several trends:

- *Seasons are shifting.* Temperatures are rising across the world, and this will continue into the future. As temperatures rise throughout the year, summers are becoming hotter and with more days of extreme heat. The growing season is becoming longer, which could improve tree growth, particularly in the North. However, warmer and shorter winters are also reducing snowpack, reducing water supply in mountainous areas and altering forest processes in the north.
- *Weather is becoming more extreme.* A more energetic climate system is increasing extreme events across the country, although the type of event varies across regions. Although these events have always occurred, climate change is increasing the odds for extreme rain, hurricanes, extreme storms and even droughts. More extreme weather means more ecosystem disturbance.
- *Tree species ranges will shift.* Each tree species has a unique distribution based on climate, environmental factors, disturbance and management. As the climate changes, the range of tree species will shift – generally northward and to higher elevations – in response to warmer conditions. Trees that are located at the southern extent of the species range may be the most vulnerable, with habitat quality deteriorating as temperatures rise.
- *Many stressors will increase.* For many foresters, reducing the effects of forest stressors is already a full-time job. Rising temperatures and more variable weather create conditions that can increase many forest stressors. A warmer climate can allow insect pests (including the mountain and southern pine beetles and hemlock woolly adelgid) and invasive plant species (including kudzu and cogongrass) to expand northward.

SAME JOB, NEW CHALLENGES

The role of a forester is to be a steward to the land, and to essentially follow the campsite rule of "leave it better than you found it." When it comes to being an ACF member, this means working to maintain the values – monetary and otherwise – that your clients associate with their lands. This is the fundamental work of forestry, and emerging management challenges like climate change don't change that.

Managing forests with climate change in mind doesn't mean throwing out what we've learned about managing forests during the past 150 years. In fact, for managers who are really thinking hard about managing for the future and doing the best for the woods and their clients, managing for climate change might not look very different at all. Many of the best forestry practices that we have available are great tools for responding to climate change. It's all about intent. Forest management that is intentional in asking the question, "How might climate change affect this forest and my ability to achieve my management goals?" will be more likely to succeed in a changing world.

Forest management can be used to respond to climate change in two different ways. The first of these is adaptation, which includes actions that prepare for the effects of changing climate and weather. Adaptation actions are often designed to reduce the negative impacts from climate change, such as thinning a forest stand to reduce risks from drought and wildfire. Adaptation can also take advantage of new opportunities from climate change, such as promoting tree species that are more tolerant of hot and dry conditions. So, what adaptation action is best? Adaptation actions will vary widely from place to place based on the needs of a particular forest, so there is no single answer. An action that is adaptive in one place might not work well in another. It's up to the manager with familiarity with that particular forest to determine what makes the most sense (although there are resources to help; see page 33).

The other way to respond to climate change through forest management is through *mitigation*, which is the process of using forests to remove carbon dioxide from the atmosphere and thereby lessen the amount of climate change that occurs. Just through the act of photosynthesis, forests absorb tremendous amounts of carbon dioxide from the atmosphere. In one year, US forests absorb more than 600 million metric tons of carbon, which equates to about 14 percent of U.S. greenhouse gas emissions from all sources (e.g., energy production, vehicles). Forests are increasingly being recognized for their potential as part of the solution to climate change, pointing to the value of many practices that forest managers are already doing: reducing forest losses from land conversion, reforesting degraded and understocked lands, reducing wildfire risks, and implementing management actions that ensure forest health and continued tree growth.

Adaptation and mitigation are often treated as two separate topics, but there's a growing recognition that forest management actions can often do both at the same time – by ensuring that forests are healthy and adapted to current and future conditions, such that they continue to sequester carbon (*aka grow!*) over the long term. Increasing interest in climate change presents an opportunity to position forests and forest management as a positive solution to the climate change problem. This might be a new and useful way to communicate the benefits of forestry to clients and members of the public.

HELPING FORESTS ADAPT TO CHANGE

The U.S. Forest Service published the guidebook *Forest Adaptation Resources*, which outlines different ways to address climate change in natural resource management (www.nrs.fs.fed.us/pubs/52760). Within it, readers will find the Adaptation Workbook, which is a flexible 5-step process that is designed to integrate climate

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change into current management planning processes. The workbook includes more detailed instructions and can be used to develop a climate change adaptation plan; but at a most basic level, it outlines five questions that can be used to think about climate change in a particular place. Think about a forest that you're currently working in – or better yet, go out and stand in it – and ask yourself:

- *What are the management goals and objectives for this place?* Just like "regular" forestry, thinking about climate change begins with identifying the values associated with the property or parcel, such as timber revenue, wildlife habitat and/or recreation.
- *How might this particular forest or stand be at risk from changes in climate?* Every forest is different based on its site conditions and management history. In this step, consider whether your forest is susceptible to potential weather events like drought, extreme rain, extreme storms or hurricanes, flooding or sea-level rise. Also consider whether the tree species might themselves be vulnerable to changes in climate. More resources for this step are provided at the end of this article.
- *Does climate change make your management objectives more or less feasible?* Once you consider how your site may be vulnerable, think about how that might affect your management goals and objectives. Depending on what you are managing for, climate change may make it harder or easier to achieve your objectives, and in some instances, you may decide that you need to change them.
- *What actions can enhance the ability of the forest to adapt to anticipated changes and meet management goals?* Once you've thought about how climate change intersects with your management, you can determine what management actions to pursue. There might not be any need to change your management, particularly if climate risks are low. But where climate risks are greater, it becomes more important to alter your management to address anticipated challenges.
- *What information can be used to evaluate whether the selected actions were effective and to inform future management?* The reason climate change is such a tough issue is because it means that we can't rely on the past to know what the future might hold. This means that we need to define what future success will look like and intentionally learn from our actions over time.

The responses to these questions will be different for every forest and forester. In fact, hundreds of foresters and natural resource managers have used this approach, resulting in a wide variety of real-world examples that match adaptation practices to the needs of a particular management situation (available at www.forestadaptation.org/demos).

Even with these differences, there are a few commonalities to consider when thinking about climate change and forest management:

- Working to maintain forest health, reduce the impacts of pests and diseases, and slow the spread of invasive species will help to reduce stress on forests and make them more resistant to climate change impacts. Keep doing this important work.
- Increasing the diversity of tree species within many forest types can be a valuable way to increase the ability of forests to adjust to changes and to create greater flexibility for future management. While one species may become less productive in the future, others may thrive and be able to fill in newly available habitat.
- Paying attention to consistent changes occurring in the woods can be a huge step forward in recognizing how climate change may be influencing a particular place. Some forest components may be more sensitive to change and need intervention, while others may actually prosper. Be ready to take advantage of new opportunities.

additional resources

The Forest-Climate Working Group (FCWG)
The nation's only forest sector coalition to represent every aspect of U.S. forests' government agencies, landowners, forest products, conservation and wildlife groups, academics and carbon finance experts.
www.forestclimateworkinggroup.org

Climate Change Impacts
The National Climate Assessment summarizes the latest science on how the climate is changing and the effects on natural ecosystems and human communities for each region of the U.S.
NCA report: https://nca2018.globalchange.gov
Summarized impacts by region: www.adaptationworkbook.org/explore-impacts
Climate Change Resource Center topic pages on different management issues: www.fs.usda.gov/ccrc/topics

Forest Adaptation
Forest Adaptation Resources: www.nrs.fs.fed.us/pubs/52760
Adaptation Workbook: www.adaptationworkbook.org

Climate Change Response Framework: www.forestadaptation.org
USDA Climate Hubs: www.climatehubs.usda.gov
Climate-Smart Land Network: www.climatesmartnetwork.org

Forest Carbon Management
Considering Forest and Grassland Carbon in Land Management: www.fs.usda.gov/treesearch/pubs/54316
Forest Carbon: An Essential Natural Solution for Climate Change: www.masswoods.org/carbon
Natural Climate Solutions: www.naturalclimatesolutions.org
Integrating adaptation and mitigation: www.forestadaptation.org/carbon

Climate change is an emerging issue for many foresters, and it will become more and more important to intentionally consider how climate change affects the lands you manage, regardless of whether you're managing for income, wood products, clean water or recreation. Likewise, climate change may introduce new business challenges and opportunities. More resources are becoming available to help managers make decisions and ensure forests are well-adapted to future conditions. As more foresters work on this issue, there is a lot to be learned from the observations and experiences of others who are thinking about how climate change may affect their forest, business or community. Continuing to learn and discuss this emerging topic is the best first step in ensuring the health and productivity of our forests.

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