

Increasing the Resiliency of Forests in New England: The Weather-Wise™ Workbook for Urban and Rural Forests

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Introduction

Over the last two decades, New England has experienced significant changes in its weather, and these changes are expected to continue over the next century and beyond¹. The region is predicted to become warmer and wetter on average, storms more frequent and intense, and with more frequent periods of extreme heat and drought. These changes will alter urban and rural forests by increasing the frequency and size of forest disturbance events, worsening the impacts of invasive and non-native plant and pest species, shifting distributions of tree species and wildlife habitats, challenging the forest economy, and changing the way the public uses and values forests. Although we cannot control these changes in climate, we can work locally to shape and sustain urban and rural forest lands and their contributions to local communities into the future. This guide introduces the WeatherWise™ Workbook and its five WeatherWise™ Worksheets for increasing the resiliency of urban and rural forests in New England to climate change.

Manomet Center for Conservation Sciences developed the WeatherWise™ Workbook to help New England communities and local conservation organizations identify ways to use their forests to make their communities more resilient to changing weather and climate. It is composed of five work sheets (Table 1) and accompanying resource guides that can be used by managers and landowners of urban and rural forests. The worksheets align with topics and themes commonly found in local plans so that users can readily streamline selected elements of a worksheet into their existing management efforts. Each worksheet is aimed at a different users as different users “manage” forests in different settings (e.g., urban vs. rural), obligations (e.g., private vs. public), and scales (e.g., homeowner vs. land use planner). Table 1 can help users identify which worksheets might be useful to their forests.

Table 1. The Weather-Wise Worksheets in the Workbook and main users for each worksheet.

Worksheet Title	Main Users
A Weather-Wise Worksheet for Homeowners	<i>Homeowners, arborists, landscapers</i>
A Weather-Wise Worksheet for Urban Forests	<i>Arborists, urban foresters</i>
A Weather-Wise Worksheet for Urban Forests and Community Planning	<i>Land use planners, urban foresters</i>
A Weather-Wise Worksheet for Private Woodland Owners	<i>Consulting foresters, private landowners</i>
A Weather-Wise Worksheet for Land Trusts and Community Forests	<i>Land trusts, consulting foresters, conservation commissions, land conservation organizations and agencies</i>

The WeatherWise™ Worksheets

Each worksheet lays out four steps to help land managers prepare their forestland for climate change (Fig. 1):

- Step 1 – Prepare for Change. Learn about predicted changes in weather and climate and how your properties might be affected, and who to share your experiences with.
- Step 2 – Plan for Change. Develop a plan for your forests that guides you to action.

¹ Frumhoff, P. C., J. J. McCarthy, J. M. Melillo, S. C. Moser, and D. J. Wuebbles. 2007. Confronting Climate Change in the U.S. Northeast: Science, Impacts, and Solutions. Synthesis report of the Northeast Climate Impacts Assessment. Cambridge, MA: Union of Concerned Scientists.

- Step 3 – Apply Key Strategies and Relevant Best Management Practices (BMPs). Select from a suite of strategies and on-the-ground practices, ranging from simple to more complex, to make your lands more resilient to changes in weather and climate.
- Step 4 – Monitor and Adjust. Develop a cost-effective monitoring plan to determine whether impacts of changing weather and climate are occurring on your parcel and whether you are making the adjustments necessary to reduce impacts.

This follows the Plan–Do–Check–Act frameworks found in diverse arenas including adaptive management, ecosystem

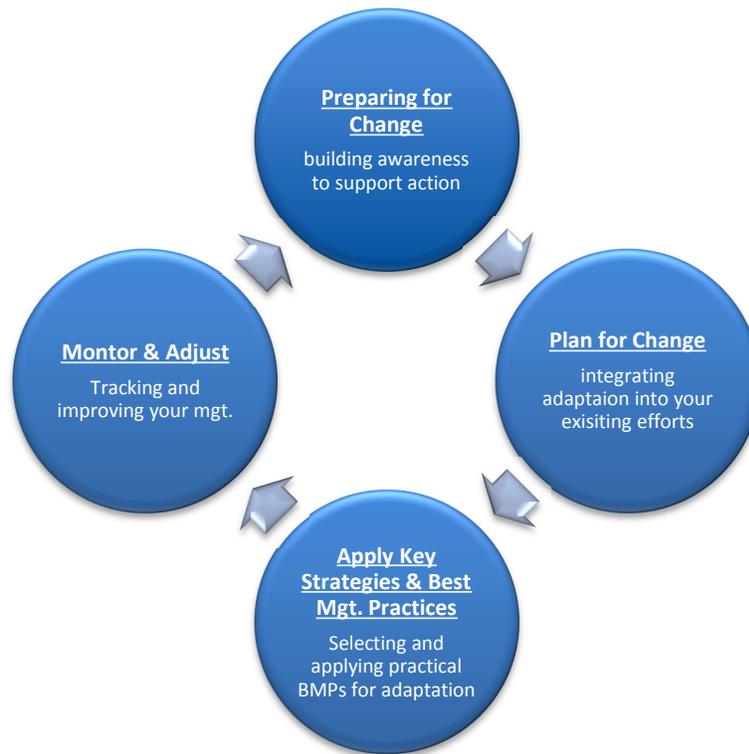


Fig. 1: Management cycle for using the Weatherwise™ worksheets to improve management of local urban and rural forests to make local communities more resilient to climate change.

management, business management, forest management, and community planning. We tried to simplify this approach to make it more useful to worksheet users. It focuses on building awareness, planning, implementation, and learning while doing (e.g., continuous improvement). Most of the worksheets include a planning step because plans are often a key step in managing urban and rural forests, especially for foresters, land trusts, urban foresters, and local planners.

The notion of taking action on climate change can be overwhelming. We designed the worksheet to provide a solid starting point to help make your forest lands more robust in the face of climate change. We encourage users to pick and choose strategies and practices that are practical and relevant to you and for your forest. Although climate change is already affecting urban and rural forests in New England, modest changes in management may be sufficient in the short-term.

The worksheets can be used to find ways to improve your existing management efforts by integrating climate change adaptation. It presupposes that a user already has a mental or written plan for their urban or rural forest. We designed the workbook to meet users where they are now and assist them in taking tangible steps to respond to climate change. You may find that you have already applied some of these strategies and, therefore, have begun preparing and responding to climate change.

Ecosystem Services: Nature's Benefits from Urban and Rural Forests

Ecosystem services of urban and rural forests are simply the natural benefits provided by local urban and rural forests. Local urban and rural forests provide wood for building materials, fuel, and paper production. Trees reduce the urban heat island effect. They reduce cooling costs and shade residents. Trees sequester carbon, manage stormwater, and remove pollutants from the air. They improve aesthetics and quality of life, and have been shown to relieve stress. Broadly speaking, these natural benefits support for human well-being by providing basic materials for good lives (e.g., livelihoods, building materials, food, etc.), health, security, and good social relations². The benefits of healthy urban and rural forests are far-reaching, and almost invaluable. For the downtown areas of Bath, urban forests provide nearly \$1 million dollars a year these types of natural benefits³.

These worksheets have been designed around a key section in each worksheet, Step 3 (Apply Key Strategies). This section encourages users to select strategies and on-the-ground practices in order to use for using forests. It has been organized around several key topics that align to ecosystem services (Table 2). We selected these topics because they are more commonly addressed by managers in management plans than the phrasing of topics typically used to describe ecosystem services. We hope that this will make the worksheets more useful and guide users to using urban and rural forest to maintain key benefits of nature from forests.

Table 2. Seven key worksheet topics in Step 3 (Apply Key Strategies) of worksheets. The list of ecosystem services is from the Millennium Ecosystem Assessment (2005)¹.

Key Worksheet Topics	Ecosystem Services ²
Tree Management and Health	Primary productivity, nutrient cycling, soil formation, Wood and fiber, fuel, climate regulation (global)
Wildlife Habitat	Biodiversity, water purification, flood regulation
Water Quality	Fresh Water, water purification, flood regulation, soil formation
Amenity Values and Recreation	Aesthetic, recreational, educational, spiritual, food
Local Climate Regulation	Climate regulation (local)
Air Quality and Greenhouse Gas Sequestration	Climate regulation (global), air purification
Human Health and Safety	Aesthetic, Recreational

Urban and Rural Forest Resiliency

Local climate change resilience is about the ability of a community to respond and adapt to climate change. To achieve urban and rural forest resilience, local communities, land owners, and land trusts should consider five concepts which can help make local urban and rural forests resilient to climate change⁴:

- **Robustness** - a robust urban or rural forest that can withstand climate change impacts without significant loss of ecosystem services. For example, through planning and management a forest can reduce the threat of climate change, invasive plant species, insect pests, etc. and maintain a healthy forest that provides timber, clean water, wildlife habitat, and other ecosystem services.

² Millennium Ecosystem Assessment. 2005. Ecosystems and Human Well-being: Synthesis. Island Press, Washington, DC.

³ Whitman, A., E. Wilkerson, and R. Wynne. 2014. I---Tree Eco Analysis for Downtown and Suburban Areas of Bath, Maine. Manomet Center for Conservation Sciences, Brunswick ME.

⁴ ICLEI. 2011. Resilient Cities: Congress Report. Bonn, Germany.

- **Spare capacity or redundancy** - An urban or rural forest with redundancy has the capacity to absorb sudden changes in maintenance or partial loss of forest canopy. For example, stands with more than one tree species dominating the canopy are better able to withstand large weather events such as ice storms or large pest outbreaks like hemlock woolly adelgid.
- **Flexibility** - A flexible urban or rural forest can provide ecosystem services to a local community through a number of pathways. For example, multiple recreational forest areas means that recreational opportunities are still available when closure of one recreational area due to storm damage.
- **Rapid re-bound** - Rapidly re-bounding urban or rural forest systems usually have consistent monitoring and oversight at different points of management to permit rapid response. For example, a town may have an urban forester, and/or a forestry committee to help track urban (and rural) forest resources and provide input to planning, planting, and care to the urban forest.
- **Constant learning** - Information is shared and planning is collaborative. For example, a local forestry committee keeps up on current knowledge and collaborates with land planning committees and planners to appropriately integrate this information into local planning.

Any way one looks at it, creating resilient urban and rural forests may require some local changes, including greater local collaboration and use of new information about climate change. These are necessary if communities are able to respond to climate change and maintain the flow of nature's benefits from their urban and rural forests.

Nature of Climate Change

Climate change models provide adequate large-scale projections about global temperature changes but this information becomes imprecise when downscaled. The projections of precipitation models are much more variable than temperature projections. Variable participation projections are challenging because forests are most sensitive to change in drought and long-term change in soil moisture (either increases or declines) and changes in seasonal precipitation patterns (rainier winters and drier summers).

We encourage users to keep climate change in perspective as climate change is not the only threat to urban and rural forests. Climate change may only have a small impact in the short-term, with the exception of Hemlock Woolly Adelgid (HWA). It is unlikely to be the major threat in next decade to urban and rural forests but may exasperate other stressors such as invasive plants and pest species. Managing these other threats to reduce their impacts is a key overall strategy for adapting to climate change. Low- or no-regret strategies and practices are strategies and practices that would make sense to apply even if climate change was not a threat (e.g., application of water quality best management practices when harvesting timber in rural forests). Applying these types of strategies and practices can help ensure your adaptation efforts align well with your goals, objectives, and existing strategies and help protect forests in the short- and long-term.

Resource Guides

The Resource Guides provide references and links to tools, information, and greater detail necessary to help users apply the strategies and practices listed in the WeatherWise™ worksheets. Like with the worksheets, we encourage users pick and choose tools and information that are practical and relevant to you and for your forest. The recommended resources contain a wealth of information but you do not need to fully understand the science on climate change to begin taking small steps to make your forest lands more robust.

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