Northeast

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Description of the Region

The Northeast Region is composed of 12 States (Connecticut, Delaware, Maine, Maryland, Massachusetts, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, Vermont, and West Virginia) and includes 9 of the 10 most densely populated States in the country. The Interstate 95 corridor from Washington, DC to Boston is a heavily urbanized landscape that is mostly at sea level and close to the coast. The Northeast climate is diverse—frequent winter storms bring bitter cold and frozen precipitation, especially to the north in the New England States. Summers are warm and humid, especially to the south in the Mid-Atlantic States surrounding the Chesapeake Bay. The Northeast has been affected by extreme events such as ice storms, floods, droughts, heat waves, hurricanes, and major storms in the Atlantic Ocean off the Northeast coast.

The Northeast is naturally forested, but agriculture is vital in the region. About 21 percent of land in the 12 States of the Northeastern United States is farmland (6 percent of the national total) and 62 percent of the land in the region is classified as timberland. The Northeastern United States is home to about 175,000 farms that collectively produce agricultural commodities worth more than $21 billion per year (USDA NASS 2009). The most prevalent commodities in the Northeast are dairy products and poultry, split about equally between chicken and eggs. About one-half of the field crops grown in the Northeast, including pasture, go to animal feed. Horticulture is a relatively large portion of total plant production in the Northeast, which includes perennial fruits such as apples, pears, blueberries, and cranberries.

Farms in the Northeast, on average, are smaller than farms in many other parts of the country. Organic production is more common in this region than in other regions. Locally grown initiatives, such as farmers markets and farm-to-table restaurants, are important to Northeast urban communities.

Urban areas disrupt much of the natural landscape in the region, which also is an area of high natural biodiversity—second only to the Southeast—and, with the various mountain ranges and physiographic provinces, microclimatic variation is extreme. The combination of urban areas and natural biodiversity in the region indicates a greater importance of the role of agroforestry to expand and link natural habitats to support biodiversity and adaptation. Farmed lands are a necessary part of landscape planning for future climate scenarios. Agroforestry practices in the Northeast can also help protect the many communities here from flood and fire. Hurricanes Irene, Lee, and Sandy provided "teachable moments" by demonstrating the region's vulnerability to extreme weather events and wide-scale flooding.

Threats and Challenges to Agricultural Production and Community Well-Being

Although some uncertainty exists about the impact of temperature rises on rainfall and storm events, increasing temperatures will at least increase the use of water and cause shifts in the timing and nature of plant growth and changes in plant species, ecosystem composition, pests, and disease dynamics. Between 1895 and 2011, temperatures in the Northeast increased by nearly 2 ˚F (NCA 2014). Projections in the Mid-Atlantic States indicate more summer days of extreme heat. More than any other region in the United States, the Northeast Region has seen a greater increase in extreme precipitation. Between 1958 and 2010, precipitation during heavy rain events increased by more than 70 percent. Due to a rise in sea level, coastal flooding has increased approximately 1 foot since 1900. This rate of sea-level rise exceeds the global average of approximately 8 inches due primarily to land subsidence (NCA 2014).

The following agricultural vulnerabilities are of known concern in the Northeast (NCA 2014, USDA Forest Service 2015)—

- Livestock operations could face increased intensity and frequency of summer heat stress, which could decrease production of dairy and poultry and increase the impact of pathogens and parasites. These conditions would likely affect livestock health and increase mortality.
- In addition to direct crop damage, increasingly intense precipitation events can result in wetter fields that may delay planting or harvesting. Field crops are likely to experience heat and ozone stress; drought conditions; impacts of water inundation on fields; and invasive weed, pest, and pathogen outbreaks.

- Warmer winters could impact apple crops due to earlier bloom, causing frost damage; increased summer heat could impact fruit set and result in greater susceptibility to fungal infections.
- Many varieties of berries require substantial winter chilling and may become less viable as warmer winter temperatures become more frequent. This trend may cause increased freeze damage after plants de-harden or if early bloom occurs. Warmer temperatures also likely will intensify pest infestations by pests such as the grape berry moth or blueberry gall midge.
- Increased summer drought frequency will likely challenge Northeast crop producers. Excessive rainfall in the other seasons could lead to flooding, delay springtime planting, and result in lower crop yields. A longer, hotter growing season may benefit some vegetable crops but could also intensify weed and pest pressures by pests such as the Colorado potato beetle, tomato and potato blight, Stewart's Wilt, kudzu, and Palmer amaranth.
- Milder winters have affected and can further affect maple syrup production. With earlier starts in the sugaring season currently experienced in central New England and with the potential decline in sugar maple trees as a result of shifts in forest species composition, producers may experience shorter tapping seasons, lower grade syrup, and reduced maple syrup production (Rustad et al. 2012, Skinner et al. 2010).

Impacts to community well-being are as follows—

- Sea level rise, saltwater intrusion, and flooding will compromise infrastructure and will increased the need for emergency response actions.
- Erosion from heavy rains and, conversely, erosion from drier conditions can adversely affect commercially important aquatic fish and shellfish habitat, as can agricultural pollutants. With additional precipitation, fertilizer applications could increasingly end up in waterways, greatly exacerbating dead zones in our bays and estuaries. Additional sediment in runoff can also be devastating because it greatly alters underwater habitat and can block primary production and sunlight energy.
- Many weeds, pests, and fungi thrive under warmer temperatures, wetter climates, and increased carbon dioxide (CO_2) levels. Many weeds and vines respond better than desirable vegetation to increasing CO_2 concentrations.
- Because each species has a unique biological response to climate change, disruptions of important species interactions—especially with plants and pollinators—can be expected. This shift in range and plant lifecycle can have negative effects culturally on traditional forest food gathering by Native American communities—such as the Wabanaki society's use of berries in the Northeast (NCA 2014).

Agroforestry as an Opportunity To Build Resilience

Agroforestry, as a professional term and suite of practices, has been gaining attention among partners in the Northeast Region during the past 5 or more years, though some agroforestry-related practices have been in use for decades. The ingenuity and flexibility of agroforestry practices and the potential for the long term would be a welcome addition to many farms in the region. On a larger landscape scale, agroforestry could play an important community role by protecting communities, reducing pollutants, storing carbon (C), adding green jobs, and providing linkages and corridors for ecosystem functions.

In summary, agroforestry can help manage the uncertainties and complexities of climate change on multiple fronts by—

- Reducing the impacts of extreme and shifting weather patterns on agricultural production.
- Expanding and linking natural habitats to support biodiversity adaptation.
- Protecting communities from flood and fire.
- Trapping sediments and nutrients before they wash into sensitive aquatic habitats.
- Reducing C impacts through the production of lower emitting biofuel energy and building materials (wood) that store C.
- Providing economic benefits and incentivizing conservation practices by making them more affordable, or providing cost-effective alternatives to traditional approaches.

As part of the development of the Chesapeake Forest Restoration Strategy (USDA Forest Service 2012), a regional Chesapeake Agroforestry Team was formed in 2011, with representatives from the U.S. Department of Agriculture (USDA) (Natural Resources Conservation Service [NRCS] and Forest Service), State forestry agencies, and universities. An expanded version of this team held a 2-day meeting in May 2014 to identify common agroforestry priorities across the partners, and the group is now developing a plan and structure for ongoing collaboration and network building. Additional examples of agroforestry collaborations are woven into the summary of specific agroforestry practices in the following sections.

Riparian Forest Buffers

Riparian forest buffers have been the primary agroforestry practice implemented in the Northeast Region to improve water quality, wildlife habitat, and farm sustainability. For example, since 1996, States in the Chesapeake Bay watershed have set policy targets for restoring riparian forest buffers on farmland and have made great strides in implementing these goals through landowner cost-share programs, such as the USDA Conservation Reserve Enhancement Program. More than 7,400 miles of riparian forest buffers have been restored in the watershed since the late 1990s (USDA Forest Service 2012). Despite this progress, implementation of riparian forest buffers has dropped significantly during the past 5 years, prompting renewed partnership efforts to promote the practice. As part of the Chesapeake Bay Executive Order strategy, USDA supported a 2014 leadership summit and State task force process to address key barriers and identify new strategies for accelerating riparian forest buffer restoration in the future.

With climate change impacts, riparian forest buffers and other types of green infrastructure will be needed more than ever to help moderate the effects of intensified storms, flooding, and related hydrologic regime changes. Farmers benefit from the practice by putting a relatively small area of vulnerable, marginally productive land into a natural buffer that absorbs flooding impacts and reduces polluted runoff, while focusing resources on productive farmland outside the floodplain/riparian zone.

Riparian forest buffers—also a key tool in headwater streams of the Northeast—help protect sensitive cold-water aquatic species from increases in water temperatures resulting from climate change. For example, partners in the Eastern Brook Trout Joint Venture conducted sophisticated climate/habitat analyses and identified riparian forest buffer restoration as a key strategy to retain and restore brook trout populations (Trumbo et al. 2010).

Riparian forest buffers restore to trees those areas that may have been in row crop agriculture, pastureland, or other land uses with limited ability to store C. Tree cover increases C storage in both long-lived woody biomass and stable, high-C forest soils. Increased C storage may eventually reverse the effects of climate change.

Forest Farming

Forest farming—or more broadly, the sustainable management of nontimber forest products—is another important agroforestry practice in the Northeast Region where most of the land is forested. A key challenge facing many forest landowners is having the economic resources to keep the forest land base sustainably managed and intact amidst development pressures. Forest farming can provide supplemental income to support forest landowners, including farmers who own woodlots. Sustainable management of nontimber forest products, such as maple syrup, mushrooms, and medicinal plants, can provide diversified income streams to buffer losses due to erratic weather patterns, new disease and insect infestations, and other anticipated effects of a changing climate.

Most maple syrup production in the United States (87 percent) takes place in seven Northeast States—Connecticut, Maine, Massachusetts, New Hampshire, New York, Pennsylvania, and Vermont—with Vermont comprising 41 percent of the annual U.S. production (USDA NASS 2015). Researchers at Cornell University who examined the potential impact of climate change on the maple syrup industry found that the number of sap flow days may not change in the Northeast, but the timing of peak production will shift earlier (Skinner et al. 2010). The findings suggest that, by adapting to an earlier tapping season, maple syrup producers in Vermont and other Northern States may be able to sustain their livelihoods for the next 100 years, but in States farther south, such as Pennsylvania, overall production may be reduced sooner.

Edible mushrooms are another forest farming product of interest in the region. Recent work by Cornell, the University of Vermont, and Chatham University in the Northeast Region resulted in the Temperate Forest Mushroom Growers Network, which provides growers with resources for the successful cultivation and marketing of log- and forest-grown mushrooms, including shiitake, oyster, lion's mane, and stropharia. In 2012, the three institutions initiated an on-farm research trial in which 25 growers inoculated 100 shiitake logs and kept data on costs, revenue, labor, and other factors. Researchers found that growers were able to begin making a profit in year 2 and projected that a small 500-log operation could gross $9,000 during a 5-year period (Cornell University 2015).

Although some edible and medicinal plants such as American ginseng, ramps (wild leeks), goldenseal, and fiddleheads are native and occur naturally in some woodlands, these plants are threatened by market pressures that can fuel overharvesting and depletion of wild populations. Forest farming can help mitigate pressure on wild populations of these species. A third-party forest-grown verification program was recently launched in Pennsylvania to verify woods-grown species are sustainably grown or managed. This program, managed by Pennsylvania Certified Organic and developed in partnership with Pennsylvania State University researchers and the Pennsylvania Department of Conservation and Natural Resources, Bureau of Forestry, addresses market demand for ethically and sustainably harvested native edible and medicinal plants.

Additional information and resources regarding forest farming are available at the following Web sites developed by partners in the region.

- The How, When, and Why of Forest Farming Resource Center (Cornell University): http://hwwff.cce.cornell.edu.
- eXtension Forest Farming (Virginia Polytechnic Institute and State University and partners): http://articles.extension.org/forest_farming.

Silvopasture

Silvopasture is an agroforestry practice that, although relatively new to the Northeast Region, is gaining in interest among natural resource professionals and landowners. Integration of trees into existing pasture provides shelter and shade to protect animals from temperature extremes and winter storms that may intensify with climate change. Carbon is sequestered in long-lived tree biomass. Practitioners are also experimenting with using intensively managed, short-rotation, fenced grazing systems in existing forests through a combination of prescribed thinning and enhancing understory forage. These systems must be carefully planned and managed to ensure that forest health will be improved through the silvopasture system by managing invasive understory plants and establishing diverse understory vegetation to improve soil health and reduce erosion. Ample training and technical assistance for practitioners are needed to clarify the silvopasture practice and ensure proper techniques are in place to benefit both the grazing animals and the condition of the forest.

A regional Web site and networking forum for silvopasture has been created by Cornell University: http://silvopasture.ning.com/. Additional webinars, videos, and other documents relevant to silvopasture in the Northeast have been archived at http://www.forestconnect.info.

Windbreaks

Windbreaks are a practice that has been used historically in the Northeast Region, although less frequently than in other regions, such as the Midwest. A modified application of windbreaks that has been growing in interest in the Chesapeake Bay region is the use of tree windbreaks—or "vegetative environmental buffers"—around animal operations such as poultry houses. These buffers filter air pollutants and odors that are emitted through the fans of these animal facilities, while also providing a visual screen for the facility, protecting it from wind and temperature extremes and sequestering C. In areas with heavy snow accumulations, living snow fence windbreaks can keep snow off roadways and can save energy by reducing snow removal needs.

Other agroforestry applications such as alley cropping have not been widely used in the Northeast but are included in agroforestry trainings and may find increased interest in the years ahead.

Challenges to Agroforestry Adoption

Agroforestry is still relatively a new term in the Northeast Region. Many practitioners cite lack of awareness of the practices and limited access to technical assistance as a key challenge to adoption. In the course of history, not much integration has occurred among the agricultural and forestry professionals who serve landowners. Furthermore, as noted, there are more, smaller farms in the Northeast so more landowners to reach.

The region offers niche agroforestry opportunities that may be unique from farm to farm requiring even more knowledge, research, and technical assistance to demonstrate the tangible benefits of adoption. As is often needed for adoption of new practices and technologies, real life examples (e.g., demonstration sites) and peer-to-peer networks are important for spreading the awareness and use of agroforestry practices. The Chesapeake Agroforestry Team, referenced above, identified a number of recommended actions to help overcome barriers and promote expanded use of agroforestry in the region.

Chesapeake Forest Restoration Strategy: Recommended Actions for Agroforestry

- Work with NRCS State Technical Committees in the Chesapeake Bay watershed to promote agroforestry practices through Farm Bill programs.
- Deliver train-the-trainer workshops that target resource professionals in the watershed as a first step toward reaching watershed landowners. Subsequent workshops can introduce agroforestry practices to landowners.
- Establish agroforestry demonstration areas by finding early adopters with working farms and forests so that others can see the conservation and economic benefits of agroforestry practices. Pursue USDA Conservation Innovation Grants and other funding sources to establish these sites.
- Work with staffs of the NRCS Ecological Sciences Division in the Chesapeake Bay watershed to get the five main agroforestry practices included in the Field Office Technical Guide and Farm Bill programs.
- Explore a bay branding campaign for agroforestry products similar to Edible Chesapeake but focused specifically on foods and products developed from businesses committed to sustaining working forests within the Chesapeake Bay watershed.
- Design and implement agroforestry research projects to ensure stakeholders have access to cutting-edge and regionally relevant science.
- Expand application of agroforestry practices and innovations to small-scale landscapes, including urban settings.

Key Information Needs

- Conduct additional field research to better quantify the environmental, social, and economic benefits of agroforestry practices in mitigating specific climate change impacts in the Northeast.
- Increase the limited data that are available on the geographic extent of agroforestry practice implementation in the region to assist current and potential agroforestry practitioners with appropriate climate change adaptation strategies.
- Conduct further analysis of climate-related changes in vegetation and wildlife species composition/ranges affecting the Northeast to inform agroforestry practice guidance in the region.

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