Issue of Concern: Invasive plants

There is considerable potential for increased establishment and vigor of non-native, invasive species under the influence of climate change. Invasive species exploit unstable conditions resulting from the combined stress of multiple climate-related disturbances, and novel invasive species may expand their range into the Northeast under future climate conditions. These factors will vary geographically, by forest community, and over time, and will likely depend heavily on human influence both in terms of treatment and introduction. Various forest adaptation practices may stop invasions before they start, and reduce impacts following establishment.

Climate Change Impacts

The Northeast is a potential hotspot of invasion under projected future climate conditions, with a large increase in the variety of invasive species expected (Bellard et al. 2014). Forest managers and the landowners in the region are likely already familiar with many of the invasive species that have established in upland forests, such as barberry, multi-flora rose, bittersweet, and non-native species of honeysuckle and buckthorn. Though there is substantial uncertainty about which invasive plant species will benefit most and at which sites (Merow et al 2017), models indicate that species with invasive characteristics will disproportionately benefit from projected climate changes due to broad environmental tolerances, extended periods of leaf-out, more effective exploitation of changed environments, and more aggressive colonization of new areas (Dukes et al. 2009, Fridley 2012, Hellmann et al. 2008, Willis et al. 2010, Wolkovich et al. 2014).

Forests that have experienced an increase in disturbances such as flooding, ice storms, or drought, are especially susceptible to higher levels of colonization by invasive plant species. This compromises the adaptive capacity of the forest by limiting the regeneration and planting success of native and desired tree species, and could hinder other management strategies (Wiedlich et al. 2020, Link III et al. 2018). Potential declines in native plants may also provide opportunities for new invaders to fill vacated niches or existing invaders to exploit fluctuating resources (Finch et al. 2021). Additionally, there are invasive species that could expand their ranges in response to climate conditions and become problematic in areas they have not previously been found. One such example is the elmleaf blackberry, which is already invasive farther south in Delaware and Maryland, and forms dense thickets that are capable of excluding other shrubs and understory plants, as well as hindering overstory regeneration (Bradley et al. 2020).

Invasive species can create a host of problems within the ecosystems where they become established. The dominance of even a few new species reduces both the native species and structural diversity of stands, rendering them more vulnerable to future impacts (Hejda et al. 2009; Jäger et al. 2009). Both reed canary grass and Japanese barberry, for example, have demonstrated the ability to reduce native species' regeneration through ground cover dominance, resource competition, and even altered hydrology (Weilhoefer et al 2017; Kurtz & Hansen, 2014; Gebauer et al. 2014; Kurtz & Hansen, 2018; Miniat et al. 2021). Replacement of native species typically reduces the habitat value for wildlife and pollinators, which can contribute to other new stressors to threaten more organisms than just those in direct competition (Burghardt 2010, Tallamy 2009; David et al. 2017).

Invasive species can sometimes fundamentally alter the character of the sites they invade. In riparian areas and on slopes, invasives can increase soil erosion, sedimentation of streams, and degradation of aquatic habitat (Seavy et al. 2009). If sufficiently dominant, they can also alter the fire regimes of the ecosystems they

invade, potentially altering the system permanently, and in some cases leading to more severe wildfire (Dibble et al. 2007; Brooks et al. 2006).

Some uncertainties that remain regarding the potential future impact of invasive plant species include: which current and/or novel invasive species will thrive at specific sites, whether climate change will support or hinder a given invasive species, and whether a given invasive species will irrevocably alter a site, or if it can assimilate to the native ecosystem (Merow et al 2017).

Adaptation Actions for Forests

Additional actions are described in the Adaptation Strategies and Approaches for Forests.

Site Condition	Adaptation Approaches	Example Adaptation Actions
Invasive plants not currently present or abundant	• Reduce the impact of biological stressors • Reduce competition for moisture, nutrients, and light • Promptly revegetate sites after disturbance • Guide changes in species composition at early stages of stand development	• Monitor for known or potential invasive species to ensure early detection, especially at trailheads, along roads, and along other pathways known for infestation • Eradicate existing populations or seed sources (e.g., upstream) of invasive plants through physical or chemical treatments • Clean equipment before and after forest operations to prevent the spread of invasive plants during site preparation, harvesting, or other activities • Reroute roads or trails away from at-risk communities to reduce the risk of introducing invasive species • Maintain closed-canopy conditions to reduce the ability of light-loving invasive species to enter the understory • Plant desired species immediately following a disturbance or management activities • Educate staff and volunteers on identification and eradication of current and potential invasive species. • Use herbicide or mechanical thinning to prevent the encroachment of woody

		competitors and invasive species, especially after disturbance
Invasive species are fundamentally changing the composition of the forest	• Maintain and restore diversity of native species • Restore or maintain fire in fire-adapted ecosystems • Prioritize and maintain sensitive or at-risk species or communities • Realign significantly disrupted ecosystems to meet expected future conditions	• Use natural or prescribed fire to restore the open character of oak woodlands and glades • Eradicate invasive species in order to minimize competition with desired species • Favor oak, pine, and other more drought- and heat-tolerant species on sites that are expected to become warmer and drier • Allow nonnative invasive to remain as part of a novel mix of species, rather than eradicating these species

On-the-Ground Examples

- Mass Audubon's Elm Hill Forest Management Project
    - Managers at this 1,000-acre wildlife sanctuary are mapping and prioritizing the treatment of invasive plants including multiflora rose, Japanese barberry, Japanese knotweed, common buckthorn, glossy buckthorn, burningbush, honeysuckle, goutweed, and Asian bittersweet.
- Mount Philo State Park: Climate Change and Rare Plants
    - This State Park in Vermont is home to many rare plant species, but managers are concerned that longer growing seasons and the park's popularity among the public will lead to increases in invasive plant species. Management actions are being taken to prevent the introduction and establishment of invasive plant species.

Potential Monitoring Items

- Presence/absence of invasive species
- Encroachment of invasive plants into a new area or rate of spread from a current infestation
- Percent coverage by invasive species
- Level of desired tree regeneration in area with invasive species present

Additional Resources

- The Northeast Regional Invasive Species & Climate Change (RISCC) Management Network synthesizes relevant science, and serves as a resource for scientists and managers.

- The Invasive Plant Atlas of New England's (IPANE) acts as a database of invasive and potentially invasive plants in New England that is updated by professionals and trained volunteers. Users can submit suspected invasive species to aid in the early detection of, and rapid response to, new invasions.
- The North American Invasive Species Management Association offers training, membership, and collaboration to professionals managing invasive species.
- Mass Audubon's page on invasive species offers reports and specific information about the invasive species that threaten the region.