Issue of Concern: Herbivory

Climate change is expected to influence the population dynamics of key herbivore species within Northeastern forests, and generally amplify the pressure of herbivory in some regional forests. Because herbivory is considered a keystone driver through its impacts on plant regeneration, forest structure, and species diversity, there are numerous implications resulting from changes in herbivore populations and behavior. A variety of forest adaptation practices may prevent or ameliorate the negative effects of increased herbivory.

Climate Change Impacts

There is mounting evidence that climate change will influence the populations of key herbivores within Northeastern forests. Warmer winter temperatures and reduced snow depth are expected to reduce the energy requirements for white-tailed deer and increase access to forage during winter months, enabling them to expand the size and range of their populations (Rodenhouse et al. 2009). Reductions in snowfall amount and duration are also expected to change the wintertime foraging behavior of moose and snowshoe hare as well (Rodenhouse et al. 2009).

However, there are complicated interactions between the expected impacts of climate change on deer and moose populations, and overall, moose populations are expected to decline (Rempel 2011). If deer expand into areas currently dominated by moose, they may spread brainworm—a common deer parasite that does not affect the species, but which causes mortality when spread to moose (Frelich et al. 2012). Moose are also expected to be negatively affected by heat stress from warmer temperatures and an increase in parasitism from winter ticks (Rempel 2011, Rodenhouse 2009). Dynamics between moose and deer populations are tightly linked to forest composition, and any changes in the distribution or abundance of deer and moose will have a strong influence on forest composition in the future (Frelich et al. 2012, Rodenhouse 2009).

Increasing herbivory under climate change can affect forest composition and structure and may generally limit the ability of forest ecosystems to respond to climate change (Fisichelli et al. 2012). In the Northeast, northern white-cedar in particular has been negatively affected by excessive deer browsing (Boulfroy et al. 2012, Larouche and Ruel 2015), and expanded deer herbivory could affect recruitment of northern white-cedar, especially where snowpack and winter severity are reduced (Kenefic et al. 2015). Additionally, many of the hardwood species that are expected to expand their range northward throughout New England are browsed more heavily than boreal fir and spruce species (Andreozzi et al. 2014). Certain hardwood species that are not preferred for browsing may benefit, such as eastern hophornbeam and black cherry. However, invasive species such as buckthorn or Japanese barberry may also benefit from this discretion.

There is some evidence that deer browse severity is of special concern within oak forests. In a study that assessed deer browse severity across the Midwest and Northeast, the oak-hickory forest type had the highest percentage of area with moderate or high browse impacts (at 69%) (McWilliams et al. 2018).

Adaptation Actions for Forests

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

Site Condition	Adaptation Approaches	Example Adaptation Actions
Local herbivore populations have reached or are close to reaching disruptive levels	• Reduce the impact of biological stressors – Manage herbivory to promote regeneration of desired species	• Partner with state wildlife agencies to monitor herbivore populations or reduce populations to appropriate levels
Regeneration or plantings are vulnerable to herbivory	• Reduce the impact of biological stressors – Manage herbivory to promote regeneration of desired species	• Apply repellant to discourage herbivory • Install fences, bud caps, or other physical barriers to prevent herbivory • Use tree tops from forest harvest or plantings of unpalatable tree species as locations for "hiding" desirable species from herbivores to reduce browse pressure

On-the-Ground Examples

- The Nature Conservancy: West Branch Forest
    - Heavy deer browse is suppressing new growth in dry oak stands across the West Branch Forest. Managers are using woven wire deer fencing and slash walls to protect regeneration and newly planted trees.
- Willistown Conservation Trust: Rushton Woods Preserve
    - Managers at the Rushton Woods Preserve are protecting young native plants from deer by caging and monitoring new plantings, and installing multiple small deer exclosures to protect natural regeneration from herbivory.

Potential Monitoring Items

- Deer population density
- Regeneration success (visit the Northeastern Forest Regeneration Network to explore different methodologies used for assessing regeneration)
- Preferential browsing of certain species

Additional Resources

- Avid Deer has developed a standardized method to assess vegetation impacts from deer in the State of New York; it enables volunteers, foresters, landowners and others to measure the effect of deer browse on New York forests. The website also provides data sheets and resources related to this topic.

- This Forest Ecosystem Monitoring Cooperative data set (developed by Harvard Forest in collaboration with researchers at the USGS Massachusetts Cooperative Research Unit) provides information on the impact of herbivory in Southern New England forest composition and structure based on experimental enclosures and control plots exposed to moose and deer browsing.