Adapting Adaptive Silviculture to the Exurban Landscape

Amanda Bunce[1], Robert Fahey[1], Maria Janowiak[2], Anita Morzillo[1], Courtney Peterson[2,3], Thomas Worthley[1]
[1:] University of Connecticut, Department of Natural Resources and the Environment
[2:] USDA Northern Research Station, Northern Institute of Applied Climate Science
[3:] Colorado State University, Forest and Rangeland Stewardship Department

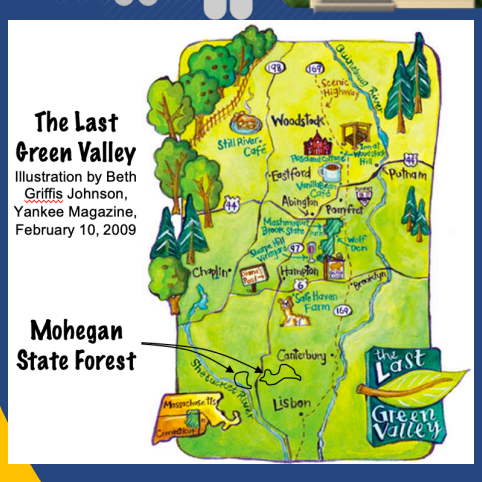
- **Changes to the climate** have the potential to impact forest ecosystems more rapidly than they can adapt.
- **Adaptive silvicultural** fosters a forest's ability to be resist impacts from disturbances, be resilient to them, or recover.
- Adaptive practices are not widely used in exurban southern New England, where both forest cover and the human population is dense.
  - Forests provides many important benefits to the population.
  - Awareness of the impacts of climate change is prevalent among forestry professionals.
  - Willingness among landowners to adapt the forest to climate challenges is generally high.
    - However, little active management is taking place.

There is motivation to manage for climate change but it's not being done. **Why?**

The exurban forest ecosystem is a **Socio-Ecological System**:
It is influenced by the social & ecological conditions around it, and influences them in turn.

Research Questions

Social
Systems and processes



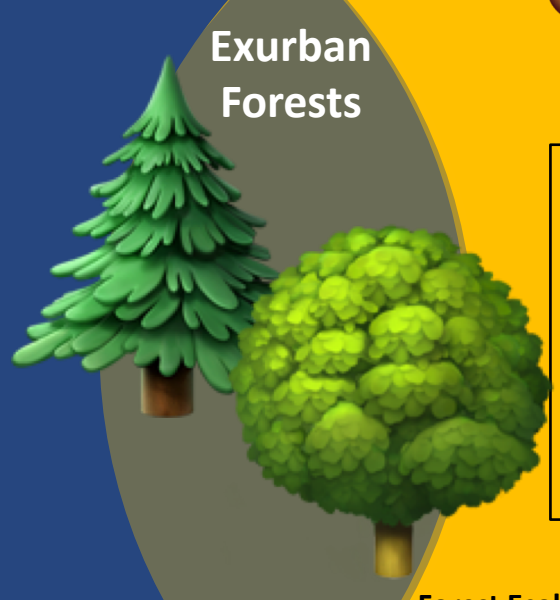
Social Science Questions

What are important considerations in silvicultural decision-making on the exurban landscape?

How does climate change effect silvicultural decision-making?

What are the priorities and knowledge levels among managers of exurban forests, as related to adaptive management strategies?

Exurban Forests



Ecological
Systems and processes

Anticipated Impacts of Climate Change
- Increased overall precipitation
- Increased drought stress
- Fire weather
- Deer herbivory
- Invasive plants
- Insect pests and pathogens
- Southern pine beetle
- Increased storms
- Tree species compositions

Forest Ecology Questions

How do the exurban forests of southern New England respond to adaptive silvicultural treatments?

What silvicultural strategies are most effective to to adapt exurban forests to climate change?

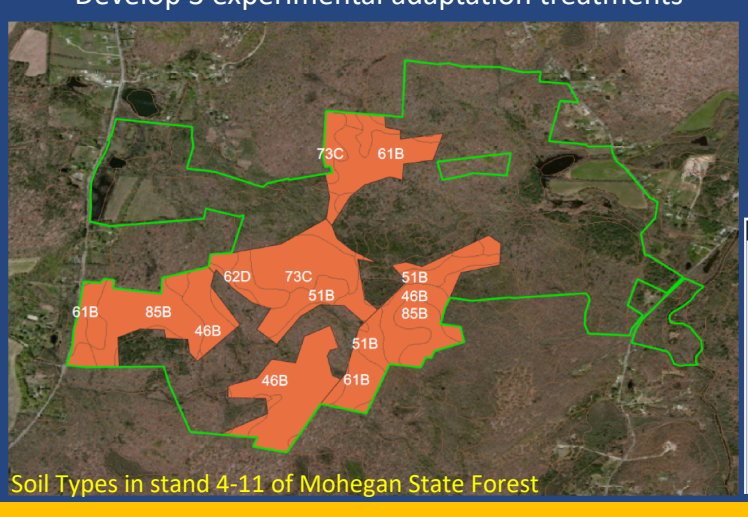
We are collaborating with the **Adaptive Silviculture for Climate Change (ASCC)** network, led by Colorado State University and the Northern Institute of Applied Climate Science (NIACS). ASCC is a series of experimental silvicultural trials incorporating different forest ecosystem types throughout the United States and Canada. To better understand the response of the exurban forest ecosystem, we initiated an ASCC trial in Connecticut in Mohegan State Forest.

Methods

The Workshop

Virtual ASCC Workshop for Mohegan State Forest in CT, Oct. 2020

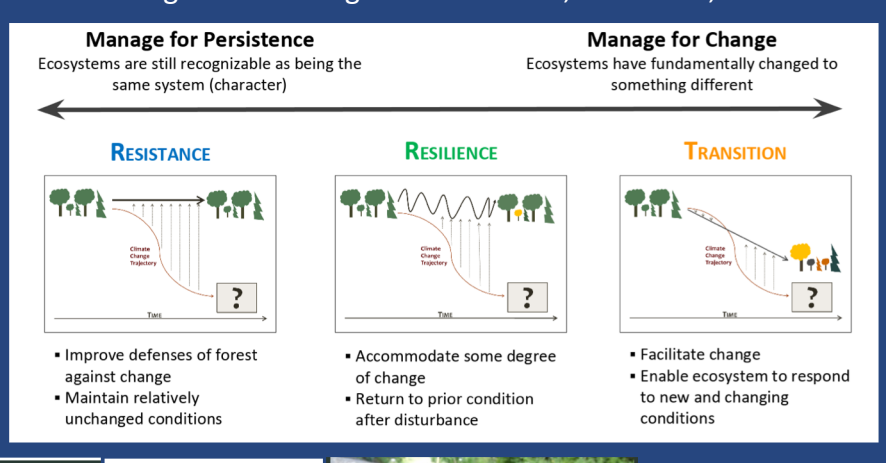
- Local scientists and forest managers get together
- Considering site specific conditions in Mohegan State Forest
- Working towards site-specific management objectives
- Develop 3 experimental adaptation treatments

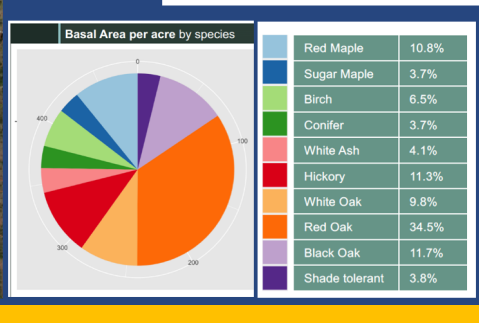


Soil Types in stand 4-11 of Mohegan State Forest

The Silvicultural Trials

- Experimental treatments are based on 3 adaptive management strategies – Resistance, Resilience, Transition:





Red Maple	10.8%
Sugar Maple	3.7%
Birch	6.5%
Conifer	3.7%
White Ash	4.1%
Hickory	11.3%
White Oak	9.8%
Red Oak	34.5%
Black Oak	11.7%
Shade tolerant	3.8%

Wood Turtle (Glyptemys insculpta) Vtherpatlas.org

To learn more about Mohegan State Forest visit the map at: https://uconnclear.maps.arcgis.com/apps/MapSeries/index.html?appid=66280fe0a1cc4a0a981e5504fa959641

Analysis of social data

Questionnaires to workshop participants:
- Forest management priorities
- Forest health concerns
- Perspectives on climate change

Workshop activities:
- Consider impacts of climate change on management decisions
- Brainstorm potential adaptive actions

Through "grounded theory" style analysis of questionnaires and activities in the workshop, we will pull out themes associated with forest management decision-making on the exurban landscape.

Preliminary Observations

Barriers

Cutting trees on public lands is a **political hotbed** recently, as their potential for carbon sequestration is highlighted.

Where can we **source** seedlings for introduction to this site? (Blight resistant chestnut and southern oak species)

White-tailed deer **herbivory** will hinder regeneration.

Will hunting continue on this land?

Opportunities

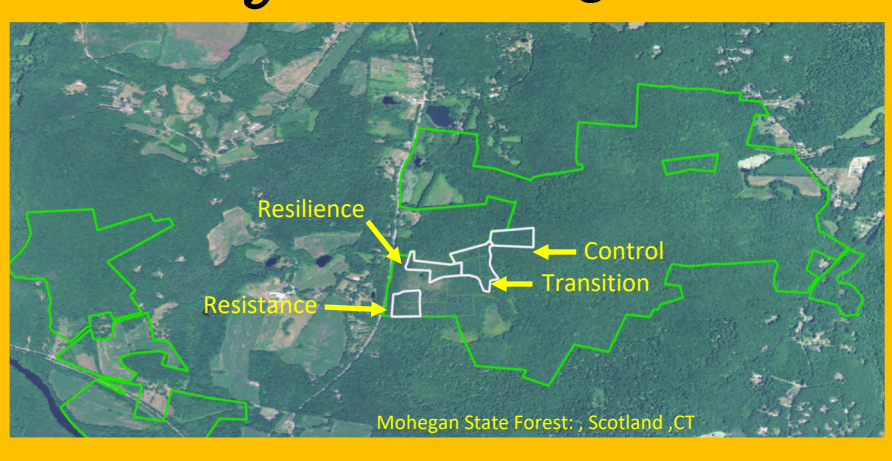
Successful plan development suggests the **creativity and ambition** to implement adaptive management is present in southern New England.

Recent oak mortality (drought/gypsy moth combination) provided the **impetus for active management** in the forest.

Are slash walls a **potential solution** to deer herbivory?

Learn more about slash walls here: http://blogs.cornell.edu/slashwall/

Analysis of ecological data



- Sites for implementing the treatment plans will be chosen based on most appropriate micro-site conditions.
- As with all sites in the ASCC network, permanent plots will be established to take measurements every 3, 5 and 10 years to evaluate the effectiveness of the adaptation actions.

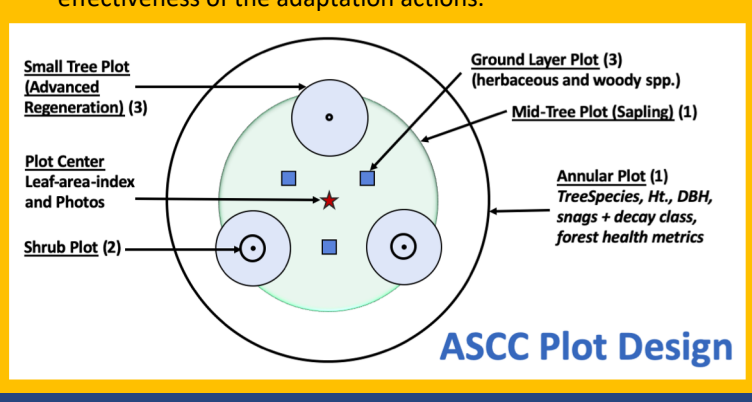


Figure adapted from "Adaptive Silviculture for Climate Change (ASCC) Network: Southern New England Oak Forests" Presentation by Maria Janowiak for Forests Climate Adaptation Network Work Group meeting, Nov., 2020

Next Steps

Focus groups & Demonstration tours

To Broaden our understanding of the social context:
- Focus groups to discuss plans with stakeholders
- Tours of managed forest to engage stakeholders

Groups to include:
- Local hunters, local residents and forest users, tribal associations, conservation groups, local private foresters, etc.

Implementing Trials & Replications

Treatments Developed for Mohegan State Forest:

Resistance	Resilience	Transition
* Reduce invasive plants * Shelterwood cut, overstory removal 20+ yrs., regenerate oak & hickory * Create reserves targeting unique or sensitive species and recreational areas.	* Reduce invasive plants * Patch cuts and controlled burn to encourage multi-age regeneration * Planting blight-resistance American chestnut	* Reduce invasive species * Large patch cuts, feather edges over years, center on high mortality areas * Planting blight-resistance chestnut and southern-origin oaks

Key Responses Monitored Across All Sites (Over and Understory):
- Species composition, density, diversity, etc.
- Forest health (mortality, local indices)
- Productivity (increment, biomass)

Replications:
Large replicated trials necessary for statistical robustness
Exurban forests are small.

We plan to replicate treatments in other forests with similar ecological conditions, but varying social contexts.
- University of CT Forest
- Privately owned Central CT forest land

Acknowledgements

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And **Maria Janowiak** from NIACS

Check out the ASCC network at this site to learn more about the project and the research network.

ASCC Adaptive Silviculture for Climate Change
https://www.adaptivesilviculture.org/

More information on the ASCC project can also be found in these resources:

Nagel, Linda M., Brian J. Palik, Michael A. Battaglia, Anthony W. D'Amato, James M. Guldin, Christopher W. Swanston, Maria K. Janowiak et al. "Adaptive silviculture for climate change: a national experiment in manager-scientist partnerships to apply an adaptation framework." *Journal of Forestry* 115, no. 3 (2017): 167-178.

Janowiak, Maria K., Christopher W. Swanston, Linda M. Nagel, Leslie A. Brandt, Patricia R. Butler, Stephen D. Handler, P. Danielle Shannon et al. "A practical approach for translating climate change adaptation principles into forest management actions." *Journal of Forestry* 112, no. 5 (2014): 424-433.

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The UConn Research Team:
Amanda Bunce, Robert Fahey, Anita Morzillo, Thomas Worthley
Department of Natural Resources and the Environment

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Will Hochholzer
Dan Evans