

# **Adaptive Silviculture for Climate Change (ASCC) in the Northern Forest**



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**Northeast Climate Hub Partners Meeting:  
Building Agricultural Resiliency Through Adaptation**

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## Signs of Stress

- **Increasing climate and growing re**
  - **Forest spe**
  - **range of cl**
  - **envelopes'**
  - **shifting cli**
- ✓ **Decreased productivity**
  - ✓ **Decreased regeneration**
  - ✓ **Increased susceptibility to pests and pathogens**
  - ✓ **Increased mortality**
  - ✓ **Increased competition from other native or invasive species**
- **Concern that current and future conditions are so novel that forests can't adapt.**
  - **Emerging need to know – NOW – how to manage our forests of tomorrow today.**

# ASCC: Overarching Goals

1. Design a long-term management and research network to address best practices for climate-informed silvicultural strategies.



# ASCC: Overarching Goals

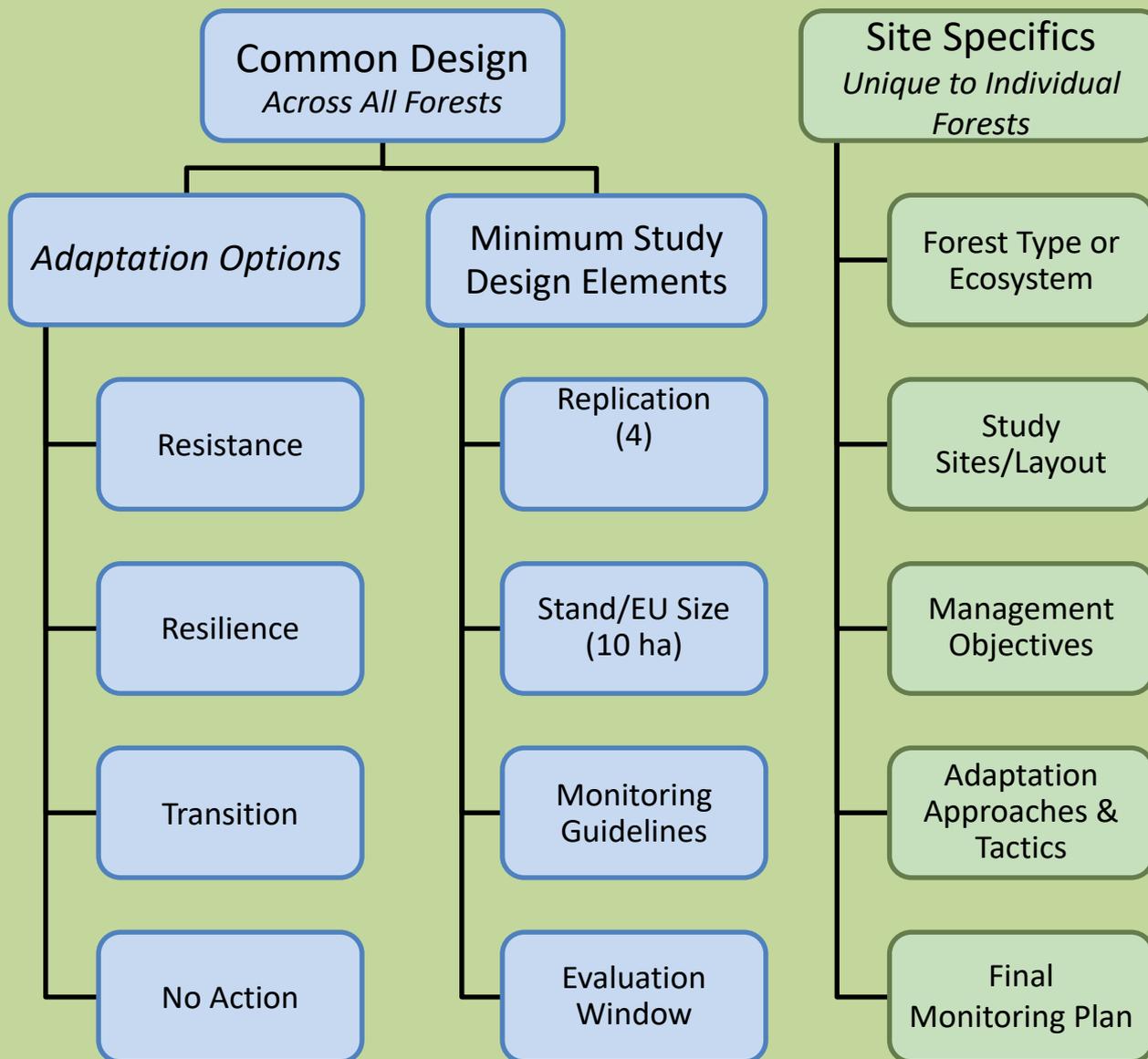
1. Design a long-term management and research network to address best practices for climate-informed silvicultural strategies.
2. Encourage **manager-scientist** partnerships to generate options and tools for integrating climate change adaptation into silvicultural planning and decision making.

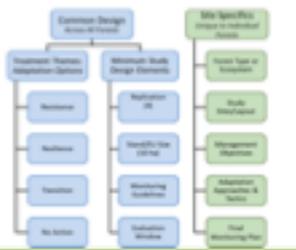




*Nagel et al. 2017 J. Forestry*

# ASCC Study Design

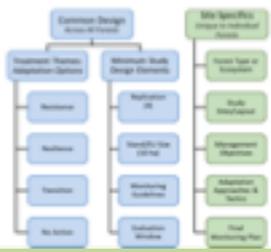




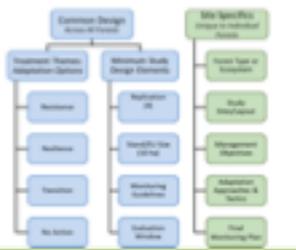
# Adaptation Options

- **Resistance:** Actions that help forests resist change, and maintain unchanged conditions over time.
- **Resilience:** Actions that allow forests some change but promote eventual return to prior conditions.
- **Transition:** Actions that proactively foster forest change, to create new, more adapted conditions.
- **No Action:** No management intervention.

# Minimum Design Elements



- **Replication:** 4 blocks of 4 treatments 160 ha
- **Stand Size:** 10 hectares/treatment
- **Monitoring Guidelines:** Basic forest mensuration for overstory, midstory and ground layer
- **Evaluation Window:** 50+ years



# Site Specific Elements

- **Forest Type:** Regional important forest type
- **Study Sites:** Local site
- **Management Objectives:** Local issues and goals
- **Adaptation Approaches:** Co-production of treatment designs
- **Final Monitoring Plan:** Site Specific

# Co-Production of Treatments

Two-day workshop at each local ASCC installation with managers and scientists

1. Overview of climate change trends, impacts, and vulnerabilities for region
2. Tour of sites to discuss ecological and operational considerations



# Co-Production of Treatments

3. Manager-scientist teams co-design each experimental treatment (Resistance, Resilience, Transition)



Desired Future Condition:

- What do you want the stand to be and look like?

Key variables/outcomes:

- Species composition
- Forest health
- Forest productivity
- Response to disturbance

For each silvicultural practice (tactic):

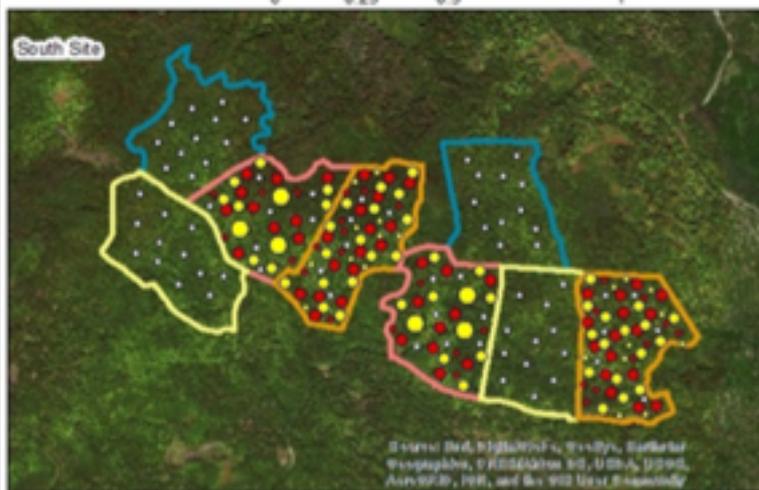
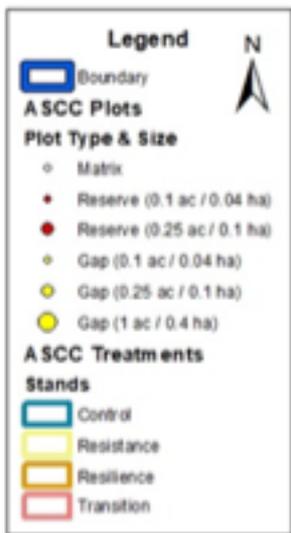
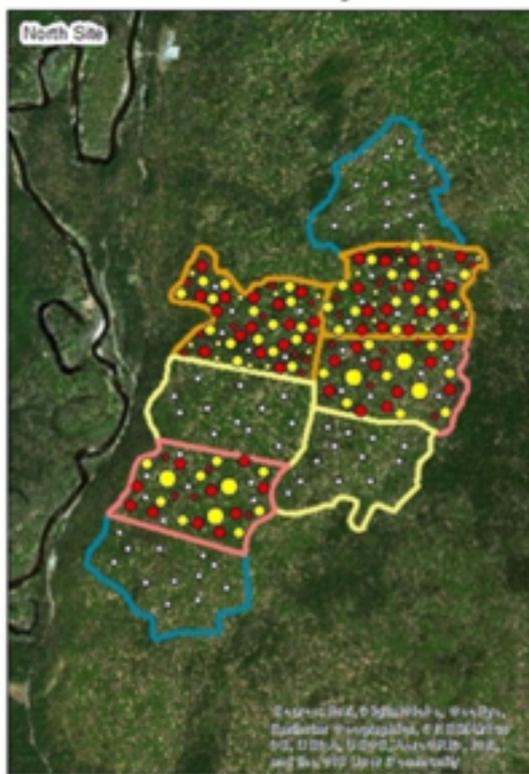
- How do you get there?

# Northern Forest ASCC

- **Forest Ecosystem:** northern hardwood and mixedwood
- **Location:** Working forest at Dartmouth College's Second College Grant, northern NH



# Second College Grant ASCC Study Site



# Northern Forest ASCC

- Experimental Treatments

| RESISTANCE  | RESILIENCE  | TRANSITION  |
|---|---|---|
| <ul style="list-style-type: none"><li>• Single-tree selection</li><li>• Multi-cohort structure</li><li>• ↑ downed dead wood</li><li>• Favor Beech Bark Disease-resistant residual stems</li></ul> | <ul style="list-style-type: none"><li>• Group selection and single-tree selection</li><li>• Multiple pathways</li><li>• ↑ downed dead wood</li><li>• ↑ wind and ice resistant species</li></ul> | <ul style="list-style-type: none"><li>• Variable density thin / Irregular shelterwood</li><li>• ↑ future-adapted component through planting</li></ul> <p>(oak, hickory, cherry, black birch, aspen, red spruce)</p> |



# Northern Forest ASCC

## Key Research Questions

1. What tradeoffs exist between managing for climate adaptation versus climate mitigation?
2. What is the effectiveness of adaptive silviculture at minimizing the negative impacts of extreme events and non-native species relative to traditional silviculture approaches?
3. How does adaptive silviculture affect key ecosystem processes (e.g., C, nutrient and water cycling)?



# Northern Forest ASCC

## Response Variables

- Forest mensuration
- Additional measurements
  - Breeding birds
  - Pollinators
  - Small mammals
  - Ground dwelling insects, Lepidoptera species
  - Coarse woody debris
  - Soil carbon
  - Litter decomposition
  - Truffle abundance
- LiDAR, Hyperspectral and Thermal Imaging



# Northern Forest ASCC

## Bonus Question

1. What is the role of standing and downed woody debris in forest adaptation to climate change in the northeast?

- ✓ Reducing overland flow
- ✓ Conserving moisture during drought
- ✓ Habitat for micro and macro fauna

➤ **Fire load**

### Wired Wood Project at HBEF



# Back to the National Network

## Social and Management Questions for ASCC

1. Will adaptation approaches work in a real-world context?
2. Are the silvicultural treatments fiscally and socially feasible?
3. How do concepts of DFC's change across sites and regions?
4. What does it mean to create a future-adapted forest, and why would a manager choose to do this?
5. What trade-offs exist between achievement of adaptation objectives and other common objectives for a region?

# Back to the National Network: Science Questions for ASCC

1. Is there a significant effect of the treatments on forest conditions and processes over time?
2. Do these treatments achieve the DFCs they were designed for?
3. Are there trends in which treatments perform better than others in meeting DFCs across all ASCC sites?

# Adaptive Silviculture for Climate Change (ASCC)



# Acknowledgements

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