What’s at risk?
Implications of climate change in regional forests

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Climate Change Response Framework
www.forestadaptation.org
Effects on Forests
Effects on Forests

SHIFTING SEASONS | SHIFTING SPECIES | SHIFTING STRESSORS
Effects on Forests

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THE GOOD:
 Longer growing seasons.
Effects on Forests

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THE BAD:
Shorter, warmer winters.
Effects on Forests

**SHIFTING SEASONS** | **SHIFTING SPECIES** | **SHIFTING STRESSORS**

**THE GOOD:**
Longer growing seasons.

**THE BAD:**
Shorter, warmer winters.

**THE UGLY:**
More extreme events.

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Effects on Forests

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Many northern/boreal species are projected to decline in the region—contract to more northerly and higher-elevation locations.

Many species common farther south are expected to see increased and new habitat within the region.
Effects on Forests

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**Likely to decline**
- Balsam fir
- Black, red, & white spruce
- Northern white-cedar
- Eastern hemlock

**Mixed model results**
- Black ash
- Paper birch
- Quaking aspen
- Tamarack

**Potential “winners”**
- American elm
- American basswood
- Black cherry
- Eastern hophornbeam
- Gray birch
- Northern red oak
- Serviceberry
- Silver maple
- Sweet birch
- White oak

**New habitat (esp. south)**
- Black hickory
- Chinkapin oak
- Common persimmon
- Hackberry
- Loblolly pine
- Osage-orange
- Shortleaf pine
- Southern red oak
- Sweetgum
- Sweet birch
- Virginia pine

[www.forestadaptation.org/ne-species](http://www.forestadaptation.org/ne-species)
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Location, Location, Location

Research and assessments describe broad trends but local conditions and management make the difference.
Climate change is a “threat multiplier”
- Chronic stress
- Disturbances
- Insect pests
- Forest diseases
- Invasive species

Interactions make all the difference.
Responding to Change
Responding to Change

**Adaptation** is the adjustment of systems in response to climate change.

Adaptation actions are designed to specifically address climate change impacts and vulnerabilities in order to meet goals and objectives.
A Spectrum of Adaptation Options

**Resistance**
- Improve defenses of forest against change and disturbance
- Maintain relatively unchanged conditions

**Resilience**
- Accommodate some degree of change
- Return to prior reference condition following disturbance

**Transition**
- Intentionally facilitate change
- Enable ecosystem to respond to changing and new conditions

Real-World Adaptation Projects

More than 50 projects in New England

www.forestadaptation.org/demos
Adaptation Options in Projects

Northern New England:
- Resistance: 32%
- Resilience: 43%
- Transition: 25%

Southern New England:
- Resistance: 21%
- Resilience: 46%
- Transition: 33%

Preliminary data via T. Ontl
Learning by Doing

Every action becomes an experiment in an era of change, increasing the need to record and evaluate our actions.

Image: USGCRP/Kareiva et al. 2010
Learning by Doing

Every action **becomes an experiment** in an era of change, increasing the need to record and evaluate our actions.
Thank you!

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Summary

Forests are changing.

- Shifting seasons, species, and stressors

Match adaptation actions to the need.

- Resistance, resilience, and transition
Vulnerability Assessment

- Synthesize existing assessments and scientific literature
- Incorporate new results from forest impact models
- Draw on local expertise of scientists and land managers
- Describe state-of-knowledge for anticipated changes in climate and response of forest ecosystems

NEW Mid-Atlantic Report!!

www.forestadaptation.org/vulnerability-assessment
The Process of Adaptation

1. DEFINE project area and management goals.
2. ASSESS climate impacts and vulnerabilities.
3. EVALUATE challenges and opportunities.
4. IDENTIFY adaptation actions for implementation.
5. MONITOR whether actions were effective.
Adaptation Actions in Projects

1. Sustain fundamental ecological functions.
2. Reduce existing biological stressors.
3. Reduce impacts of severe disturbances.
4. Maintain or create refugia.
5. Enhance species and structural diversity.
6. Promote ecosystem redundancy.
7. Increase landscape connectivity.
8. Enhance genetic diversity.
10. Realign after disturbance.

Preliminary data via T. Ontl
If you want a single “answer” for how to respond to climate change, it’s

“It depends”

It depends on where you are working and what you’re trying to achieve.