Adaptation Concepts

Stacey Clark (stacey.clark@usda.gov)
Regional Ecologist, Natural Resources Conservation Service
2019 Northern Forests Climate Hub Liaison, Northern Institute of Applied Climate Science

www.niacs.org / www.forestadaptation.org
How do we respond to climate change?
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**Adaptation** is the adjustment of systems in response to climate change.

Adaptation actions are designed to specifically address climate change impacts & vulnerabilities in order to meet goals and objectives.
**Adaptation** is the adjustment of systems in response to climate change.

Ecosystem-based adaptation activities build on sustainable management, conservation, and restoration.
Invasives

Natural Forest Dynamics

Past Management History

Management Plan Requirements

Landowner Objectives

Timber Sale Revenue

Forest Health

Wildlife Habitat

Disturbance: Past + Future

And more!!

Climate Change

Deer

And more!!

Timber Sale Revenue

Revenue
Helping Managers to Respond

What actions can help systems adapt to climate change and other threats while also meeting landowner needs?
If you want a single “answer” for how to respond to climate change, it’s
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“It depends”
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It depends on where you are working and what you’re trying to achieve.
Forest Adaptation Resources

A flexible workbook and menu to address diverse needs

- Designed for a variety of landowners with diverse goals
- Does not make recommendations
- Includes:
  - Menu of adaptation strategies and approaches for forest management
  - Adaptation Workbook

Swanston et al. 2016 (2nd edition); www.treesearch.fs.fed.us/pubs/52760
A workbook process provides "structured flexibility"
Adaptation “Menus”

Published:
- Forestry
- Urban Forestry
- Agriculture
- Forested Watersheds
- Tribal Perspectives

In Preparation:
- Wetlands
- Wildlife Management
- Coastal Ecosystems
- Forest Carbon Management
- Recreation

www.forestadaptation.org/strategies
Options

Resist Change

Enhance Resilience

Promote a Transition

Strategies

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.
9: Facilitate species transitions.
10: Realign after disturbance.

www.forestadaptation.org/strategies
Getting from Goals to Action

The Workbook helps you create clear rationale for your actions by connecting them to broader adaptation ideas.
Adaptation Options (Millar et al. 2007)

Manage for Persistence:
Ecosystems are still the same

Manage for Change:
Ecosystems have fundamentally changed

Resilience

Transition (response)
**Resistance**

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

**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

Adaptation Options

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

Adaptation Actions

CONCEPT
STRATEGIES
APPROACHES
TACTICS

Sustain fundamental ecological functions

ACTION

[Diagram showing a cascade from Concept to Action with steps in between: Strategies, Approaches, Tactics]
Adaptation Actions

CONCEPT

STRATEGIES

APPROACHES

TACTICS

ACTION

Maintain or restore soil quality and nutrient cycling
Adaptation Actions

CONCEPT

STRATEGIES

APPROACHES

TACTICS

ACTION

Delay operations to coincide with frozen ground to minimize disturbance

Will also evaluate benefits, drawbacks, practicability and time frame associated with tactic
Plant future-adapted oak species on south-facing slopes in Spring
Adaptation Actions

Emphasize drought- and heat-tolerant species & populations
Adaptation Actions

Option: Transition (facilitate change)
Facilitate community adjustments through species transitions
Menu + Workbook

Management Goals & Objectives
- Climate Change Impacts
- Challenges & Opportunities
- Intent of Adaptation (Option)
- Make Idea Specific (Strategy, Approach)
- Action to Implement (Tactic)
Actions for Adaptation
...are intentional

Connect the dots!
- What are your management goals and objectives?
- How might your ecosystem be uniquely affected by climate change?
- How are your goals challenged? Are they still feasible?
- What specific actions can you take to address specific impacts?
Actions for Adaptation

...are intentional
...but not always different

“Climate-informed” decisions still reflect
- Restrictive mandates, plans, laws, etc.
- Public perception
- Costs
- Values
- Other barriers to change
Re-cap

▪ Best management principles, but applied in the context of climate change
▪ Hierarchy helps organize and justify adaptation actions
▪ Menu allows user to pick and choose actions that are relevant to their situation
▪ Managers design tactics to suit particular needs
Adaptation Demonstrations

Real-world examples of climate-informed management

250+ Projects have used the Adaptation Workbook

www.forestadaptation.org/demos
NRCS
Technical and Financial Assistance

- Conservation Stewardship Program (CSP)
- Environmental Quality Incentives Program (EQIP)

EXAMPLES:

**OBJECTIVE:** Improve degraded plant communities

**ADAPTATION STRATEGIES:** Sustain fundamental ecological functions, Maintain and enhance species and structural diversity.

**NRCS CONSERVATION PRACTICE:** Forest Stand Improvement

**OBJECTIVE:** Increase Native Plants

**ADAPTATION STRATEGIES:** Maintain and enhance genetic diversity, Facilitate community adjustments through species transitions.

**NRCS CONSERVATION PRACTICE:** Tree/Shrub Establishment
Conservation + Adaptation

EXAMPLES (cont.):

**OBJECTIVE:** Mimic natural disturbances

**ADAPTATION STRATEGIES:** Sustain fundamental ecological functions, Reduce the risk and long-term impacts of severe disturbances.

**NRCS CONSERVATION PRACTICE:** Prescribed Burning

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**OBJECTIVE:** Reduce Invasive Species

**ADAPTATION STRATEGIES:** Sustain fundamental ecological functions, Reduce the impact of biological stressors

**NRCS CONSERVATION PRACTICE:** Brush Management
Management GOALS

- Enhance wildlife habitat
- Maintain wetland function
- Minimize invasive species

Stand 1: Dry to Dry-Mesic Mixed Forest
- Increased pests, diseases, drought stress
- Deer herbivory
- Decreased snowpack and boreal species

Stand 2: Northern Hardwoods Swamp (black ash)
- Increased susceptibility to flooding, soil erosion, oxidation
- Loss of wetland habitat and function

Yuck white spruce!

Oak Invasion!

Elm Invasion?
Adaption APPROACHES

2017: $ EQIP: Forest Stand Improvement
- Reduce competition for moisture, nutrients, and light.
- Maintain or improve the ability of forests to resist pests and pathogens.

2018-2019 $ EQIP: Brush Management
- Prevent the introduction and establishment of invasive plant species and remove existing invasive species.

2020 $ EQIP: Tree/Shrub Establishment
- Manage herbivory to promote regeneration of desired species.
- Protect future-adapted seedlings and saplings.
- Introduce species that are expected to be adapted to future conditions.
Adaptation demonstration projects are real-world examples of how managers have integrated climate considerations into land management planning and activities.

https://forestadaptation.org/node/716
Additional Resources

- Tree Species Handouts: [www.forestandadaptation.org/pa](http://www.forestandadaptation.org/pa)
- Seedlot Selection Tool [https://seedlotselectiontool.org/sst/](https://seedlotselectiontool.org/sst/)
- The Office of Sustainability and Climate (OSC)
  - Drought Gallery [https://usfs.maps.arcgis.com/apps/PublicGallery/index.html?appid=a2a9bef1ca3249e0b4f6c6c4354bc69d](https://usfs.maps.arcgis.com/apps/PublicGallery/index.html?appid=a2a9bef1ca3249e0b4f6c6c4354bc69d)
  - Climate Gallery [https://usfs.maps.arcgis.com/apps/PublicGallery/index.html?appid=a36acbdfd1a41c28c918758872504](https://usfs.maps.arcgis.com/apps/PublicGallery/index.html?appid=a36acbdfd1a41c28c918758872504)