

FOREST ADAPTATION PLANNING AND PRACTICES

~ ONLINE COURSE ~

Session 3 Discussion: Challenges and Opportunities
Session 4 Lecture: adaptation strategies and approaches

Tuesday, February 12, 2019

Discussion session: Please free to join the discussion on webcam or by phone – we want to hear from you!



CHECK INTO CHAT BOX!

Type your name(s), organization, and...
dream vacation destination!

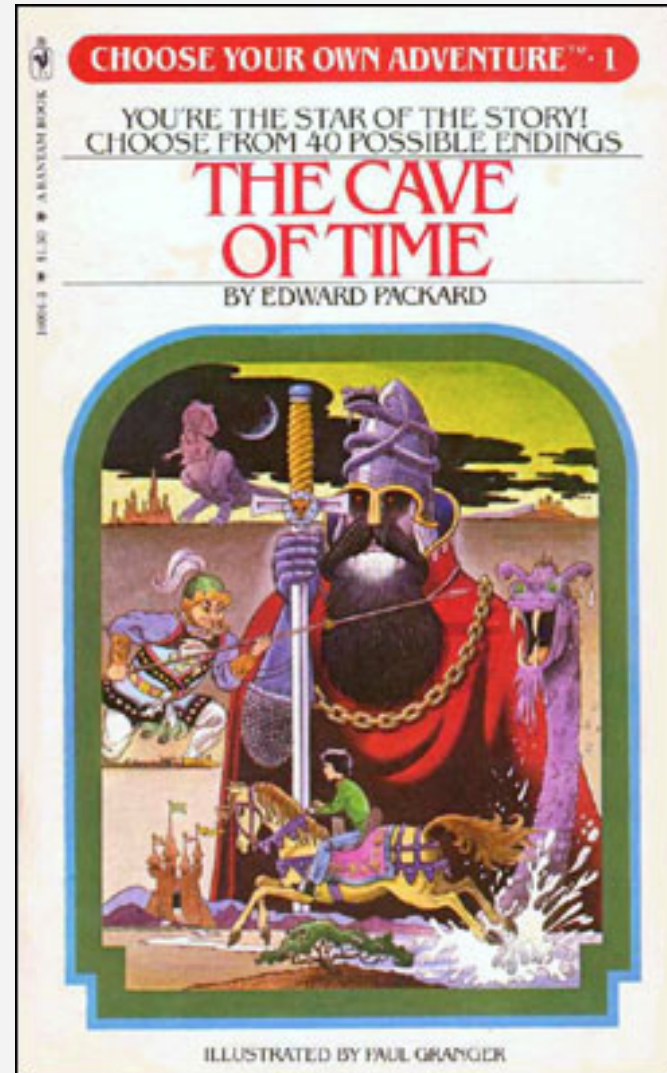
Welcome back!

Discussion: 10:00-10:45

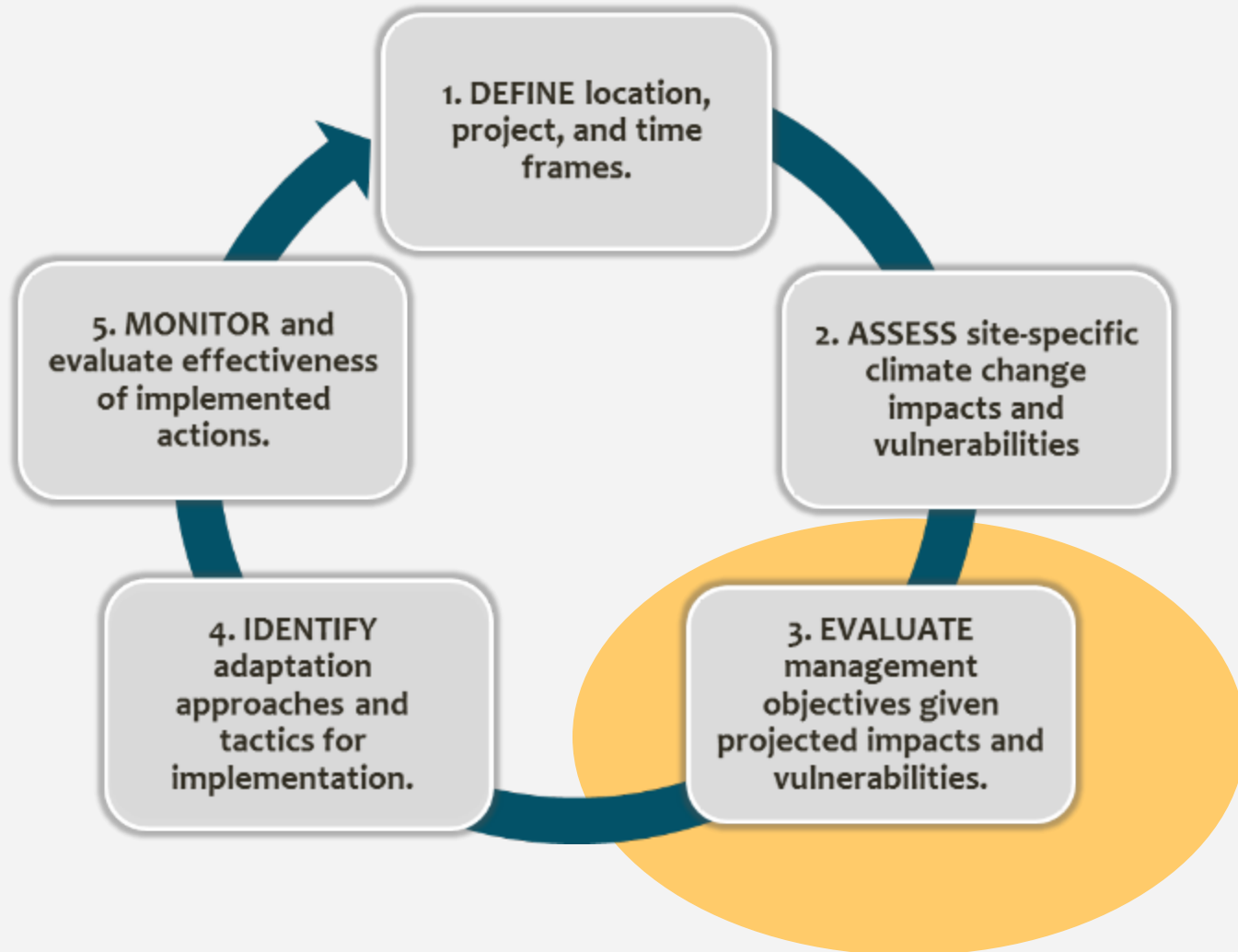
- Discuss climate change challenges and opportunities

Lecture: 10:50-11:30

- Step 4 introduction
- Assignment for Monday, Feb 18



Step 3 Review



Step 3: EVALUATE management objectives given projected impacts and vulnerabilities.

Key Question:

- What management challenges or opportunities might occur?
- Can current management meet management goals?
- Do goals need to change?

Step 3: EVALUATE management objectives given projected impacts and vulnerabilities.

Challenges to Meeting Management Objective with Climate Change – Things that will make it harder to achieve the management objective due to climate change.

Opportunities to Meeting Management Objective with Climate Change – Things that will make it easier to achieve the management objective due to climate change.

Step 3: EVALUATE management objectives given projected impacts and vulnerabilities.

Feasibility – Can you meet your management objectives using current (business-as-usual) management actions?

- **High:** We can do it!

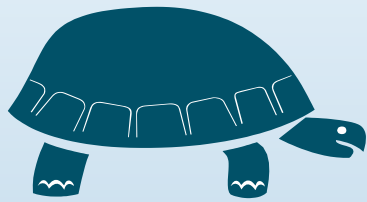
Opportunities > Challenges

- **Low:** We'll need more resources or effort.

Challenges > Opportunities

Other Considerations – Social, financial, or other factors that also affect your ability to meet objectives.

Step 3: EVALUATE management objectives given projected impacts and vulnerabilities.



Slow down!

*Are you going to
continue with these
management objectives?*

Step 3

- Adaptation Workbook
- My dashboard
- Log out
- Resources
- Patricia's Dream Property
- Progress Summary
- Step 1
- Define Management Topics
- Management Goals and Objectives
- Homework 1
- Step 2
- Climate Impacts and Vulnerability
- Vulnerability Determination
- Homework 2
- Step 3
- Evaluate Objectives
- Homework 3
- Step 4
- Adaptation Actions
- Tactic Recommendations
- Homework 4
- Step 5
- Monitoring Plan
- Homework 5

Evaluate Objectives instructions

Step 3 course materials

Evaluate Objectives ⓘ

northern forest Objectives
1 of 1 objectives evaluated

< Previous
Homework 2

Next >
Homework 3

Review Potential Regional Climate Impacts ⓘ

Review Potential northern forest Climate Impacts

Goal #1:
Objective:
All evaluation details supplied

Challenges

warmer temperatures and drier conditions may limit regeneration of a desired species, making it more challenging to rely on natural regeneration to achieve future desired conditions

Opportunities

increased disturbances in areas with advance oak regeneration can open the canopy, increase light reaching the forest floor, and actually release the seedlings and help regeneration

Feasibility Under Current Management ⓘ

Medium See above

Other Considerations

No other considerations

Add a Challenge ⓘ

Add an Opportunity ⓘ

Challenges

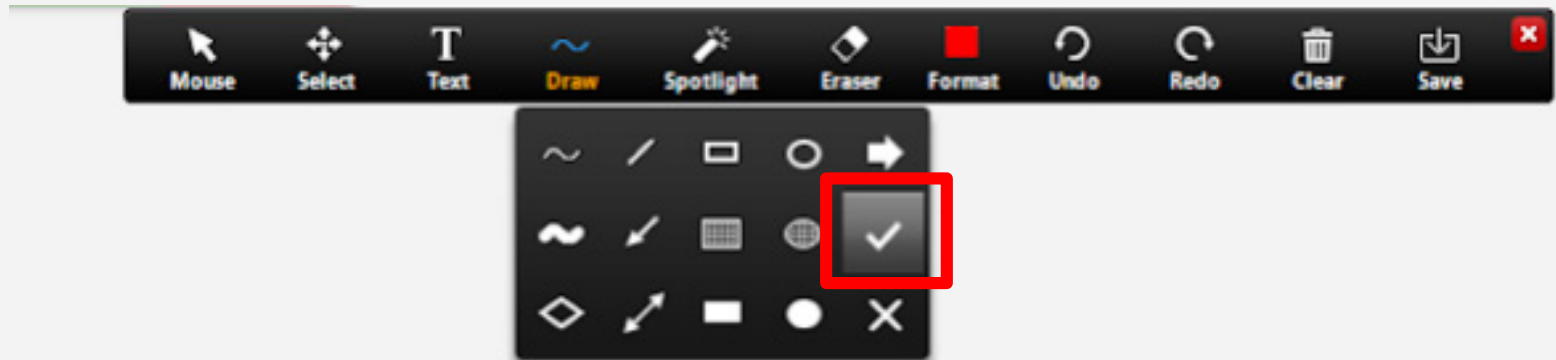
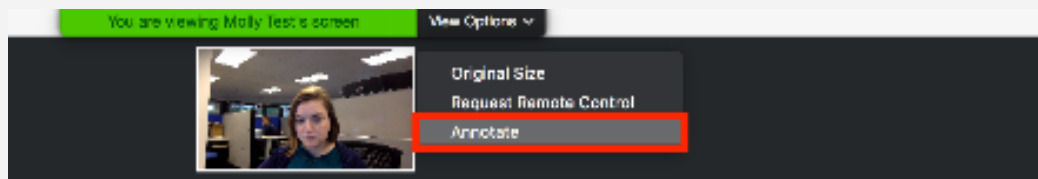
- Reduced regeneration due to
 - Invasive species control (x2)
 - Other factors (i.e., heat stress, disease, soil moisture variability)
 - Interrupted flowering and decreased seed production resulting from premature warming, then frost
 - Continued herbivory
- Stressed trees are more prone to pest attacks and disease.
- More resources needed for tree establishment/maintenance between rain events.
- Soil erosion and nutrient loss from heavy precip.
- Events, may lower water table and increase drought along stream valleys.
- Increased disturbance from extreme weather events (storms)
- Uncertainty in species shifts

Opportunities

- Declining mesophytic spp. may require intense oak/ hickory management to establish a healthy forest in the understory.
- Decreased threat from gypsy moth, reduced gm population.
- Increase in southern tree species to offset decline of less adaptable northern species.
- Increased public desire for shade trees to help mitigate heat island effects.
- Some native species may benefit from climate change like: red cedar, sweet gum, and pawpaw.
- Increased drought may lower competition from hardwoods to favor oak/hickory/pine.
- Drier wetlands may become suitable for hardwood species

Feasibility Activity

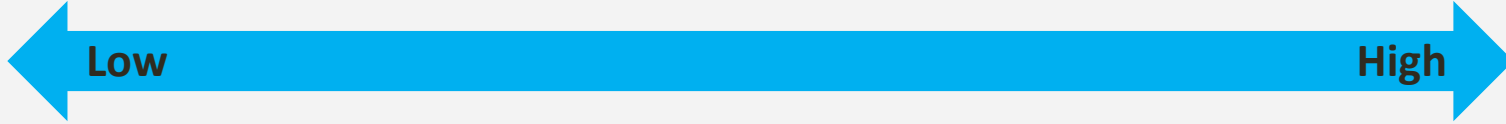
- Pick one of your objectives– preferably the one with the **lowest** feasibility
- Use “**annotate**” feature to add a **check mark** describing the feasibility of that objective on the scale on the next slide.





Feasibility: Short Term (<10 yrs)

Use a check mark



Bean Ridge	
The Glades Red Spruce Release	
conifer restoration in western MD	
Fairfax County	
Chickory Lane Farm	
Edge of Appalachia Preserve	
Potomac Fish and Game	
Drda Woods	
CJO Property Trust	



Feasibility: Long Term (>50 yrs)

Use the X to mark the spot

Low

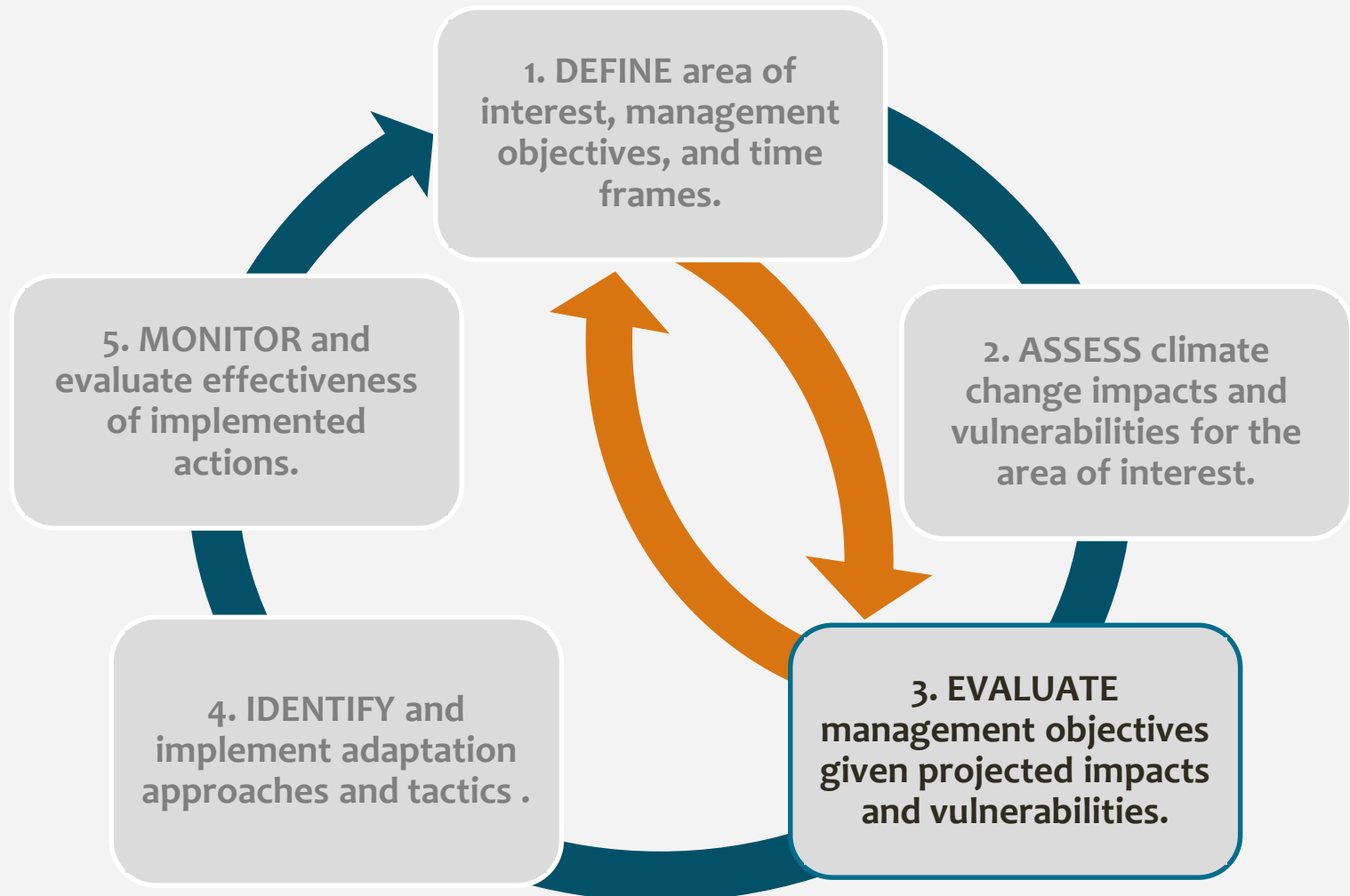
High

Bean Ridge	
The Glades Red Spruce Release	
conifer restoration in western MD	
Fairfax County	
Chickory Lane Farm	
Edge of Appalachia Preserve	
Potomac Fish and Game	
Drda Woods	
CJO Property Trust	

Did anyone adjust their objectives?



Workbook Cycle: Step 3

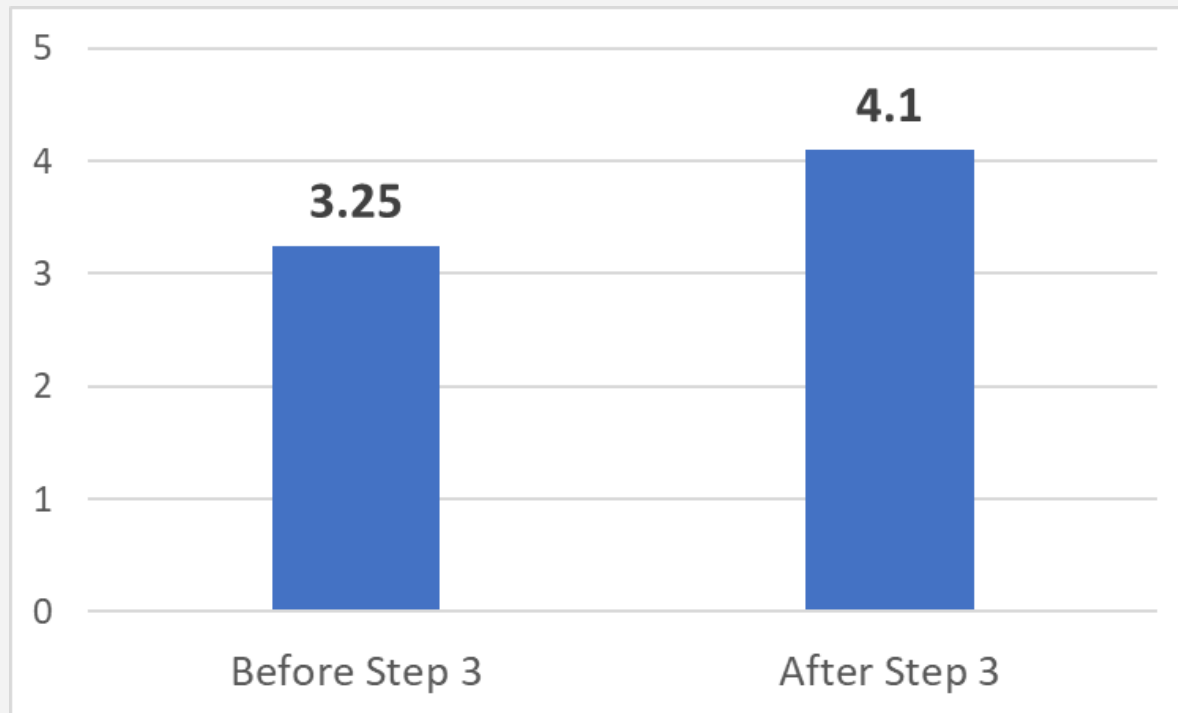


... or, RE-EVALUATE

Other comments on step 3?



I can explain how climate change may affect my ability to meet management goals and objectives.



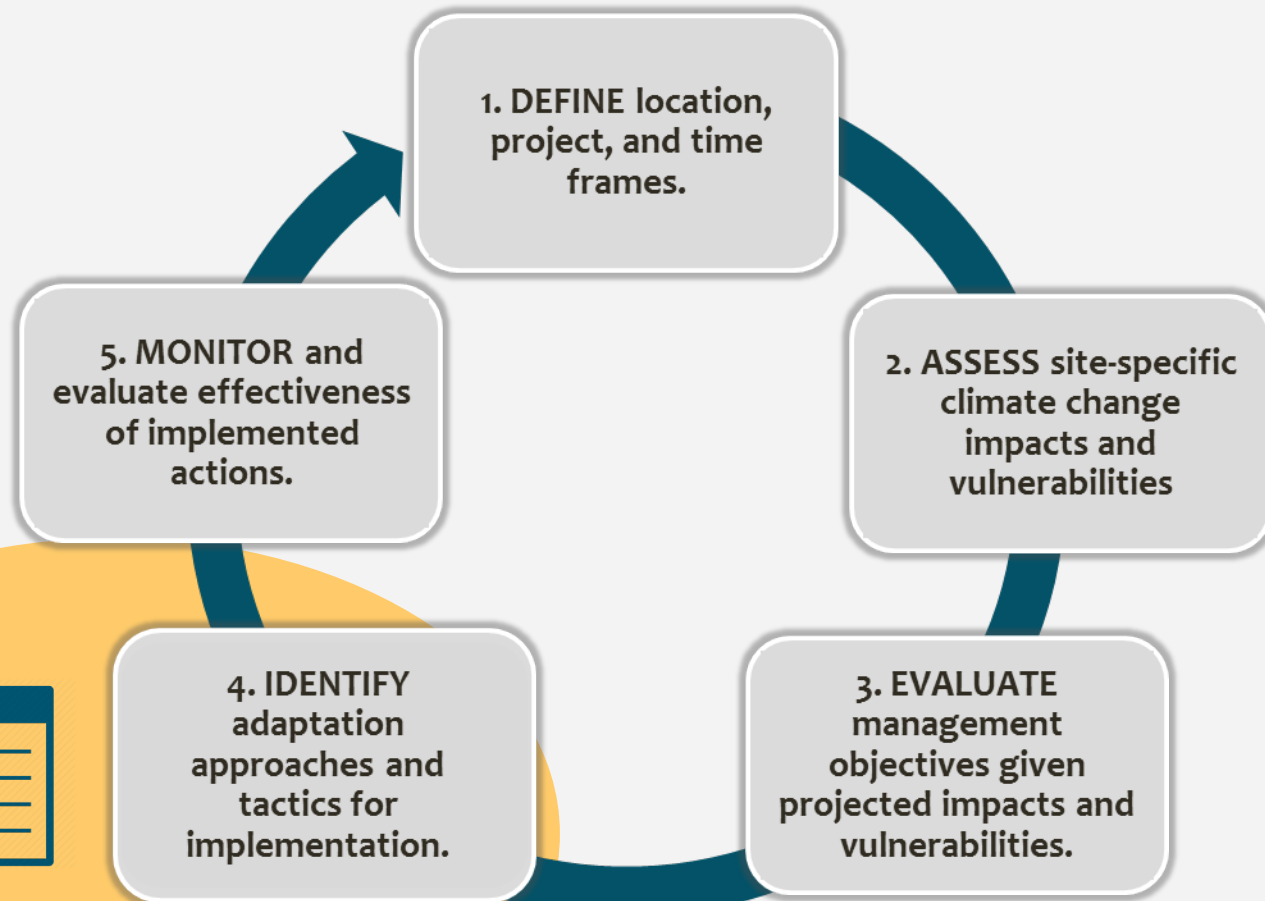


break

A red alarm clock with two bells on top and a white face with black numbers. A yellow sticky note is attached to the top of the clock, tilted at an angle. The text on the sticky note is written in a black, cursive font.

Time's up

Adaptation Workbook Process



Resource: Adaptation Strategies & Approaches

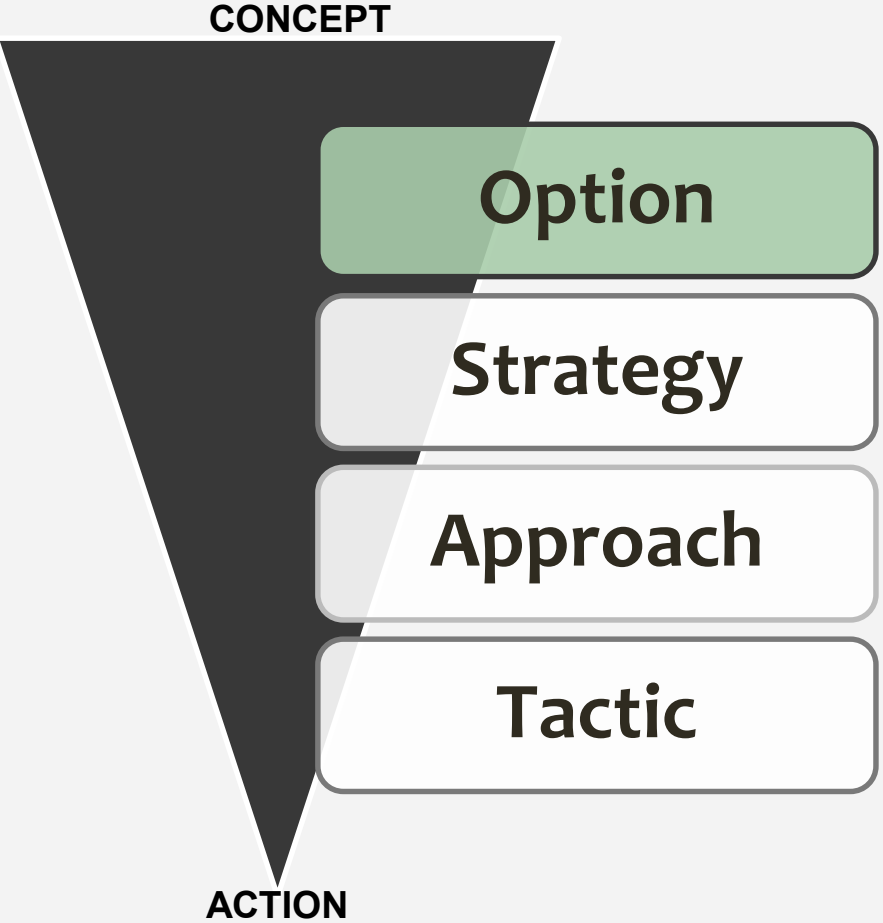
Adaptation Strategies & Approaches



A “menu” of possible actions that allows you to decide what is most relevant for a particular location and set of conditions.

*Find in: Step 4 of online workbook, Chapter 3-4 of FAR , or
www.adaptationworkbook.org/niacs-strategies
www.adaptationworkbook.org/niacs-strategies/urban*

Adaptation Strategies & Approaches



CONCEPT

Option

Strategy

Approach

Tactic

ACTION

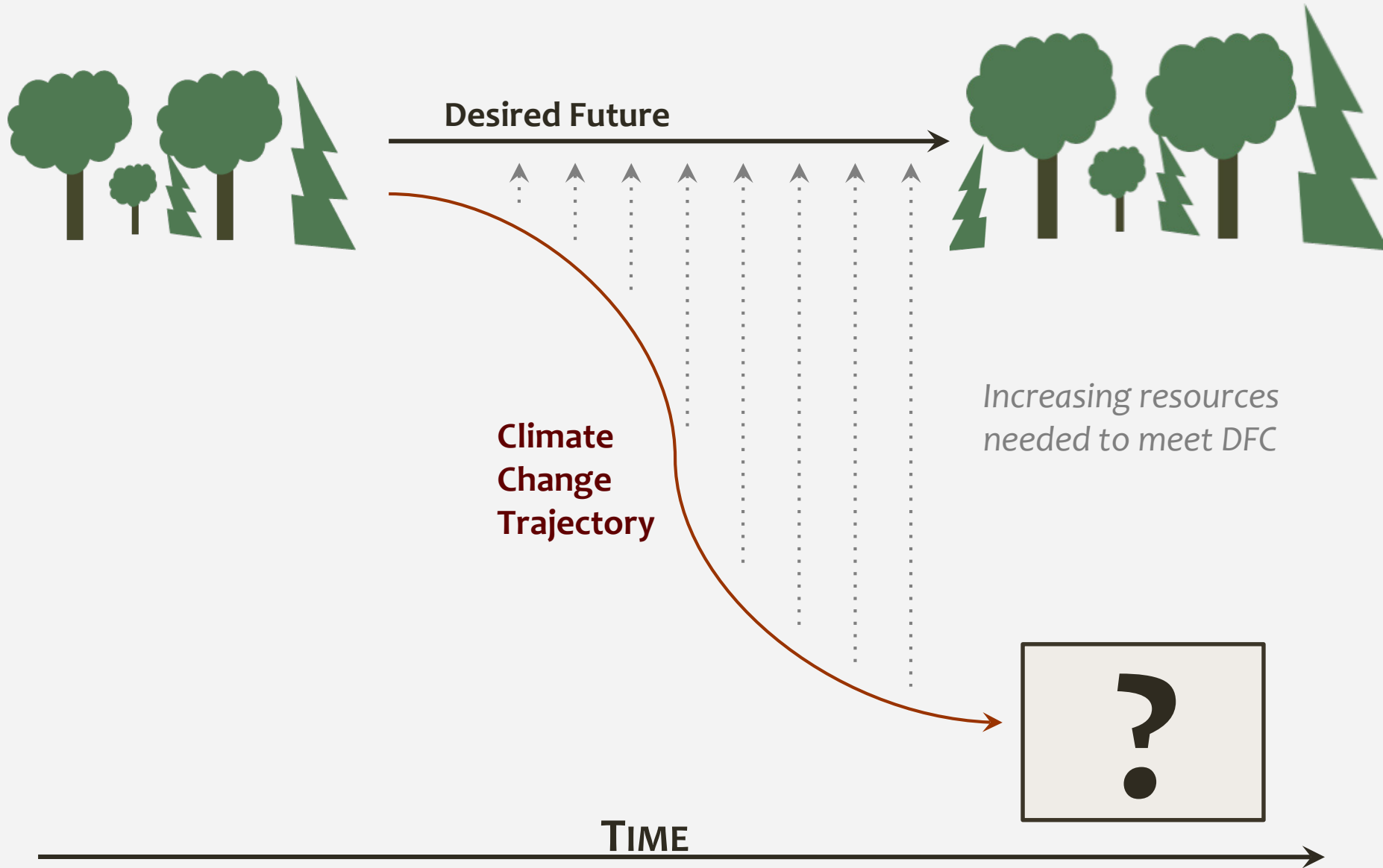
Climate-Driven Changes



TIME

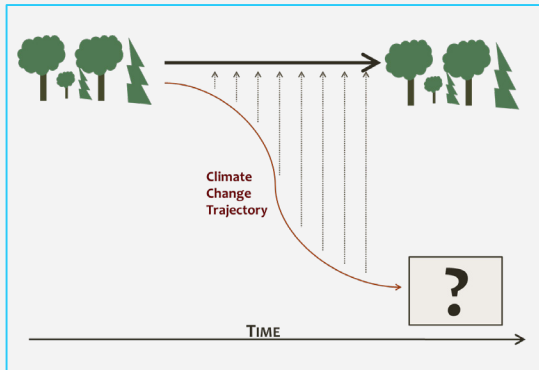


Climate-Driven Changes



Adaptation Options

RESISTANCE



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

Refugia

Valleys that harbor cold air pools and inversions can decouple local climatic conditions from regional circulation patterns.

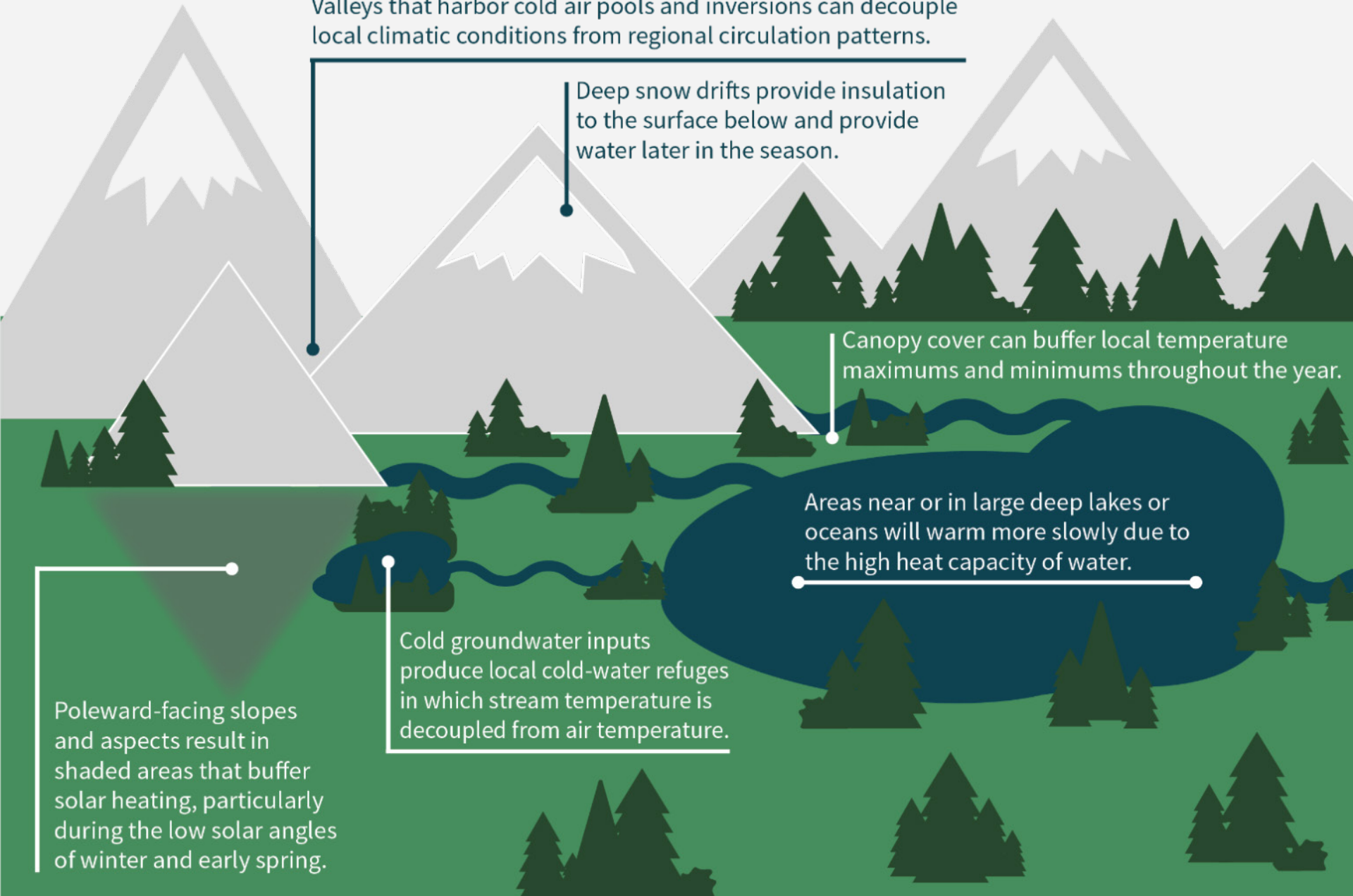
Deep snow drifts provide insulation to the surface below and provide water later in the season.

Canopy cover can buffer local temperature maximums and minimums throughout the year.

Areas near or in large deep lakes or oceans will warm more slowly due to the high heat capacity of water.

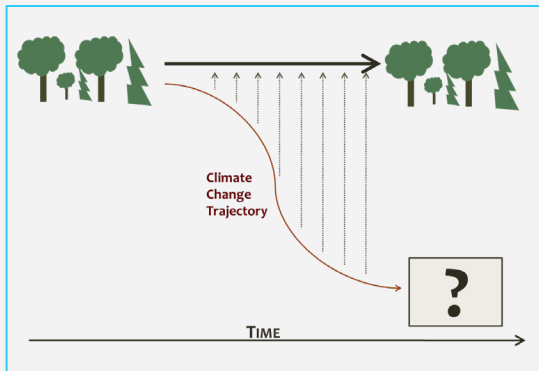
Cold groundwater inputs produce local cold-water refuges in which stream temperature is decoupled from air temperature.

Poleward-facing slopes and aspects result in shaded areas that buffer solar heating, particularly during the low solar angles of winter and early spring.

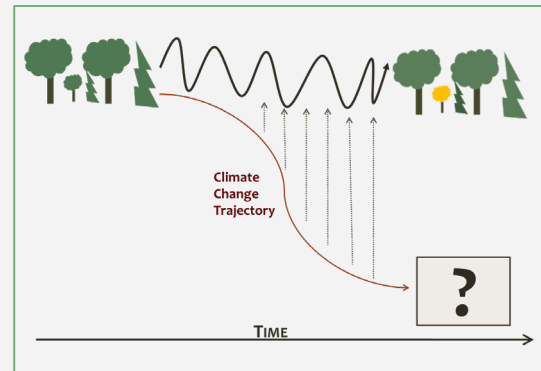


Adaptation Options

RESISTANCE



RESILIENCE

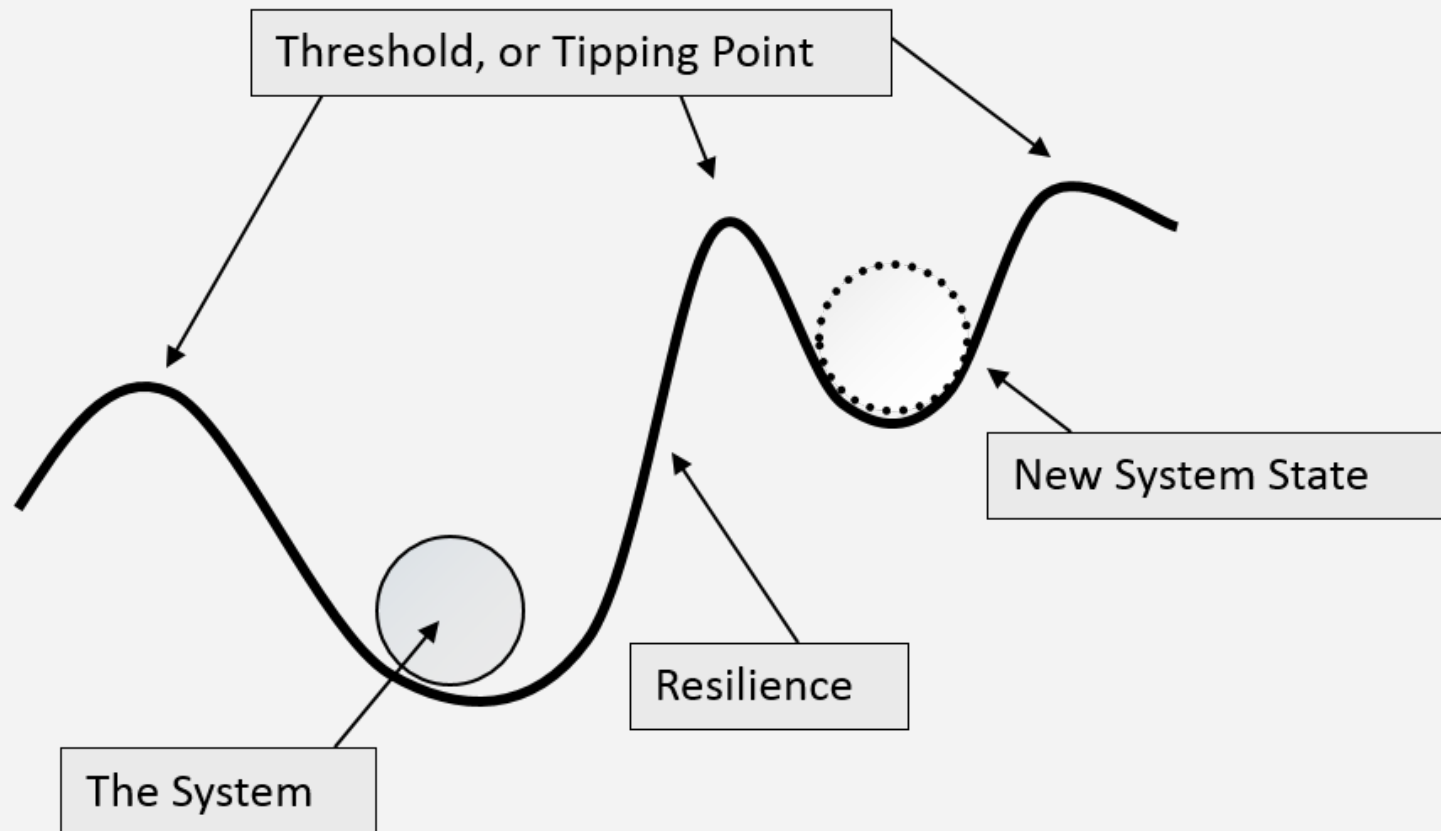


- Improve defenses of forest against change
- Maintain relatively unchanged conditions

- Accommodate some degree of change
- Return to prior condition after disturbance

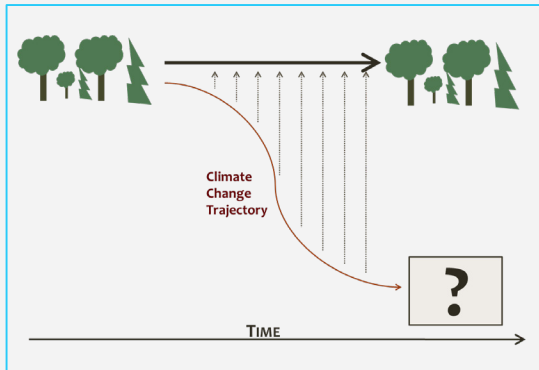
Resilience

ability of a system to maintain or return to a particular ecological state following a disturbance (e.g., Holling 1973, Griffith et al. 2009)

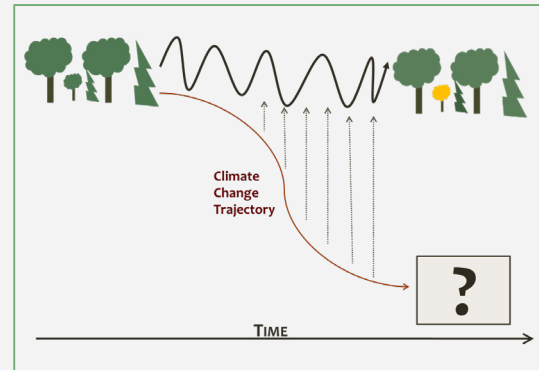


Adaptation Options

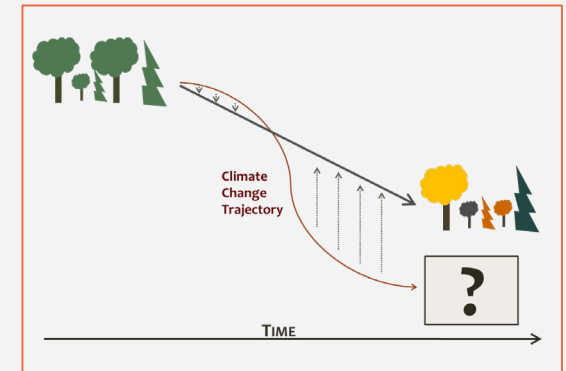
RESISTANCE



RESILIENCE



TRANSITION

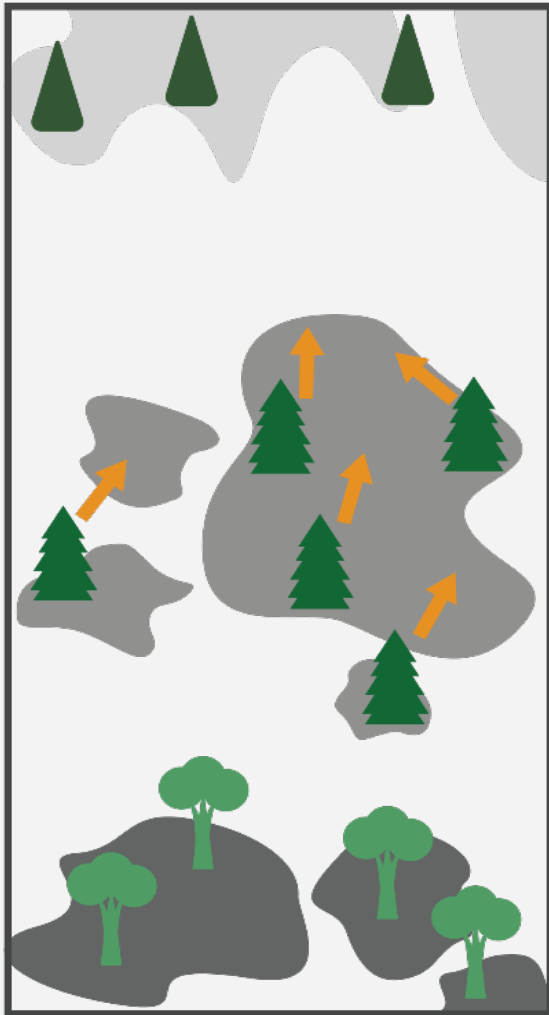


- Improve defenses of forest against change
- Maintain relatively unchanged conditions

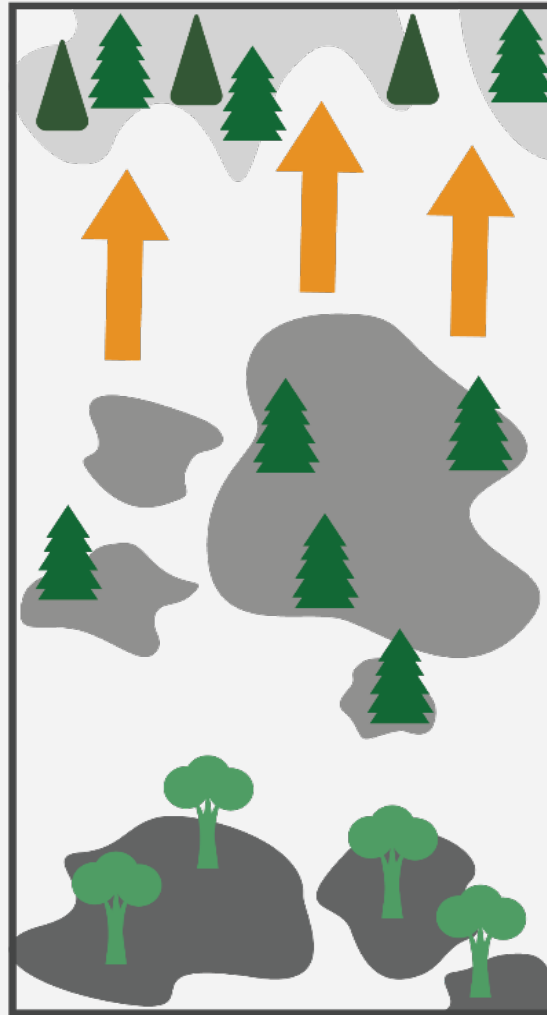
- Accommodate some degree of change
- Return to prior condition after disturbance

- Facilitate change
- Enable ecosystem to respond to new and changing conditions

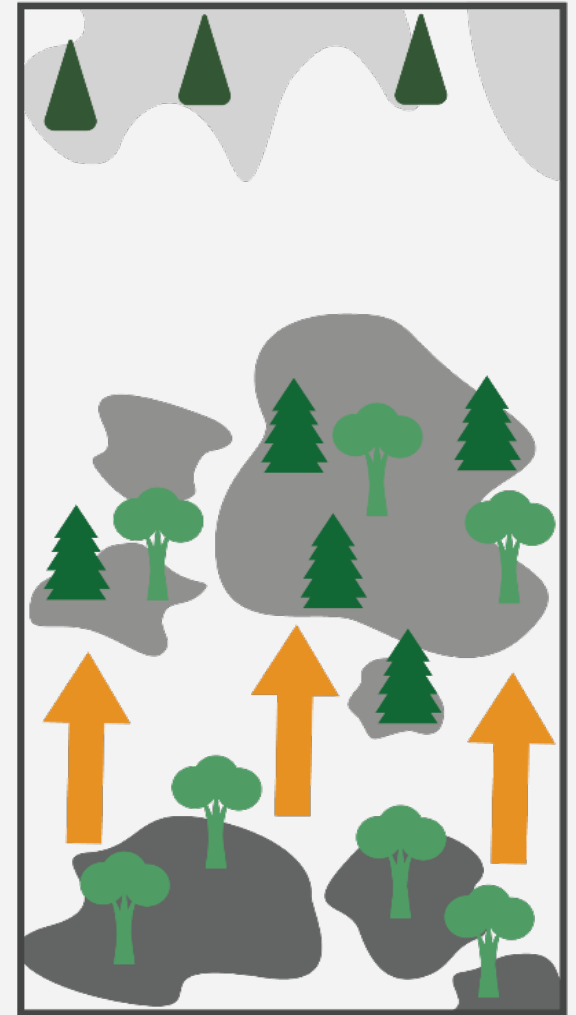
Assisted Migration



Assisted Population Migration

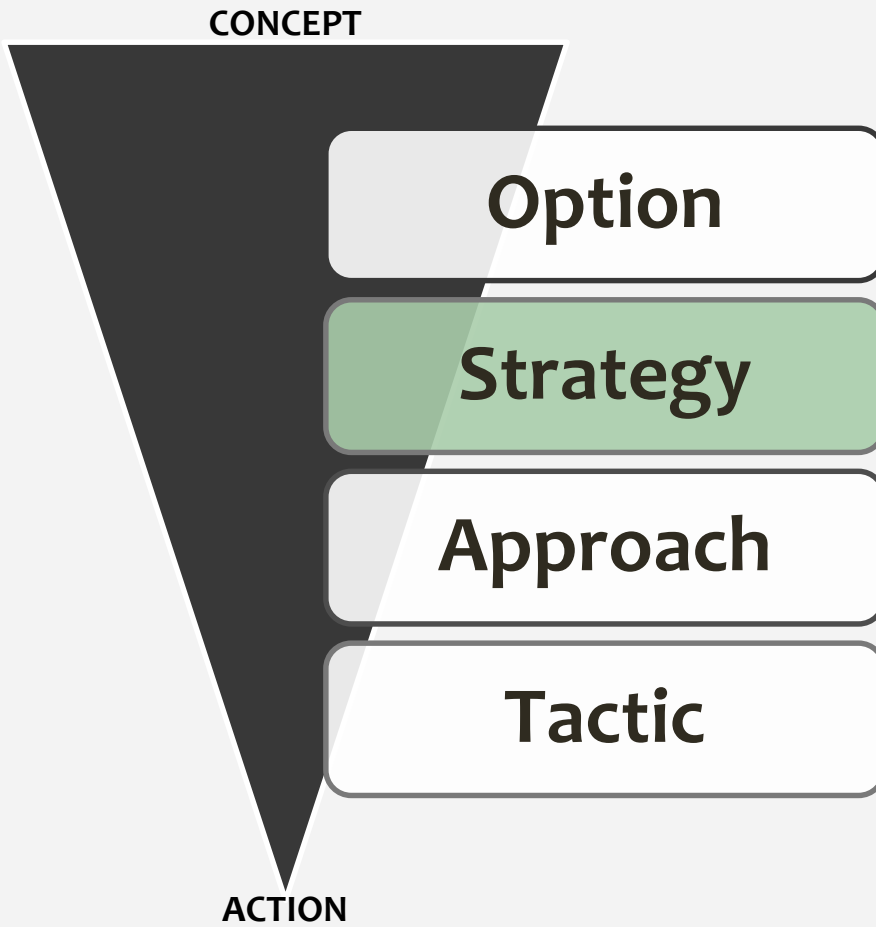


Assisted Range Expansion



Assisted Species Migration

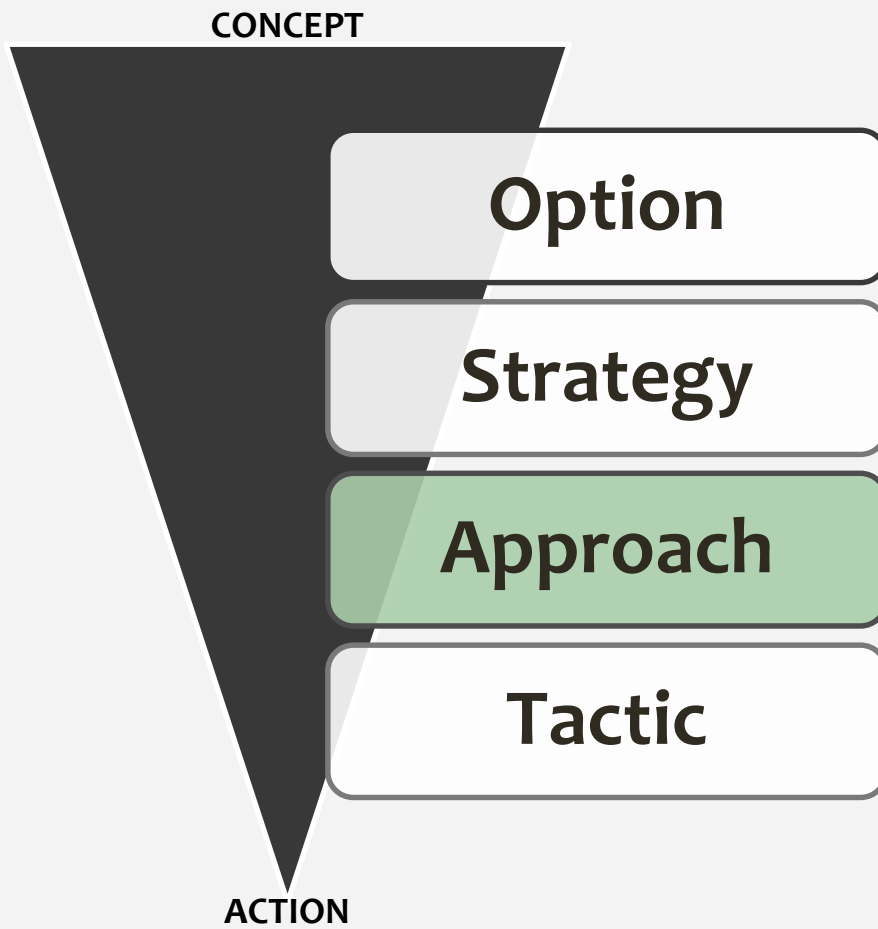
Adaptation Strategies & Approaches



Broad adaptation responses

- Sustain fundamental ecological functions
- Reduce the impact of existing biological stressors
- Maintain and enhance species and structural diversity
- Facilitate community adjustments through species transitions

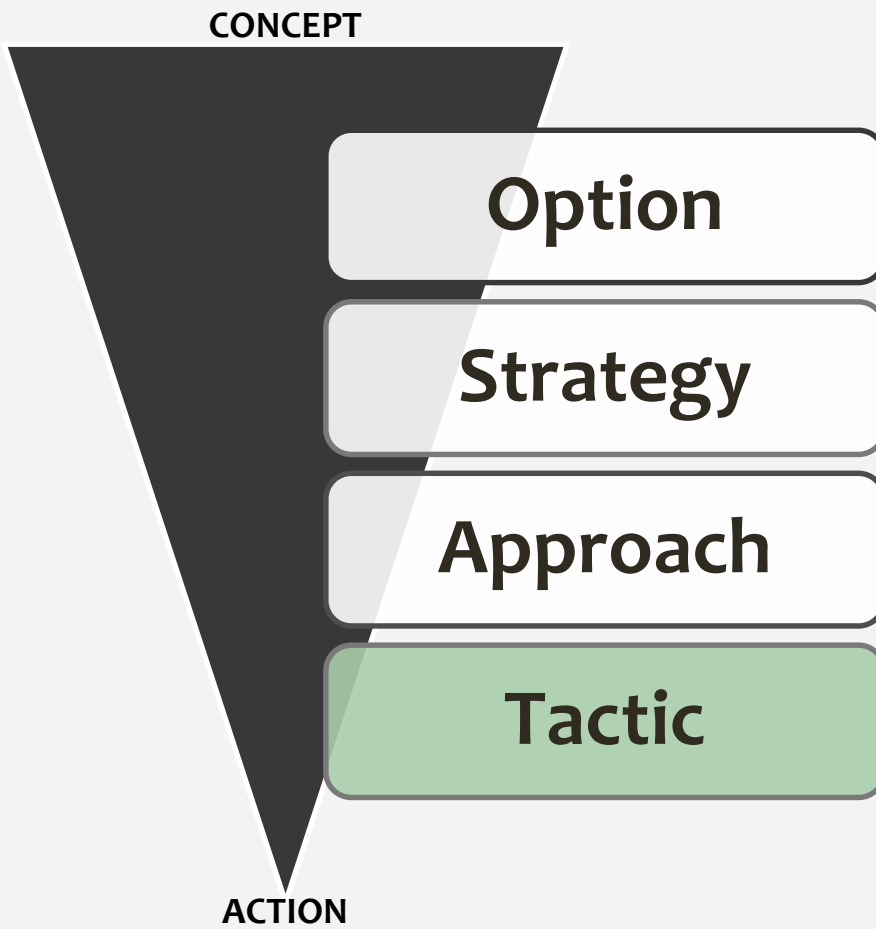
Adaptation Strategies & Approaches



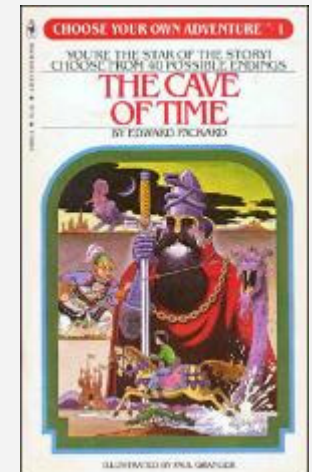
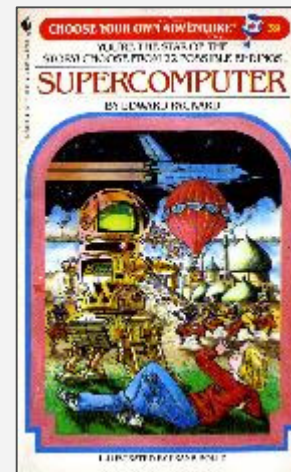
More specific actions

- Promote diverse age classes
- Maintain and restore diversity of native tree species
- Identify and move species to sites that are likely to provide future habitat

Adaptation Strategies & Approaches



Prescriptive actions selected by producer that are designed for individual site conditions and management objectives
→ **YOU DECIDE!**



Adaptation Strategies & Approaches

Management Goals
& Objectives

Climate Change
Impacts

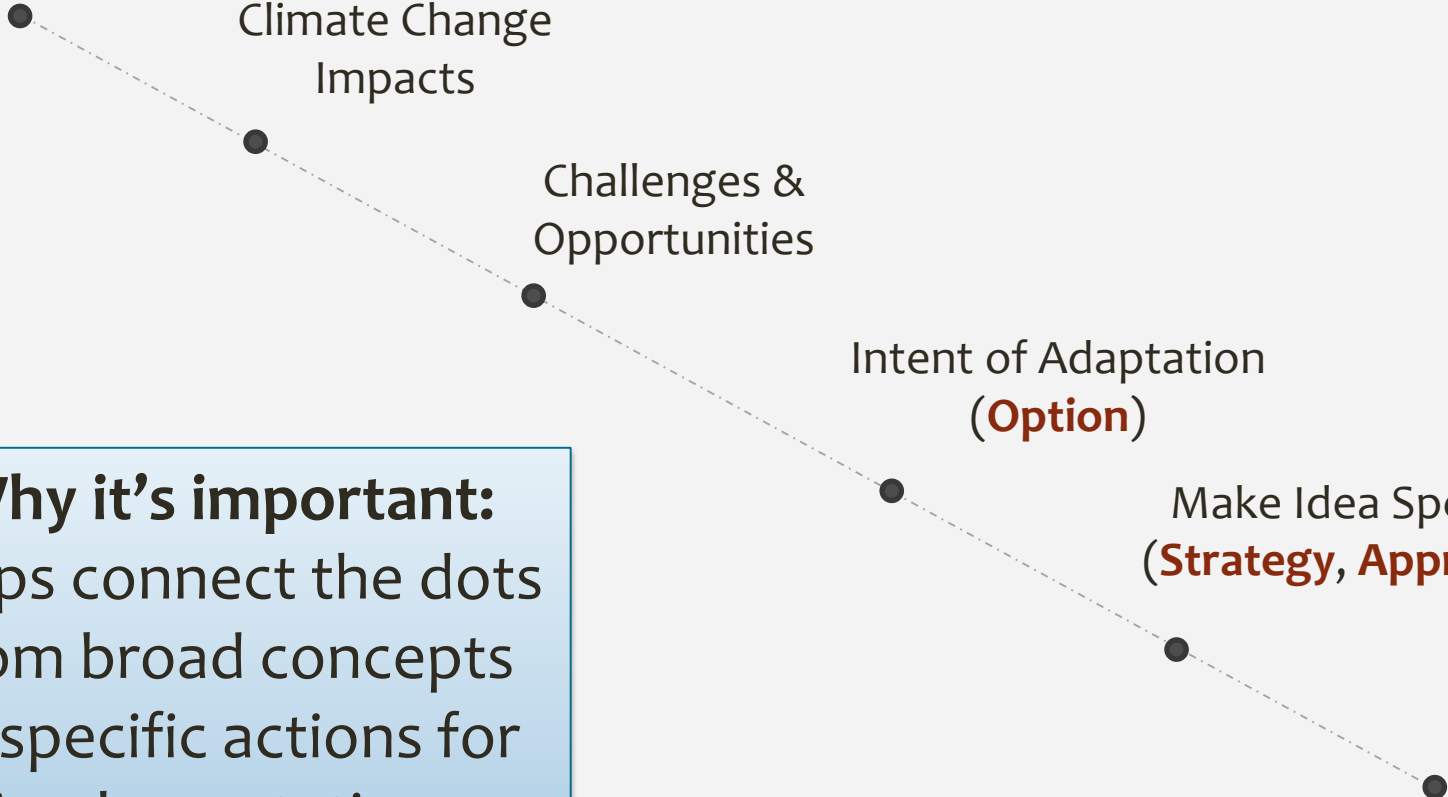
Challenges &
Opportunities

Intent of Adaptation
(**Option**)

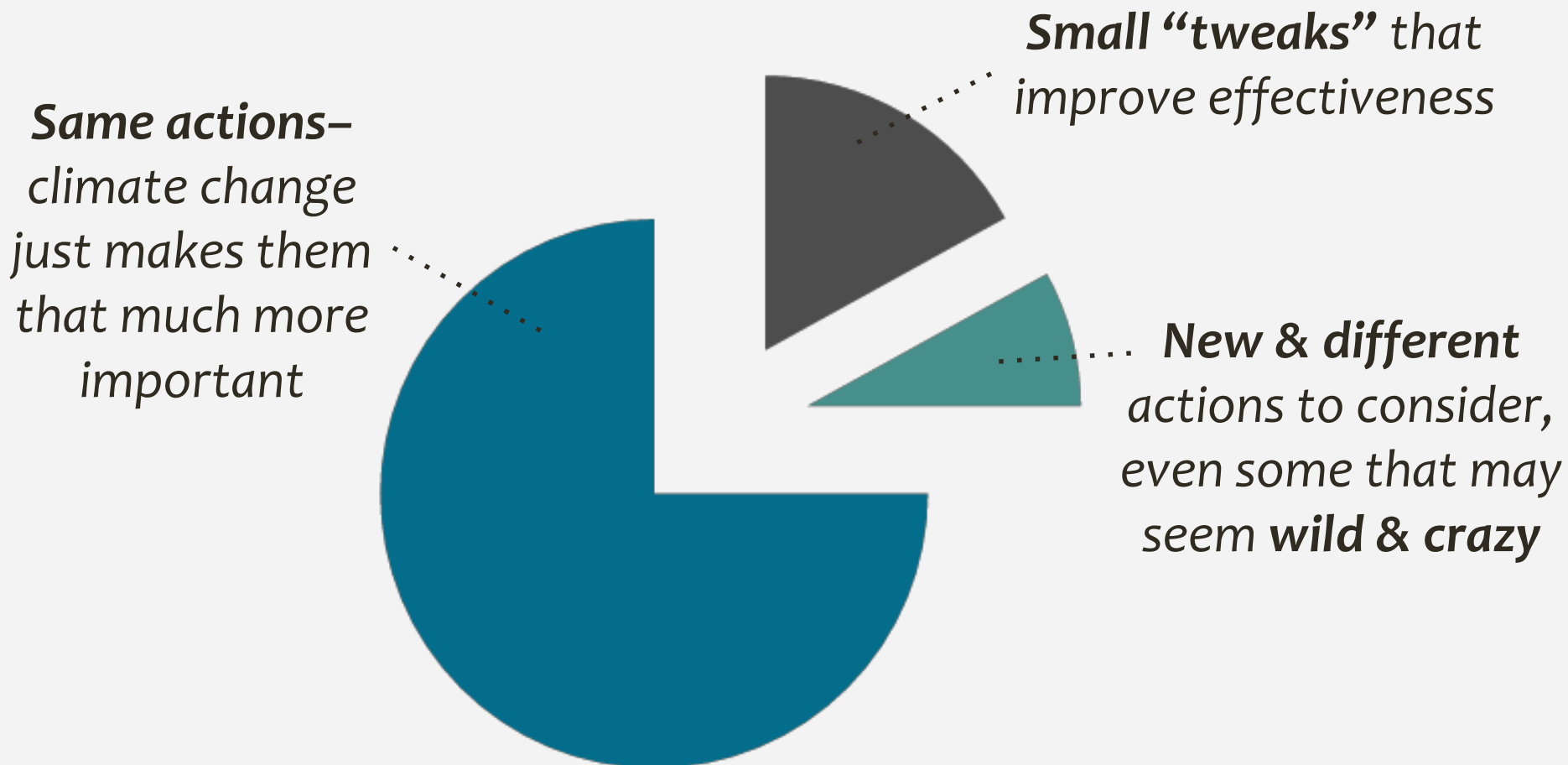
Make Idea Specific
(**Strategy, Approach**)

Action to Implement
(**Tactic**)

Why it's important:
Helps connect the dots
from broad concepts
to specific actions for
implementation.



Adaptation actions may not look that different from current management actions, especially in the near term.



**individual results will vary*

Step 4: IDENTIFY adaptation approaches and tactics for implementation.

Key Question:

- What actions can enhance the ability of the project area to adapt to anticipated changes and meet management goals?

Adaptation Workbook: Step 4

Course materials

Adaptation Workbook

- My dashboard
- Log out
- Define Management Topics
- Management Goals and Objectives
- Homework 1
- Step 2**
- Climate Impacts and Vulnerability
- Vulnerability Determination
- Homework 2
- Step 3
- Evaluate Objectives
- Homework 3
- Step 4**
- Adaptation Actions
- Tactic Recommendations
- Homework 4
- Step 5
- Monitoring Plans

Adaptation Actions instructions

Step 4 Course Materials

This is the step that you have probably been waiting for—now that you've considered climate change impacts, challenges, and opportunities, you'll identify and evaluate tactics that can help meet your management objectives and help your project area adapt to climate change. Before starting, we recommend that you watch this video to better understand how to develop adaptation actions.

View **Session 4 slides**.

You can also [read summaries](#) or [view videos](#) describing other adaptation projects if you want to see how other natural resource professionals have developed their actions.

If you have any technical issues with the Workbook or have suggestions for improvements, send us an email using [this link](#).

Add A Tactic

« Previous
Homework 3

Next »
Tactic Recommendations

Forestadaptation.org/demos

Climate Change Response Framework

Home Our Approach Projects Demos Products Partners Resources Contact

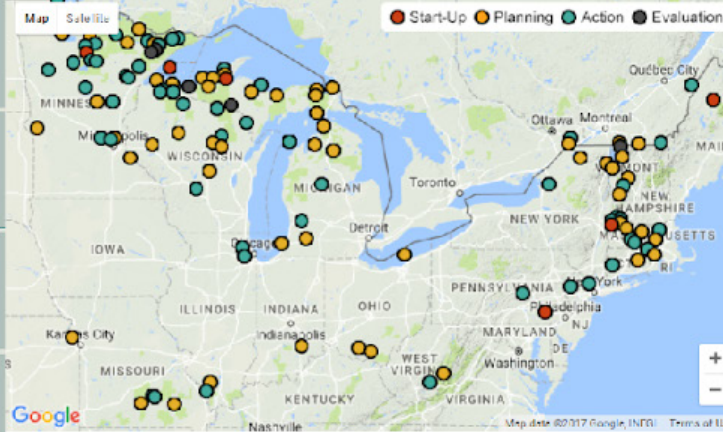
Central Appalachians

Central Hardwoods

Mid-Atlantic

New England

Northwoods



Demonstration Projects

Demonstration projects are real-world examples of how managers have integrated climate considerations into forest management planning and activities. These projects use the partnerships and resources developed through the Framework to test new ideas and actions for responding to changing conditions. Demonstrations come in all shapes and sizes, showing a variety of adaptation actions that also achieve forest management goals.

Keywords [Full List](#)

State

Landowner Type

Status

[Kestrel Land Trust: Buffam Brook Community Forest](#)

Filter by location or ecosystem of interest

Adaptation Workbook: Step 4

- Adaptation Workbook
- My dashboard
- Log out
- Resources ▾
- Chicago project
- Progress Summary
- Step 1
- Define Management Topics
- Management Goals and Objectives
- Homework 1
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- Homework 3
- Step 4
- Adaptation Actions >
- Tactic Recommendations
- Homework 4
- Step 5
- Monitoring Plan

Step 4.1: Identify adaptation approaches and tactics

The Adaptation Workbook helps you brainstorm management actions that can help prepare for changing conditions. You should think how you might address the challenges and opportunities you identified in Step 3, and try to make these adaptation ideas concrete and operational. The purpose of this step is for you to generate a custom set of adaptation tactics. **Tactics are prescriptive actions designed for your specific property and your unique management objectives.**

For each idea you generate, you'll also evaluate the benefits and drawbacks. You're not committed to implementing any idea at this point, so don't limit your creativity. You'll have an opportunity to review all your suggested tactics during the next step.

The Workbook also helps you create a clear rationale for your suggested tactics by connecting them to broader adaptation ideas. We've created a "menu" of adaptation strategies and approaches for forest management and conservation. This list is derived from the *Forest Adaptation Resources* document, where a number of adaptation approaches have been summarized and described in greater detail.

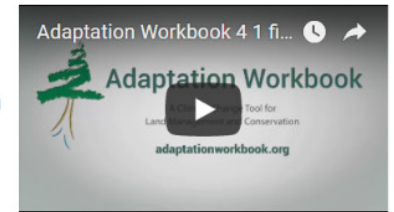
As you brainstorm and evaluate ideas for adaptation tactics, **you'll also link these specific ideas to the list of more general adaptation strategies and approaches.** These links will provide important context and rationale to justify your adaptation tactics. If you need help brainstorming specific adaptation tactics, you can use the menu of general strategies and approaches as a springboard.






For example:

Let's say you're managing street trees for a city, and your objective is to maintain most or all of the existing canopy cover through a 5 year pruning schedule on all street trees. You expect an increase in extreme storms and pest outbreaks may lead to a decreased ability to maintain canopy cover and have sufficient resources to prune on a regular basis. You may devise a tactic to incorporate more species that are more wind-tolerant and require less pruning. This tactic could be linked to approach 9.3: select tree species to match current and future site conditions.

 Adaptation Actions Resources

**Adaptation
Action
Resources**



-  A red triangle indicates fields are incomplete
-  An orange triangle indicates fields are partially complete
-  Hover to learn more about a particular item
-  Click to edit
-  Expand/collapse a section

« Previous
Homework 3

Next »
Tactic Recommendations

Adaptation Actions Resources

Adaptation Actions Resources

Forest Adaptation Resources: Climate change tools and approaches for land managers, 2nd Edition
This document provides a suite of materials to help land managers to consider climate change and to develop adaptation actions. It does not provide specific recommendations, but rather serves as a decision-support tool for incorporating adaptation considerations into current management objectives.
C. Swanston, M. Janowiak, and others. 2016. USDA Forest Service Northern Research Station.

- [Forest Adaptation Resources: Climate change tools and approaches for land managers, 2nd Edition](#)
- [Forest Adaptation Strategies and Approaches](#)
- [Urban Forest Adaptation Strategies and Approaches](#)

Climate Change Atlas
Landscape Change Research Group. 2014. USDA Forest Service Northern Research Station.

- [Climate Change Atlas](#)

Climate-Smart Conservation: Putting adaptation principles into practice
B. Stein, P. Glick, and others. 2014. National Wildlife Federation.

- [Climate-Smart Conservation: Putting adaptation principles into practice](#)

Urban Forest Climate Adaptation Framework for Metro Vancouver: Tree Species Selection, Planting and Management

- [Urban Forest Climate Adaptation Framework for Metro Vancouver: Tree Species Selection, Planting and Management](#)

The New Hampshire climate action plan: a plan for New Hampshire's energy, environmental and economic development future
New Hampshire Climate Change Policy Task Force. 2009.

**Links to tools
and
publications**

Adaptation Workbook: Step 4

The screenshot displays the 'Adaptation Workbook' interface. On the left is a dark sidebar with navigation options: 'My dashboard', 'Log out', 'Resources', 'Chicago project', 'Progress Summary', 'Step 1', 'Define Management Topics', 'Management Goals and Ob', 'Homework 1', 'Step 2', 'Climate Impacts and Vulner', 'Vulnerability Determination', 'Homework 2', 'Step 3', 'Evaluate Objectives', 'Homework 3', 'Step 4', 'Adaptation Actions', 'Tactic Recommendations', 'Homework 4', and 'Step 5'. A teal arrow points from the 'Adaptation Actions' menu item to a callout box. The main content area shows 'Adaptation Actions instructions' and 'Step 4 Course Materials'. Under 'Adaptation Tactics', it says '0 tactics' and features a button 'View a Menu of Urban Adaptation Strategies and Approaches'. Below this is a 'Review Goals and Objectives' section with an 'Add A Tactic' button. At the bottom, there are navigation links: '<< Previous Homework 3' and 'Next >> Tactic Recommendations'.

Review the Menu of Adaptation Strategies and Approaches

Find all menus at:
adaptationworkbook.org/strategies

Adaptation Strategies and Approaches Forest Menu

Adaptation Strategies and Approaches (Forest)

Adapted from Forest Adaptation Resources: Climate Change Tools and Approaches for Land Managers

Created using the NIACS Adaptation Workbook



Strategy 1: Sustain fundamental ecological functions

- Reduce impacts to soils and hydrologic conditions
- Maintain or restore hydrologic conditions
- Maintain or restore riparian and wetland functions
- Reduce competition for moisture
- Restore or maintain fire in fire-dependent ecosystems

Strategy 2: Reduce the impact of biological invasions

- Maintain or improve the ability of ecosystems to resist biological invasions
- Prevent the introduction and spread of nonnative species
- Manage herbivory to promote ecosystem health

Strategy 3: Reduce the risk and loss of cultural resources

- Alter forest structure or composition
- Establish fuelbreaks to slow fire spread
- Alter forest structure to reduce erosion
- Promptly revegetate sites after disturbance

Strategy 4: Maintain or create refugia

- Prioritize and maintain unique natural resources
- Prioritize and maintain sensitive natural resources
- Establish artificial reserves for at-risk and displaced species

Strategy 5: Maintain and enhance species and structural diversity

- Promote diverse age classes
- Maintain and restore diversity of native species
- Retain biological legacies
- Establish reserves to maintain ecosystem diversity

Strategy 1: Sustain fundamental ecological functions

Climate change will have substantial effects on a suite of ecosystem functions, such as carbon storage, nutrient cycling, habitat, or water provisioning. As a result, many management actions will need to work both directly and indirectly to maintain the integrity of ecosystems in the face of climate change. This strategy seeks to sustain fundamental ecological functions, especially those related to soil and hydrologic conditions.

Reduce impacts to soils and nutrient cycling

Maintaining both soil quality and nutrient cycling are already common tenets of sustainable forest management (Burger et al. 2010, Oliver and Larson 1996) and can help improve the capacity of ecosystems to persist under new conditions. Physical and chemical changes can result from a variety of forest management and recreation activities, as well as from climate-related processes including fire, drought, and flooding. Examples of physical impacts to soil are compaction, mixing of soil layers, removal of organic layers, rutting, erosion, and landslides. Complex interactions among climate, vegetation, and landforms can result in changes in nutrient cycling, including the leaching or fixation of nutrients and changes in soil biota. Many existing guidelines and best management practices describe actions that can be used to reduce impacts to soil and water; many of these actions are also likely to be beneficial in the context of adaptation, either in their current form or with modifications to address potential climate change impacts.

Examples

- Altering the timing of forest operations to reduce potential impacts on water, soils, and residual trees, especially in areas that rely on particular conditions for operations that may be affected by a changing climate (e.g., frozen soil, or dry conditions)
- Modifying forest operations techniques and equipment (e.g., using pallets, debris mats, or float bridges) to minimize soil compaction, rutting, or other impacts on water, soils, and residual trees
- Retaining coarse woody debris to maintain moisture, soil quality, and nutrient cycling
- Restricting recreational access in areas that show signs of excessive wear on natural resources in order to allow for revegetation or soil stabilization
- Using soil amendments to restore or improve soil quality (e.g., using lime to increase base cations in the soil profile in areas affected by long-term acid deposition)
- Restoring native herbaceous groundcover following management activities in order to retain soil moisture and reduce erosion.



Adaptation Strategies and Approaches Urban Menu

Adaptation Strategies and Approaches (Urban)

Adapted from Forest Adaptation Resources: Climate Change Tools and Approaches for Land Managers

Created using the NIACS Adaptation Workbook



Strategy 1: Sustain or restore fundamental ecological functions

- Maintain or restore soils and nutrient cycling in urban areas
 - Maintain or restore hydrology
 - Maintain or restore riparian areas
 - Reduce competition for moisture, nutrients, and light
 - Restore or maintain fire in fire-adapted ecosystems
- Strategy 2: Reduce the impact of biological stressors
 - Maintain or improve the ability of forests to resist biological stressors
 - Prevent the introduction and establishment of nonnative species
 - Manage herbivory to promote regeneration, growth, and survival
 - Strategy 3: Reduce the risk and long-term impacts of disturbance
 - Alter forest structure or composition to reduce disturbance risk
 - Maintain trees and remove hazards to reduce disturbance risk
 - Strategy 4: Maintain or create refugia
 - Prioritize, maintain, and restore unique sites
 - Prioritize and maintain sensitive or at-risk species
 - Establish artificial reserves for at-risk species
 - Strategy 5: Maintain and enhance species and structural diversity
 - Promote diverse age structure
 - Maintain and restore diversity of native species
 - Retain biological legacies
 - Establish reserves to maintain ecosystem diversity
 - Strategy 6: Increase ecosystem redundancy across taxonomic groups
 - Manage habitats over a range of sites and corridors
 - Expand or buffer the boundaries of reserves to increase redundancy
 - Strategy 7: Promote landscape connectivity
 - Reduce landscape fragmentation
 - Maintain and create habitat corridors through landscape fragmentation
 - Strategy 8: Maintain and enhance genetic diversity
 - Use seeds, germplasm, and other genetic material
 - Favor existing genotypes that are better adapted to current conditions
 - Use new genotypes that are better adapted to future conditions
 - Strategy 9: Facilitate composition adjustments through species transitions
 - Favor or restore native species that are expected to be adapted to future conditions
 - Establish or encourage new mixes of native species
 - Select tree species to match current and future site conditions
 - Protect future-adapted seedlings and saplings
 - Disfavor species that are distinctly maladapted

Strategy 1: Sustain or restore fundamental ecological functions

The changing climate may alter the complex interactions among climate, vegetation, and landforms, resulting in changes in hydrology, soil quality, and nutrient cycling. Urban areas often involve further complications because of the greater likelihood that human activities have already significantly altered ecosystem functioning and will continue to do so. Urban conditions are often characterized by difficult growing conditions, including impermeable surfaces, air and water pollution, frequent human interaction, and small soil volumes. Existing guidelines and best management practices for forest management describe actions that can be used to reduce or reverse impacts to soil and water. Many of these actions are also likely to be beneficial in the context of adaptation, although additional effort may be required to maintain ecosystem function in urban areas.

Maintain or restore soils and nutrient cycling in urban areas

Most urban tree problems are related to poor soils or growing conditions (Patterson and Mader 1982), which could exacerbate stresses induced by climate change. Urban soils are often highly disturbed, lack essential nutrients, and commonly include detrimental elements such as chemicals, concrete, asphalt, and other foreign matter that limit the long-term viability of a tree. Trees are dependent on adequate soil characteristics such as rooting volume, organic matter content, drainage capacity, and nutrient availability to achieve healthy maturity. Prior to planting a tree, soil and site analyses can be conducted to determine if the soil content, texture, or volume would meet the long-term needs of a growing healthy tree.

Examples

Urban natural areas:

- Removing invasive species that have negative impacts on soil processes or undesirable feedbacks to nutrient inputs (e.g., European buckthorn; Heneghan et al. 2006)
- Adding organic soil amendments (e.g., mulch, biochar) to urban sites undergoing restoration or revegetation.

Developed urban sites:

- Providing and developing adequate soil volume, texture, structure, and organic matter to support healthy tree growth (e.g., Watson and Himelick 2013)
- Removing and replacing the soil if toxicity or chemical levels are too high
- Amending soil with organic or structural material to improve drainage, pH, and rooting
- Installing a layer of mulch over the root zone of the tree to help retain moisture and mimic a natural growing environment.

Maintain or restore hydrology

Changes in climate may increase runoff during heavy storm events in some areas. Impermeable surfaces are more common in the urban setting and direct water into water bodies through storm sewers. Stormwater thus bypasses vegetation and other natural features that could slow water flow and reduce pollution. Vegetation and associated ecosystem features can filter, intercept, and absorb stormwater, reducing runoff and improving the quality of water reaching streams and lakes. Water is intercepted by the tree canopy and held by the root systems of herbaceous and woody plants and associated soil organic material. In highly developed areas where large areas of vegetation are not feasible, engineered features can also be used to increase permeability and help redistribute water.

Examples

Urban natural areas:

- Restoring natural hydrology where appropriate by removing drain tiles or other remnant hydrological modifications
- Restoring native communities and ecosystem components (e.g., natural groundcover, litter layer, coarse woody debris) in riparian areas
- Adjusting trail location and design to minimize erosion under more intense surface runoff.

Developed urban sites:

Review Goals and Objectives

The screenshot displays a web application interface for an 'Adaptation Workbook'. On the left is a dark sidebar with a navigation menu including 'My dashboard', 'Log out', 'Resources', 'Chicago project', 'Progress Summary', and five steps. Step 4, 'Adaptation Actions', is highlighted with a yellow arrow. The main content area shows 'Adaptation Tactics' with '0 tactics' and a button to 'View a Menu of Urban Adaptation Strategies and Approaches'. Below this is a section titled 'Review Goals and Objectives'. A callout box with a teal border and a large teal arrow points to this section, containing the text 'Expand/contract'. At the bottom of the main area are navigation links: '<< Previous Homework 3' and 'Next >> Tactic Recommendations'.

Step 4: IDENTIFY adaptation approaches and tactics for implementation.

Approach – Select from the menu. Pick any that seem to make sense and help address the challenges.

Tactic – Describe a specific action you can take.

These details should ideally answer what, where, and how you will implement the actions.



Add a Tactic

The screenshot displays a web application interface for an 'Adaptation Workbook'. On the left is a dark sidebar with a navigation menu. The main content area is white and shows the 'Adaptation Tactics' section, which currently contains 0 tactics. A highlighted link 'View a Menu of Urban Adaptation Strategies and Approaches' is visible. A dark bar at the bottom of the main content area contains the text 'Review Goals and Objectives'. In the bottom right corner of the main content area, there is an orange button labeled 'Add A Tactic' with a plus icon. A large teal arrow points from a text box containing the words 'Add a Tactic' to this button. At the bottom left of the main content area, there are navigation links: '<< Previous' and 'Homework 3'. At the bottom right, there are navigation links: 'Next >>' and 'Tactic Recommendations'. The sidebar menu includes items such as 'My dashboard', 'Log out', 'Resources', 'Chicago project', 'Progress Summary', and a series of steps from 'Step 1' to 'Step 5', with 'Adaptation Actions' currently selected and highlighted.

Adaptation Workbook

- My dashboard
- Log out
- Resources
- Chicago project
- Progress Summary
- Step 1
 - Define Management Topics
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Adaptation Actions instructions

Step 4 Course Materials

Adaptation Tactics

0 tactics

[View a Menu of Urban Adaptation Strategies and Approaches](#)

Review Goals and Objectives

[Add A Tactic](#)

<< Previous
Homework 3

Next >>
Tactic Recommendations

Add a Tactic

Select a Strategy

Adaptation Work **New Tactic**

Strategy

- Strategy 1: Sustain or restore fundamental ecological functions
- Strategy 2: Reduce the impact of biological stressors
- Strategy 3: Reduce the risk and long-term impacts of severe disturbances
- Strategy 4: Maintain or create refugia
- Strategy 5: Maintain and enhance species and structural diversity
- Strategy 6: Increase ecosystem redundancy across the landscape
- Strategy 7: Promote landscape connectivity
- Strategy 8: Maintain and enhance genetic diversity
- Strategy 9: Facilitate composition adjustments through species transitions
- Strategy 10: Realign urban ecosystems after disturbance

Approach

Add Strategy/Approach

Timeframe

Practicability

Drawbacks and Barriers

List any drawbacks associated with this tactic, such as harmful ecosystem impacts, potential conflicts with other management goals, or institutional barriers.

Save

« Previous
Homework 3

Next »
Tactic Recommendations

Select an Approach

Adaptation Work **New Tactic**

Strategy
Strategy 2: Reduce the impact of biological stressors

Approach
Maintain or improve the ability of forests to resist pests and pathogens
Prevent the introduction and establishment of invasive plants and remove existing invasive species
Manage herbivory to promote regeneration, growth, and form of desired species

Tactical Details
Describe specifically the action you can take. These details should ideally answer what, when, how, and where you will implement the actions.

Time Frame

Benefits
List any benefits associated with using this tactic. For example, note if a tactic addresses addresses multiple challenges, has important side benefits, or is already part of your business as usual management.

Practicability

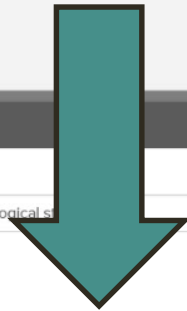
Drawbacks and Barriers
List any drawbacks associated with this tactic, such as harmful ecosystem impacts, potential conflicts with other management goals, or institutional barriers.

Save

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Next »
Tactic Recommendations

Describe your Tactic



New Tactic

Strategy: Strategy 2: Reduce the impact of biological s

Approach: Maintain or improve the ability of forests to resist pests and pathogens

[Add Strategy/Approach](#)

Tactical Details

Plant Dutch elm disease-resistant elm cultivars such as Princeton elm and Accolade elm. Treat ash trees with insecticide. Plant less common species that are disease-resistant.

Benefits

List any benefits associated with using this tactic. For example, note if a tactic addresses addresses multiple challenges, has important side benefits, or is already part of your business as usual management.

Drawbacks and Barriers

List any drawbacks associated with this tactic, such as harmful ecosystem impacts, potential conflicts with other management goals, or institutional barriers.

[Save](#)

[Timeframe](#)

[Practicability](#)

[« Previous](#)
Homework 3

[Next »](#)
Tactic Recommendations

Open
Strategies
and
Approaches

Approaches

Step 4: IDENTIFY adaptation approaches and tactics for implementation.

Timeframe – Specify when you will implement the tactic.

For example:

- Summer 2019
- Winter 2019-2020
- Within 3 years of...
- After...
- If... then...

Describe your Timeframe

Adaptation Work **New Tactic**

Strategy
Strategy 2: Reduce the impact of biological stressors

Approach
Maintain or improve the ability of forests to resist pests and pathogens

Tactical Details
Plant Dutch elm disease-resistant elm cultivars such as Princeton elm and Accolade elm. Treat ash trees every 3 years. Treat every 3 years, plant 1000 new trees annually.

Benefits
List any benefits associated with using this tactic. For example, note if a tactic addresses multiple challenges, has important side benefits, or is already part of your business as usual management.

Drawbacks and Barriers
List any drawbacks associated with this tactic, such as harmful ecosystem impacts, potential conflicts with other management goals, or institutional barriers.


Timeframe
Timeframe: Treat every 3 years, plant 1000 new trees annually

Practicability
Practicability: [Dropdown menu]

Save

« Previous
Homework 3

Next »
Tactic Recommendations



Step 4: IDENTIFY adaptation approaches and tactics for implementation.

Benefits – Describe why the tactic is good.

For example:

- addresses biggest or multiple challenges
- is cheap and easy
- has co-benefits
- is likely to succeed

Step 4: IDENTIFY adaptation approaches and tactics for implementation.

Drawbacks and Barriers – Describe why it's not so good.

For example:

- it may have negative side effects,
- Requires high cost or effort
- may not be successful
- has social, financial, or other barriers

Describe your Benefits and Drawbacks/Barriers

Adaptation Work

New Tactic

Strategy: Strategy 2: Reduce the impact of biological stressors

Approach: Maintain or improve the ability of forests to resist pests and pathogens

Add Strategy/Approach

Tactical Details

Plant Dutch elm disease-resistant elm cultivars such as Princeton elm and Accolade elm. Treat ash trees with insecticide. Plant less common species that are disease-resistant.

Benefits

List any benefits associated with using this tactic. For example, note if a tactic addresses addresses multiple challenges, has important side benefits, or is already part of your business as usual management.

Drawbacks and Barriers

List any drawbacks associated with this tactic, such as harmful ecosystem impacts, potential conflicts with other management goals, or institutional barriers.

Timeframe: Treat every 3 years, plant 1000 new trees annu

Practicability

Save

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Next »
Tactic Recommendations

Step 4: IDENTIFY adaptation approaches and tactics for implementation.

Practicability – Is it both *effective* (will meet desired intent) and *feasible* (capable of being implemented)?

- **High:** Yes to both!
- **Moderate:** Yeah, but it will take some additional effort or planning...
- **Low:** No, the barriers/drawbacks seem too big or the benefits too small.

Practicability

The screenshot shows a 'New Tactic' form with the following details:

- Strategy:** Strategy 2: Reduce the impact of biological stressors
- Approach:** Maintain or improve the ability of forests to resist pests and pathogens
- Tactical Details:** Describe specifically the action you can take. These details should ideally answer what, when, how, and where you will implement the actions.
- Benefits:** List any benefits associated with using this tactic. For example, note if a tactic addresses addresses already part of your business as usual management.
- Drawbacks and Barriers:** List any drawbacks associated with this tactic, such as harmful ecosystem impacts, potential conflicts with other institutional arrangements.
- Timeframe:** Time Frame
- Practicability:** A dropdown menu with options: Low, Medium (highlighted), High.

A central graphic features the text 'LOW MEDIUM HIGH' in a vertical stack, with a green arrow pointing from the 'Practicability' dropdown menu towards it.

Navigation buttons include 'Save' at the bottom of the form, and '« Previous' and 'Next »' at the bottom of the page.

Apply tactics to objectives

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Adaptation Actions instructions

Step 4 Course Materials

Adaptation Tactics

1 tactics

[View a Menu of Urban Adaptation Strategies and Approaches](#)

Review Goals and Objectives

Tactic: qew

Applicable to 1 objectives

Benefits

Drawbacks and Barriers

Timeframe
<Empty>

Practicability
Medium

Does this tactic apply to these objectives?

<input type="radio"/> No	<input checked="" type="radio"/> Yes	Management Topic: Park > Goal: Increase species diversity Objective: Have no more than 20 percent of a family, 10 percent of a genus and 5 percent of a species
<input type="radio"/> No	<input checked="" type="radio"/> Yes	Management Topic: Park > Goal: Increase species diversity Objective: Increase the percent of species that are native or expected to gain habitat in the area.

« Previous
Homework 3

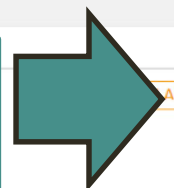
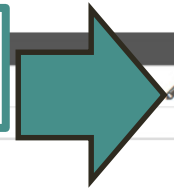
Next »
Tactic Recommendations

[Another Tactic](#) +

Apply tactic to multiple objectives

Edit tactic

Add another tactic



Step 4: IDENTIFY adaptation approaches and tactics for implementation.

Recommend Tactic– Given all this, is this tactic likely to be helpful?

Also consider: trade-offs, urgency, likelihood of success, cost, and effort...

Yes: look to integrate into plan, prescription, or other activities

No: not useful at this time

Recommend tactic?

The screenshot shows a web application interface for 'Tactic Recommendations'. On the left is a dark sidebar with navigation options: 'Adaptation Workbook', 'My dashboard', 'Log out', 'Resources', 'Chicago project', 'Progress Summary', 'Step 1', 'Define Management Topics', 'Management Goals and Objectives', 'Homework 1', 'Step 2', 'Climate Impacts and Vulnerability', 'Vulnerability Determination', 'Homework 2', 'Step 3', 'Evaluate Objectives', 'Homework 3', 'Step 4', 'Adaptation Actions', 'Tactic Recommendations' (highlighted with an orange arrow), 'Homework 4', and 'Step 5'. The main content area has a header with 'Tactic Recommendations Instructions' and 'Step 4 Course Materials'. Below this is a 'Tactic Recommendations' panel for a 'Park' location, showing '1 of 1 tactics recommended'. A large teal arrow points from this summary to a detailed tactic card. The card contains an objective, strategy, approach, and sections for 'Benefits' and 'Drawbacks and Barriers'. A second teal arrow points from the tactic card to a 'Recommended' / 'Not recommended' toggle. A green box with the text 'Recommend tactic?' is overlaid on the right side of the interface. At the bottom of the tactic card, there are 'Previous' and 'Next' navigation buttons.

Adaptation Workbook

My dashboard

Log out

Resources

Chicago project

Progress Summary

Step 1

Define Management Topics

Management Goals and Objectives

Homework 1

Step 2

Climate Impacts and Vulnerability

Vulnerability Determination

Homework 2

Step 3

Evaluate Objectives

Homework 3

Step 4

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Monitoring Plan

Tactic Recommendations Instructions

Step 4 Course Materials

Tactic Recommendations

Park

1 of 1 tactics recommended

Objective: Have no more than 20 percent of a family, 10 percent of a genus and 5 percent of a species

gew

Strategy: Reduce the impact of biological stressors > Approach: Maintain or improve the ability of food and pathogens

Benefits

werw

Drawbacks and Barriers

gew

Recommended

Not recommended

Recommend tactic?

« Previous

Adaptation Actions

Next »

Homework 4

Step 4.2: Tactic Recommendations



Slow Down to Consider...

Are you going to continue with the adaptation tactics you have selected?

Take a step back and think about whether the adaptation tactics you selected will help address the management challenges that you identified in Step 3. Have you considered actions that will help address your primary challenges or take advantage of any opportunities? Do your adaptation tactics seem feasible and effective?

- If you feel comfortable with your list of adaptation tactics and these actions seem like they'll address your major challenges and opportunities, proceed to Step 5.
- If you've recommended tactics with low practicability, you may want to record the reasons why you are proceeding with that tactic.
- If there are major climate change challenges that you haven't addressed, you may want to evaluate additional adaptation approaches and tactics before moving on to Step 5. Read the Adaptation Strategies and Approaches in [Forest Adaptation Resources](#), read other resources on climate change adaptation, and consult with colleagues to identify other viable actions.

Don't show this again.

Continue working on this step

Move on!

Species that are expected to be adapted to future conditions

Homework

- Adaptation Workbook
- My dashboard
- Log out
- Resources ▾
- Chicago project
- Progress Summary
- Step 1
 - Define Management Topics
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 - Climate Impacts and Vulnerability
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Homework 4

Describe a Strategy that is particularly relevant for your project area, and why. What approaches have you decided to pursue to achieve it, and how/when (tactics and timelines) do you plan to implement them?

Describe a Strategy that is particularly relevant for your project area, and why. What approaches have you decided to pursue to achieve it, and how/when (tactics and timelines) do you plan to implement them?

Identifying Adaptation Options: rate how strongly you agree/disagree with the following.

	Disagree			Agree
I can identify viable climate change adaptation strategies and/or approaches that can be applied to my local area.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I can translate broad adaptation strategies to specific, actionable adaptation tactics in my local area.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
The tactics I've developed for climate adaptation on my forest or project area will help me minimize risk and maximize future management options.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I am comfortable articulating my approach and tactics for incorporating climate adaptation into management of this forest/project area to my supervisors and/or clients.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Where do you think your adaptation plan falls on the spectrum of adaptation Options? Would you characterize your adaptation plan as primarily Resistance, Resilience, or Transition?

Where do you think your adaptation plan falls on the spectrum of adaptation Options? Would you characterize your adaptation plan as primarily Resistance, Resilience, or Transition?

Which adaptation tactics did you develop that weren't actually practical for your forest or project area? Did you decide not to recommend some of these tactics?

Which adaptation tactics did you develop that weren't actually practical for your forest or project area? Did you decide not to recommend some of these tactics?

« Previous
Tactic Recommendations

Next »
Monitoring Plan

www.forestadaptation.org/demos

The screenshot displays the 'Climate Change Response Framework' website. The navigation menu includes Home, Our Approach, Projects, Demos, Products, Partners, Resources, and Contact. The 'Demos' section is active, showing a map of the eastern United States and southern Canada with colored markers representing project status: Start-Up (red), Planning (orange), Action (green), and Evaluation (black). The map shows projects across various states including Minnesota, Wisconsin, Michigan, Illinois, Indiana, Ohio, Pennsylvania, New York, New Jersey, Maryland, Delaware, Virginia, West Virginia, Kentucky, Missouri, and Maine. A legend in the top right of the map area identifies the status markers.

Below the map, the 'Demonstration Projects' section provides a definition: 'Demonstration projects are real-world examples of how managers have integrated climate considerations into forest management planning and activities. These projects use the partnerships and resources developed through the Framework to test new ideas and actions for responding to changing conditions. Demonstrations come in all shapes and sizes, showing a variety of adaptation actions that also achieve forest management goals.'

A filter section allows users to refine their search by 'Keywords Full List', 'State', 'Landowner Type', and 'Status'. Each filter has a dropdown menu and a search button. A large blue arrow points from the 'Urban' category in the left sidebar to the filter section.

The left sidebar lists six geographic regions: Central Appalachians, Central Hardwoods, Mid-Atlantic, New England, Northwoods, and Urban. The 'Urban' category is highlighted with a blue arrow pointing towards the filter section.

At the bottom of the page, a specific project is listed: 'Kestrel Land Trust: Buffam Brook Community Forest'.

Filter projects by keyword, state, land ownership, or project status.

Assignment

- Go back and complete **Step 3** as needed
- Complete **Step 4: Identifying Adaptation Actions**
- Complete the **Homework** section after Step 4
- These course materials may be helpful:
 - Adaptation Strategies and Approaches
 - Adaptation Demonstrations
- Come to Session 5 (Feb 19) ready to discuss your approaches and actions!

Thanks everyone!

Troubleshooting? Stay on the line.

Questions?

