

ONLINE COURSE

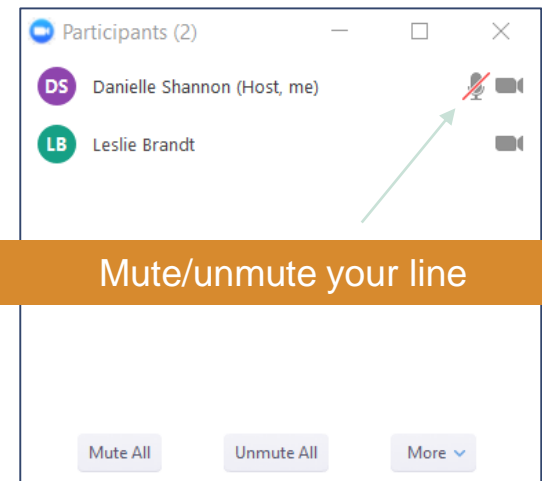
URBAN FORESTED WATERSHEDS ADAPTATION PLANNING AND PRACTICES

Session 4: Identifying Adaptation Strategies, Approaches and Tactics

Tuesday, November 27, 2018 @ 11 am ET

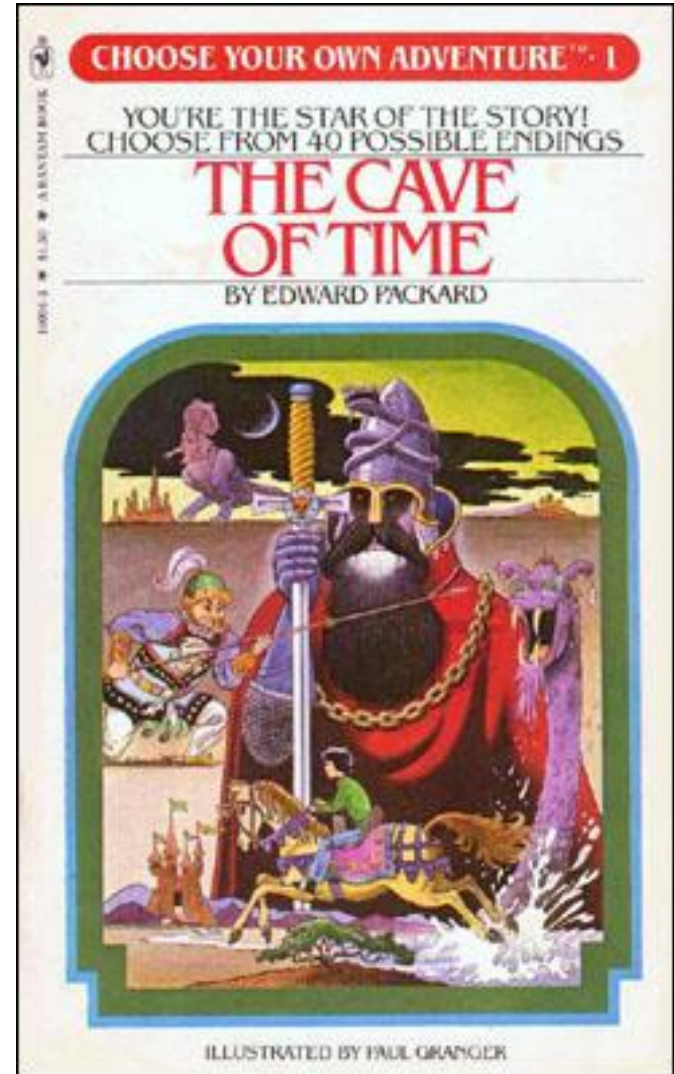
Web session etiquette. Please:

- If you are using a phone, turn off your computer speakers to avoid feedback and terrible noises.
- Mute your line unless you are speaking to the group.



Today's Agenda

- **Discussion:**
 - Step 3 review
 - Step 3 discussion
- **Lecture**
 - Adaptation concepts
 - Step 4 Intro



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.

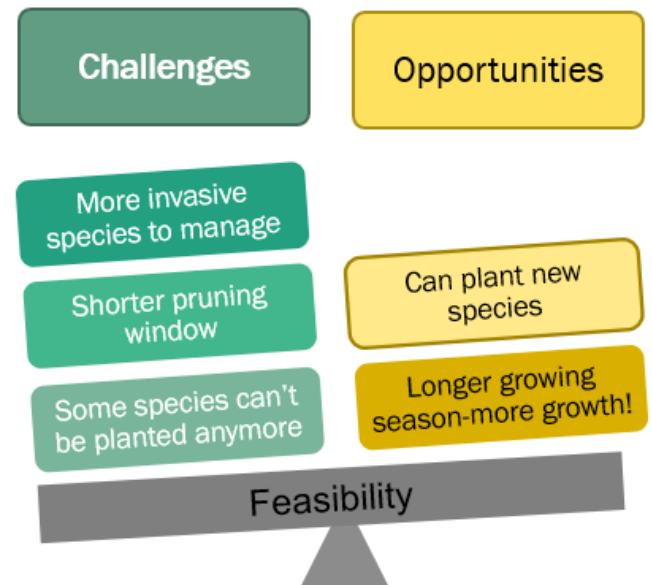
Feasibility – Can you meet your management objectives using current (business-as-usual) management actions?

High: We can do it!

Opportunities > Challenges

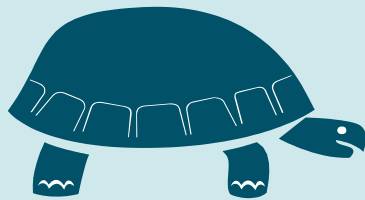
Low: We'll need more resources or effort.

Challenges > Opportunities



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

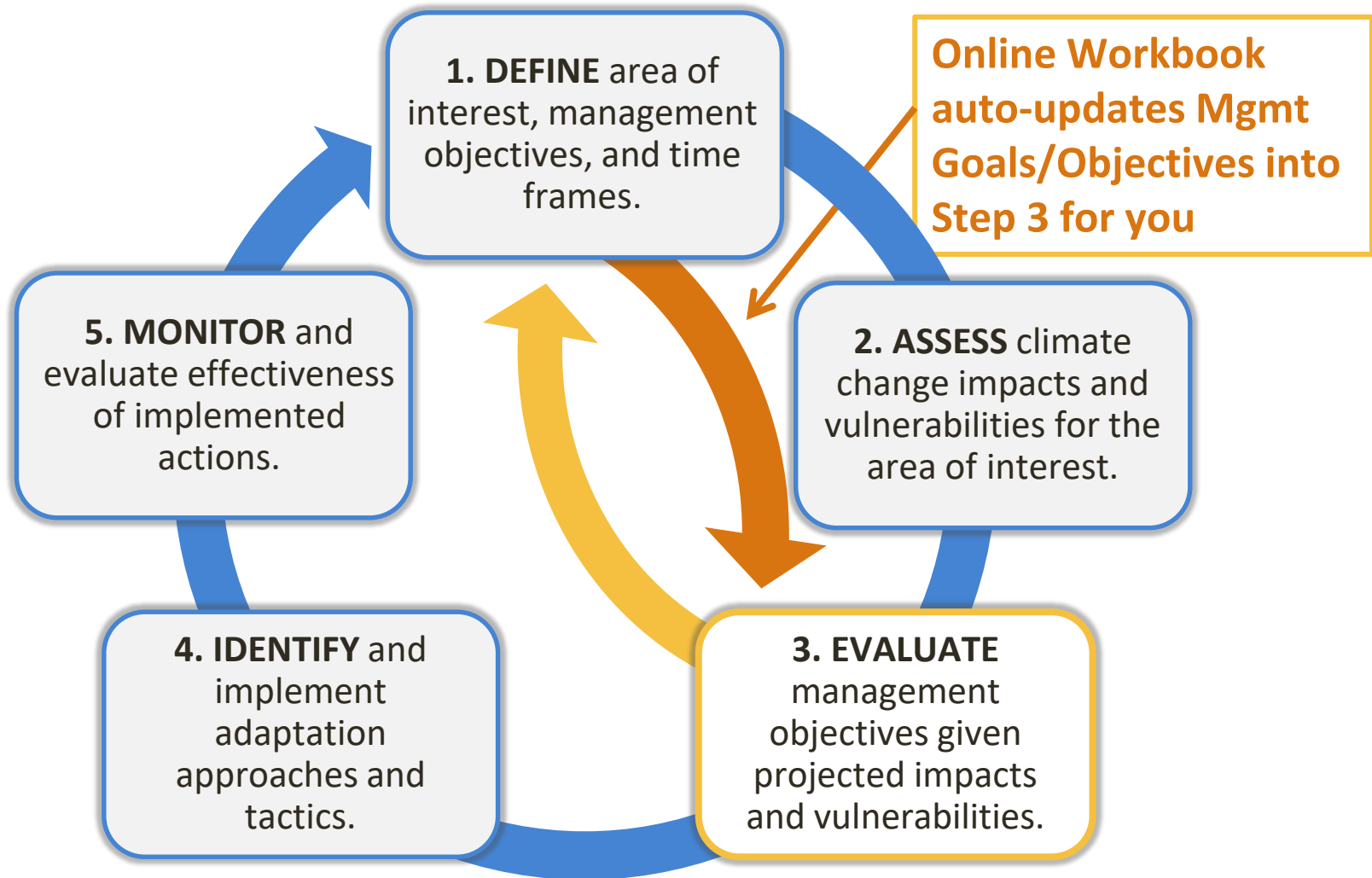
Step 3: EVALUATE management objectives given projected impacts and vulnerabilities.



Slow down!

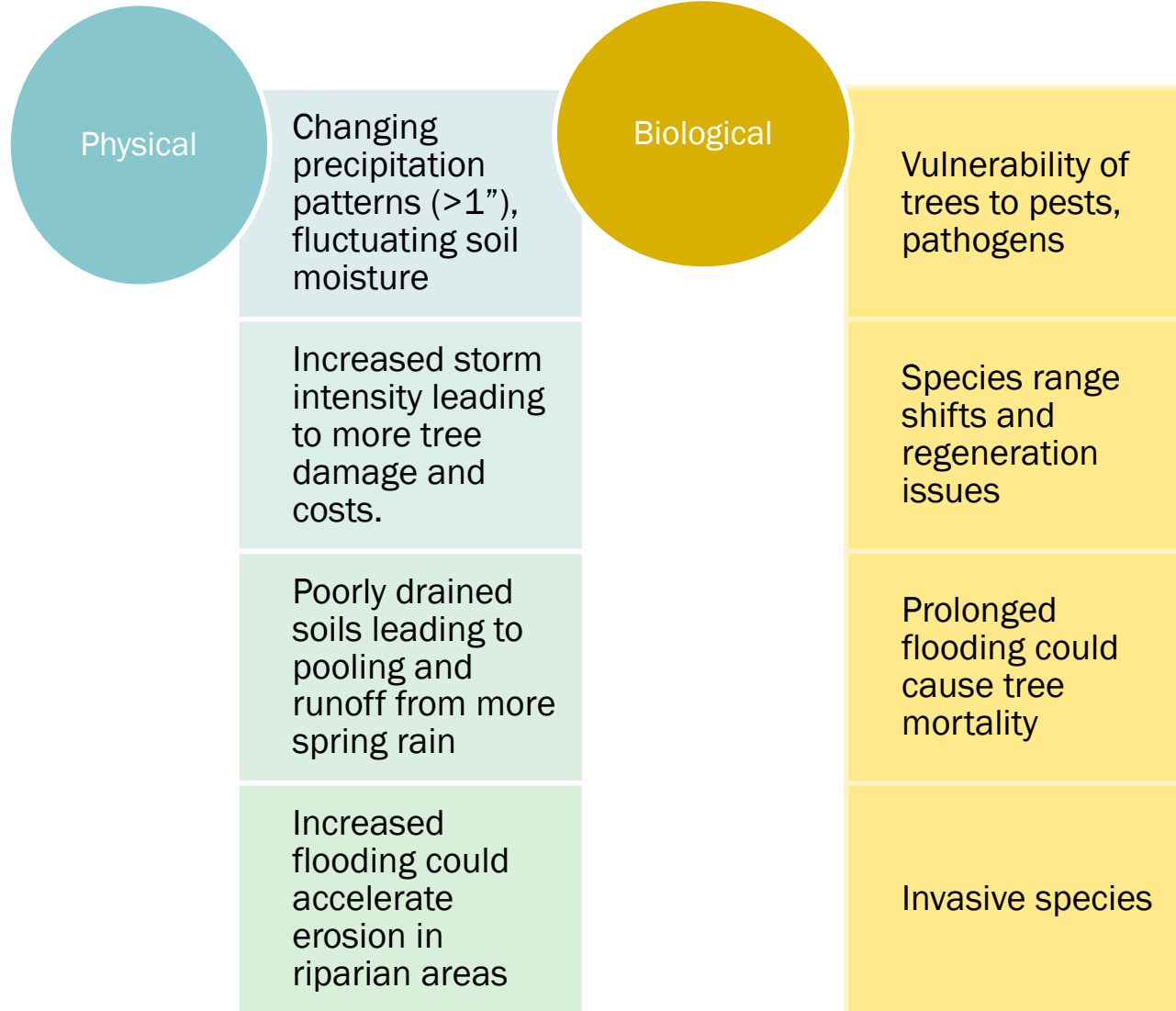
*Are you going to
continue with these
management objectives?*

Workbook Cycle: Step 3



...or, RE-EVALUATE

Challenges



Opportunities

Are there any climate impacts that present opportunities for meeting your management goals and objectives?

- **Longer growing seasons** may promote the growth of adaptable species
- Several species suited to oak savanna or prairie habitats **may be suited to projected climate conditions**. This could increase diversity in upland areas of the park and overall habitat complexity across the site.
- **Probably not**. The predicted longer growing season could be beneficial in allowing more species to grow here, but only if these species could also do well under less predictable precipitation patterns.
- Increased frequency of extreme events may increase public awareness drawing more public support for projects.

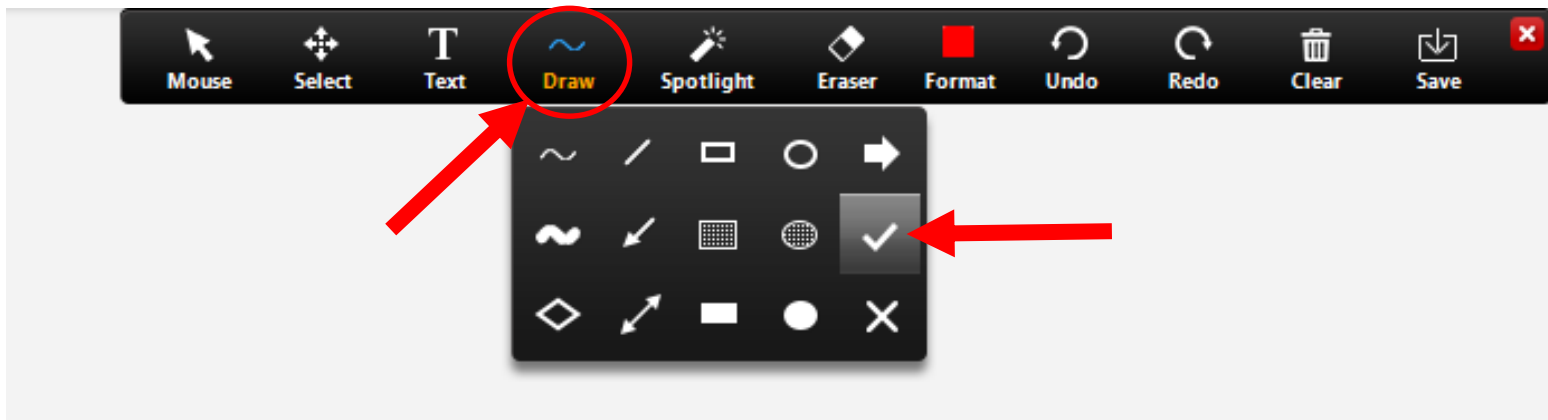
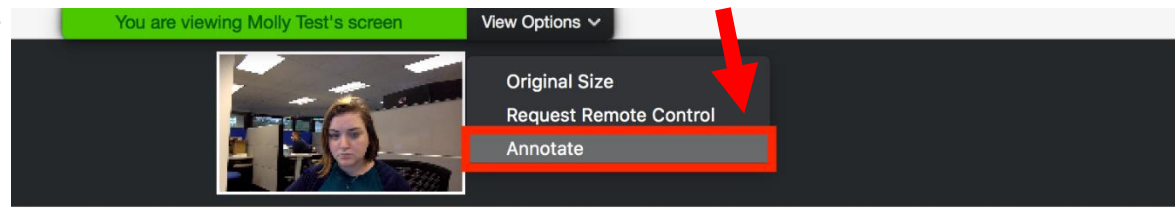
Challenges and Opportunities

Do your homework!



Feasibility Activity

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





Use a check mark

Feasibility: Short Term (<10 yrs)



Low

High

Arcelor Harbor	
Centennial Park/Millsap Mountain	
Chandler Park	
City of Racine Coastal Habitat Restoration and Water Quality Improvement	
Columbus County Park Invasive Species Management Plan	
Columbus Indiana Tree Canopy Improvement	
Forested Watersheds and Urban Forest Patch Connectivity in Bloomington IN	
Golf Mill Park	
Hot Springs	
Horticulture education center	
Kansas City Urban Forest Master Plan	
Kensington Metropark Oak/Hickory Forest Management	
Marine on St. Croix	
Port of Indiana	
Reducing Runoff at Riparian Restoration Sites in Northwest Michigan	
Reforestation of Urban Vacant Lots for Water Quality Improvement and Climate Resilience	
Rogue River Watershed	
TreePhilly Climate-Adaptation 3-year Work Plan	
Washington Park Tree Planting	
Westerly Perimeter Tree Rescue	



Feasibility: Long Term (>50 yrs)

Note factors that affect feasibility

Use the X to mark the spot




Arcelor Harbor	
Centennial Park/Millsap Mountain	
Chandler Park	
City of Racine Coastal Habitat Restoration and Water Quality Improvement	
Columbus County Park Invasive Species Management Plan	
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Washington Park Tree Planting	
Westerly Perimeter Tree Rescue	

Did anyone adjust their objectives?



Can current
management meet
management goals?



Did you revise goals
and objectives?

Other comments on Step 3?

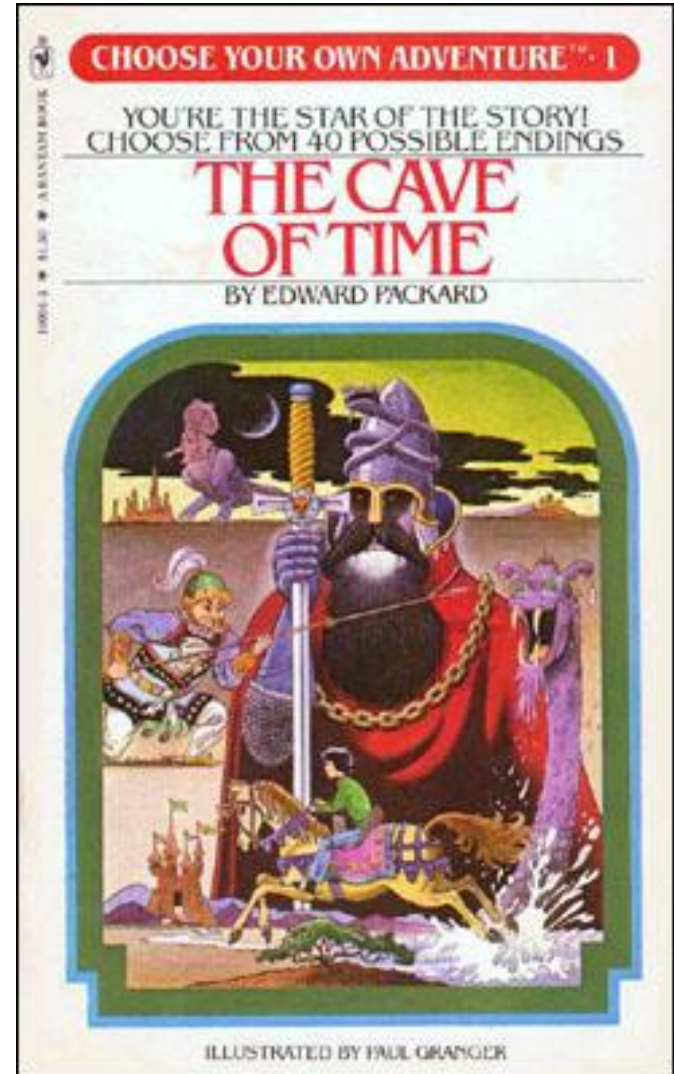
Were there any goals or objectives that were deemed unfeasible under climate change?

Any climate impacts that complicate meeting your management goals and objectives?

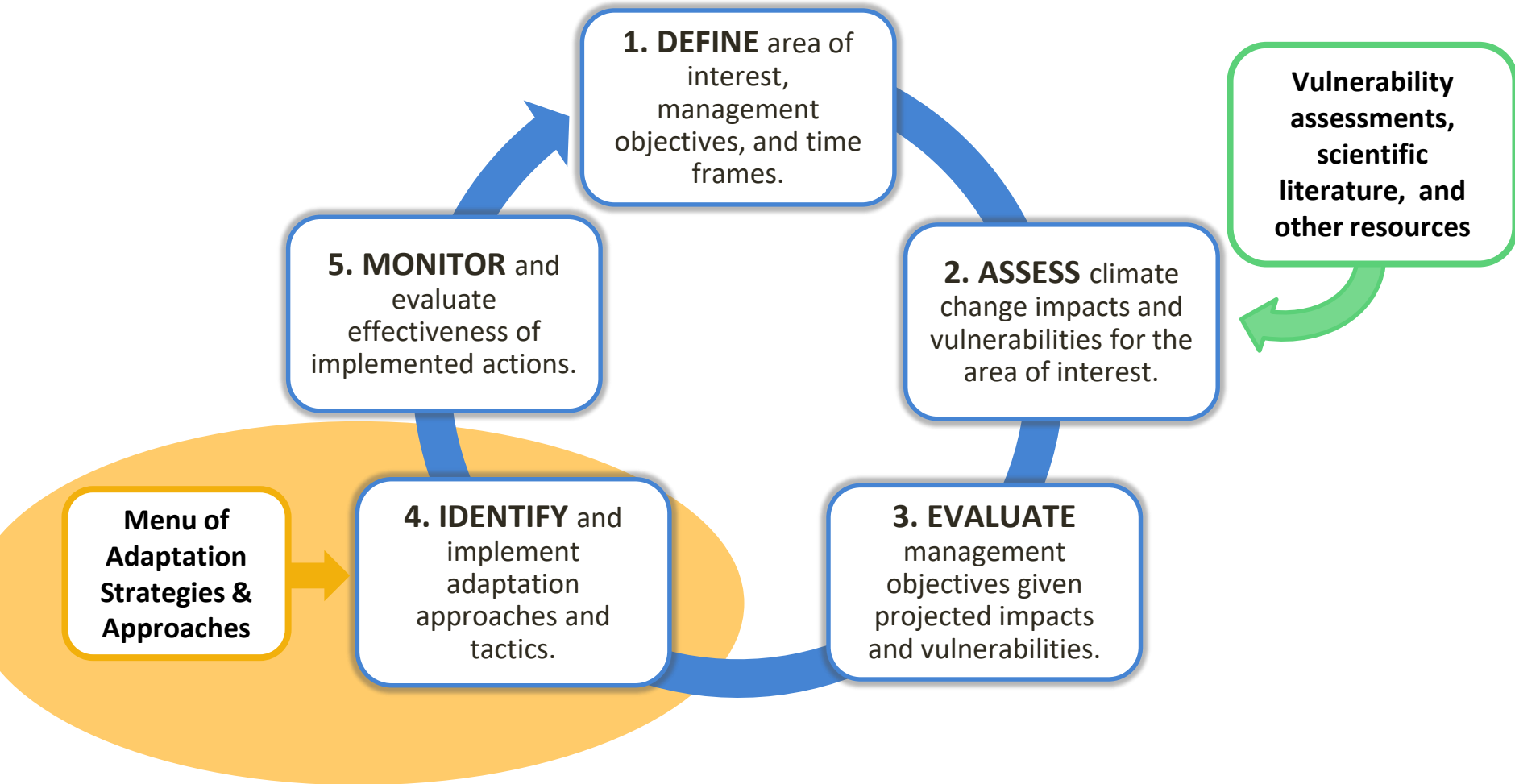
How's it going?

Today's Agenda

- **Discussion:**
 - Step 3 review
 - Feasibility activity
- **Lecture**
 - Adaptation concepts
 - Step 4 Intro



Today – Step 4!



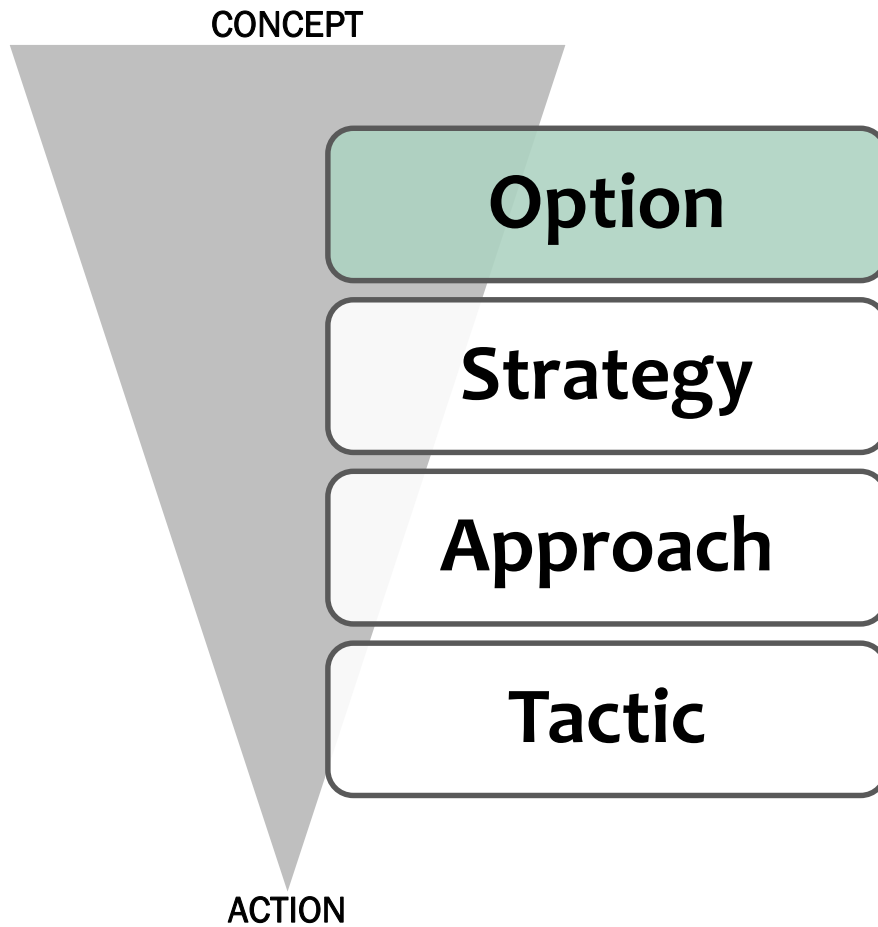
Adaptation Strategies & Approaches



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 and Approaches

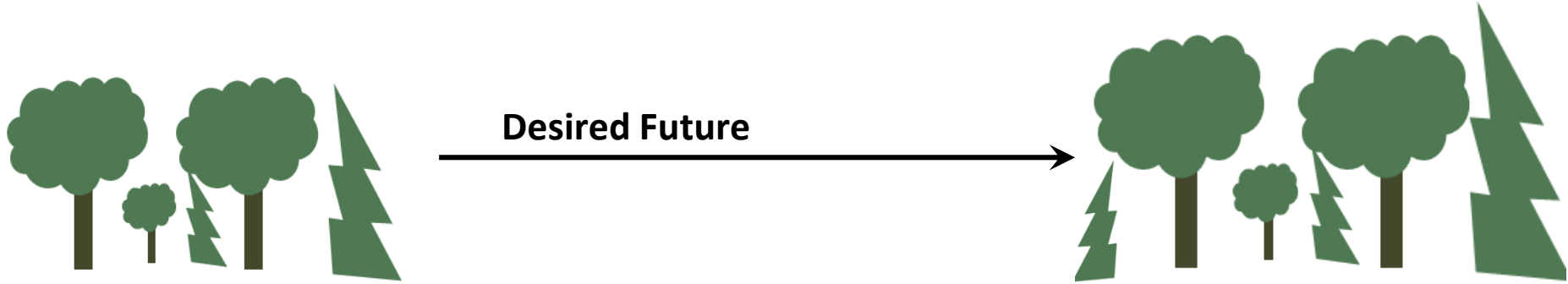


Manage for Change:
System fundamentally becomes something different



Manage for Persistence:
Still be recognizable as being the same system

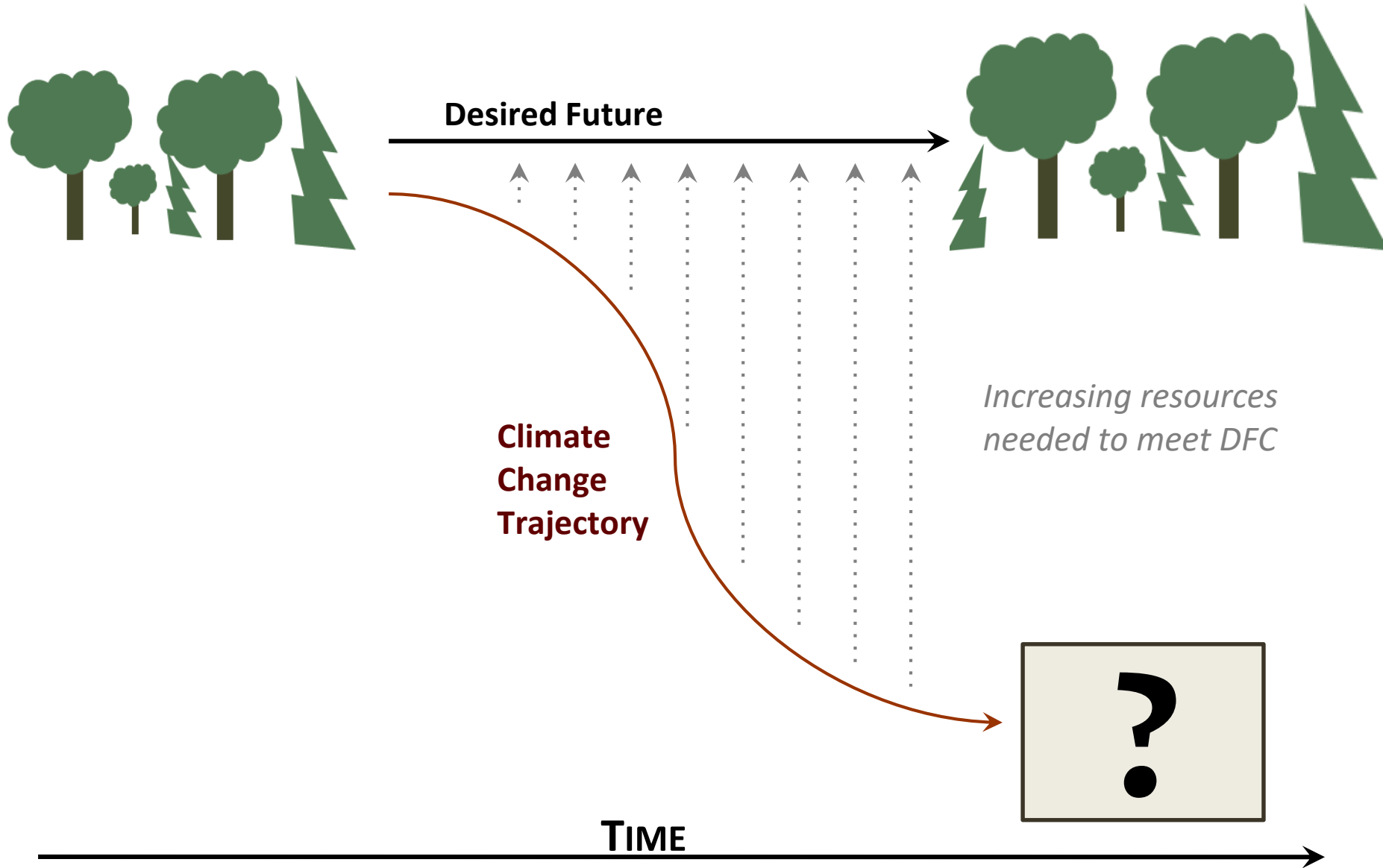
Climate-Driven Changes



TIME

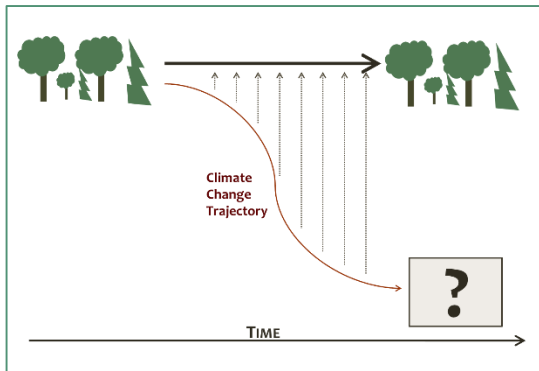


Climate-Driven Changes



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.

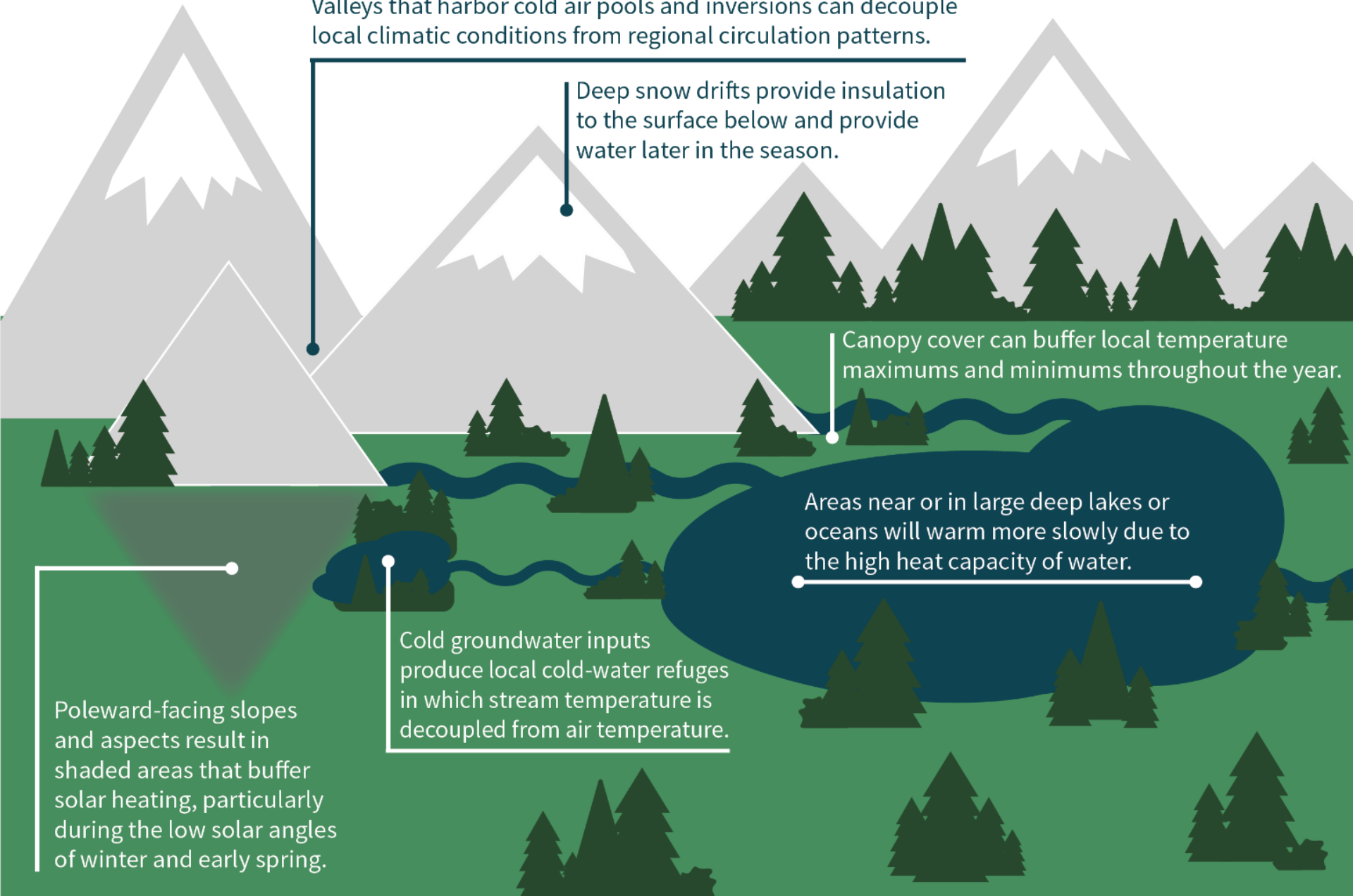
Deep snow drifts provide insulation to the surface below and provide water later in the season.

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.

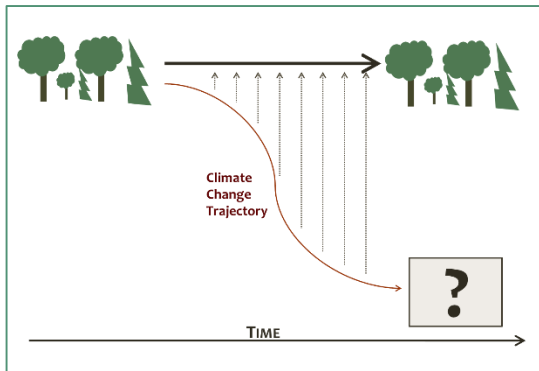
Cold groundwater inputs produce local cold-water refuges in which stream temperature is decoupled from air temperature.

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

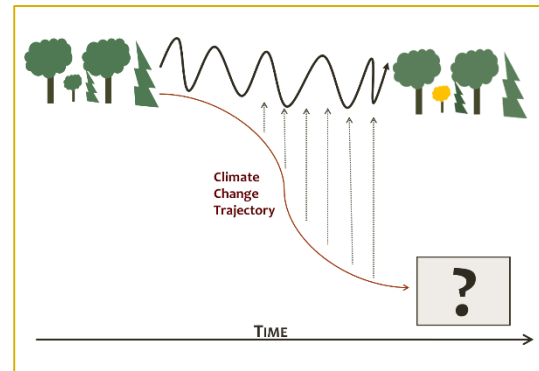


Adaptation Options

RESISTANCE



RESILIENCE

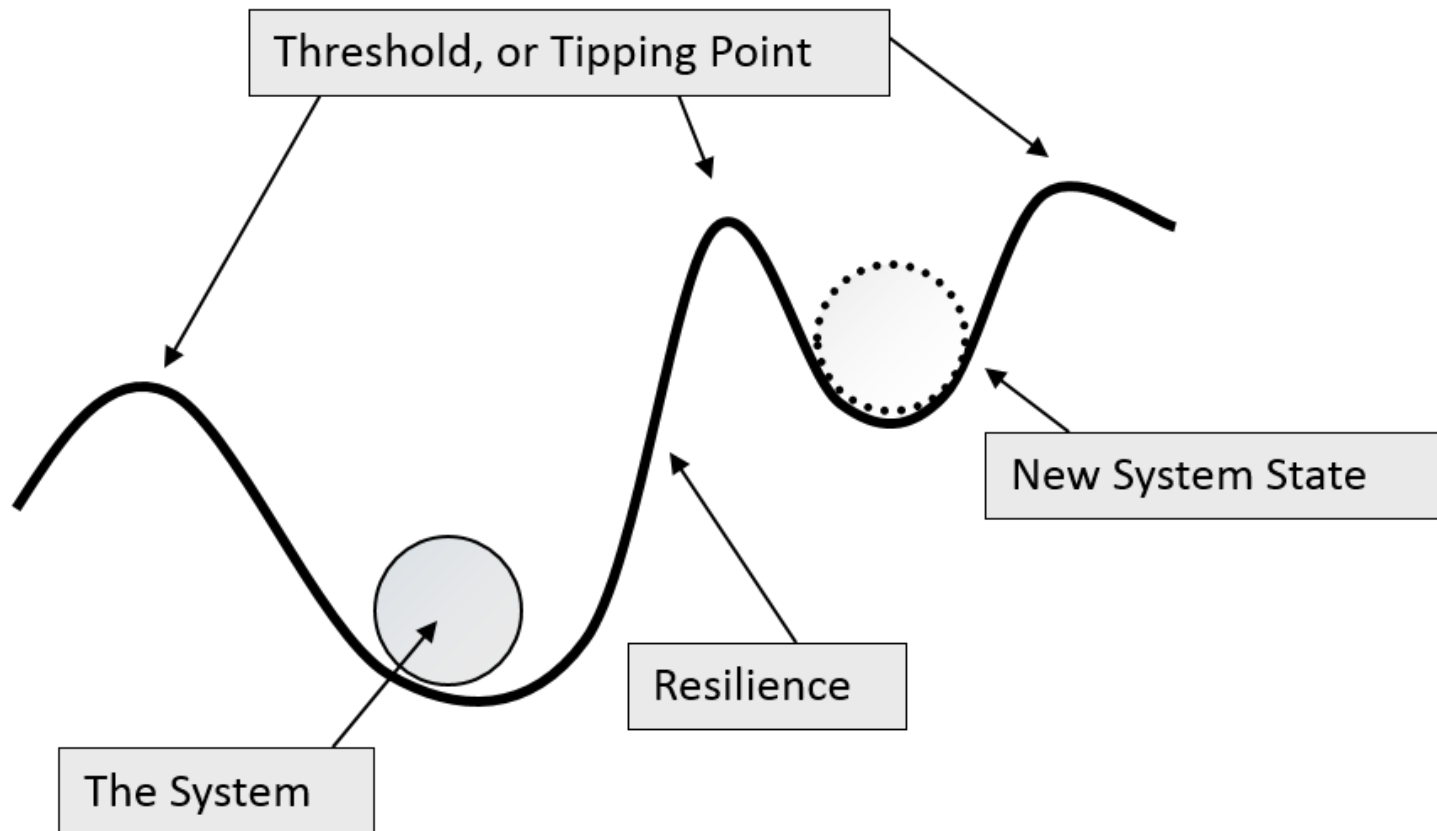


- Improve defenses of forest against change
- Maintain relatively unchanged conditions

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

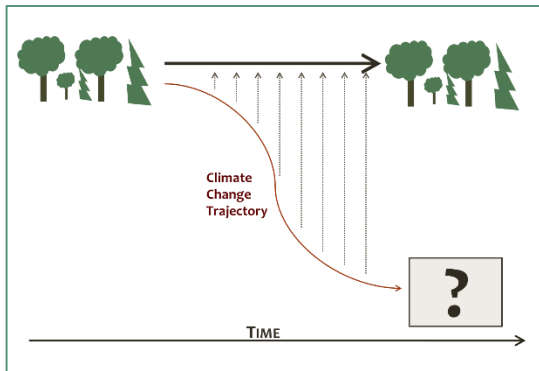
Resilience

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

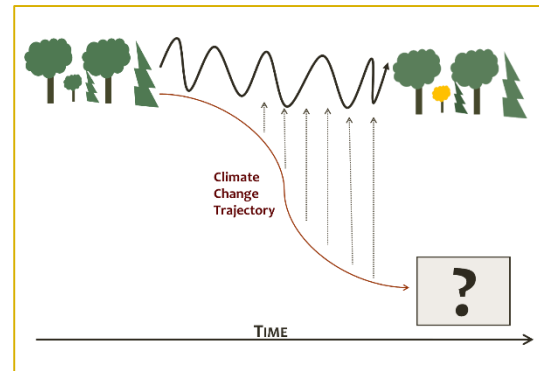


Adaptation Options

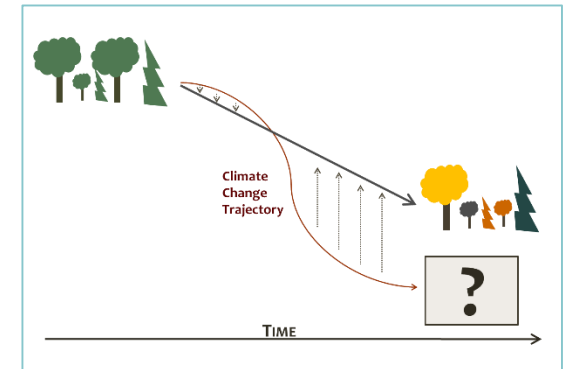
RESISTANCE



RESILIENCE



TRANSITION

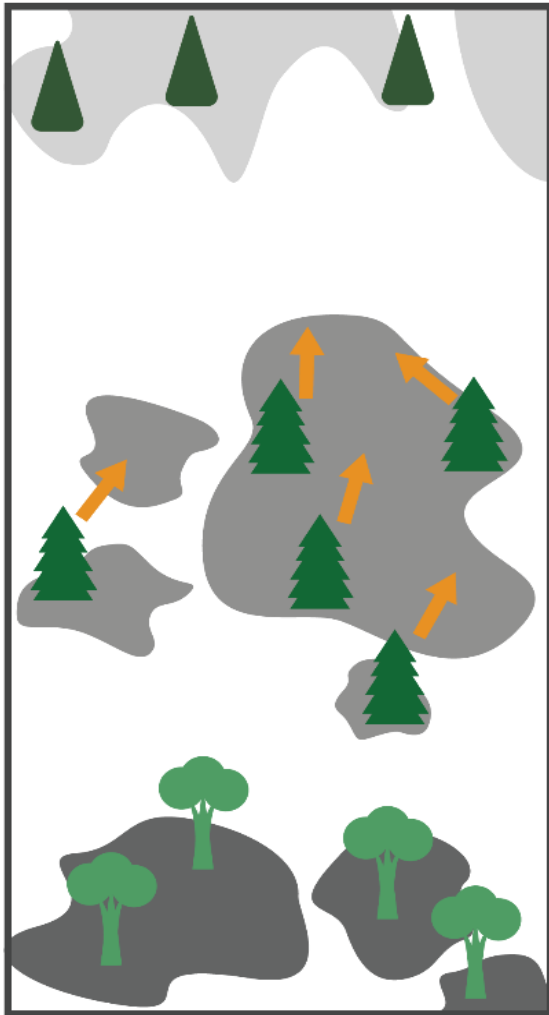


- Improve defenses of forest against change
- Maintain relatively unchanged conditions

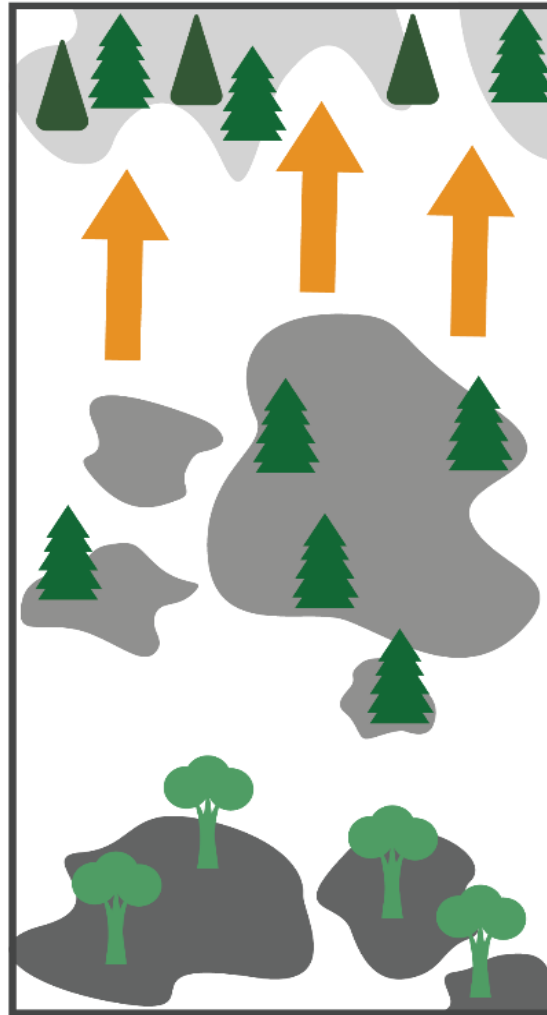
- Accommodate some degree of change
- Return to prior condition after disturbance

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

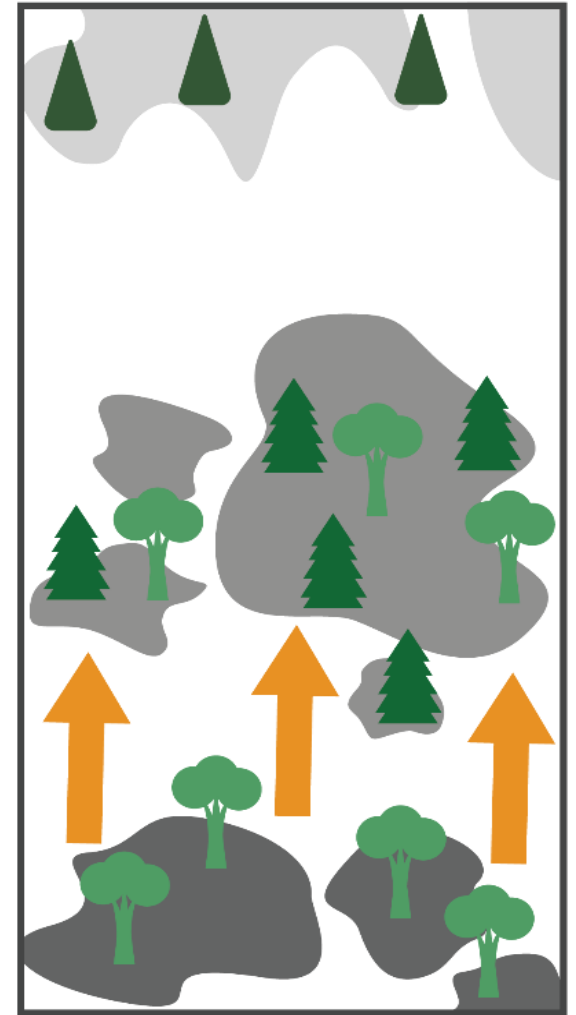
Assisted Migration



Assisted Population Migration

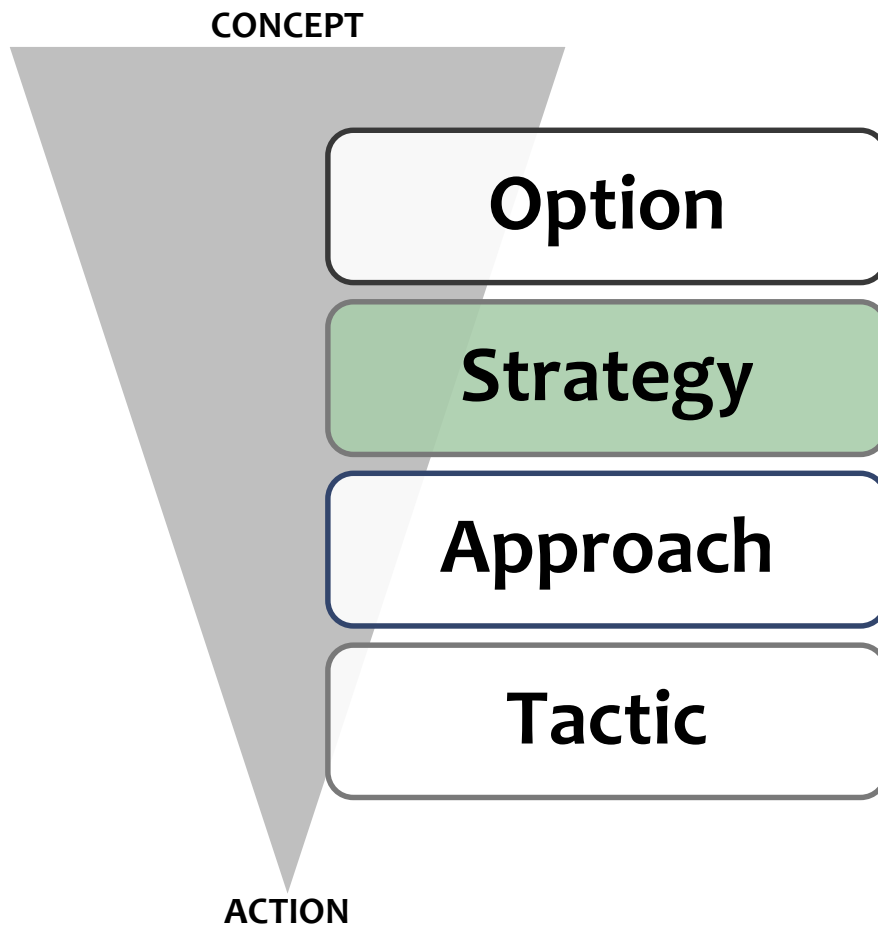


Assisted Range Expansion



Assisted Species Migration

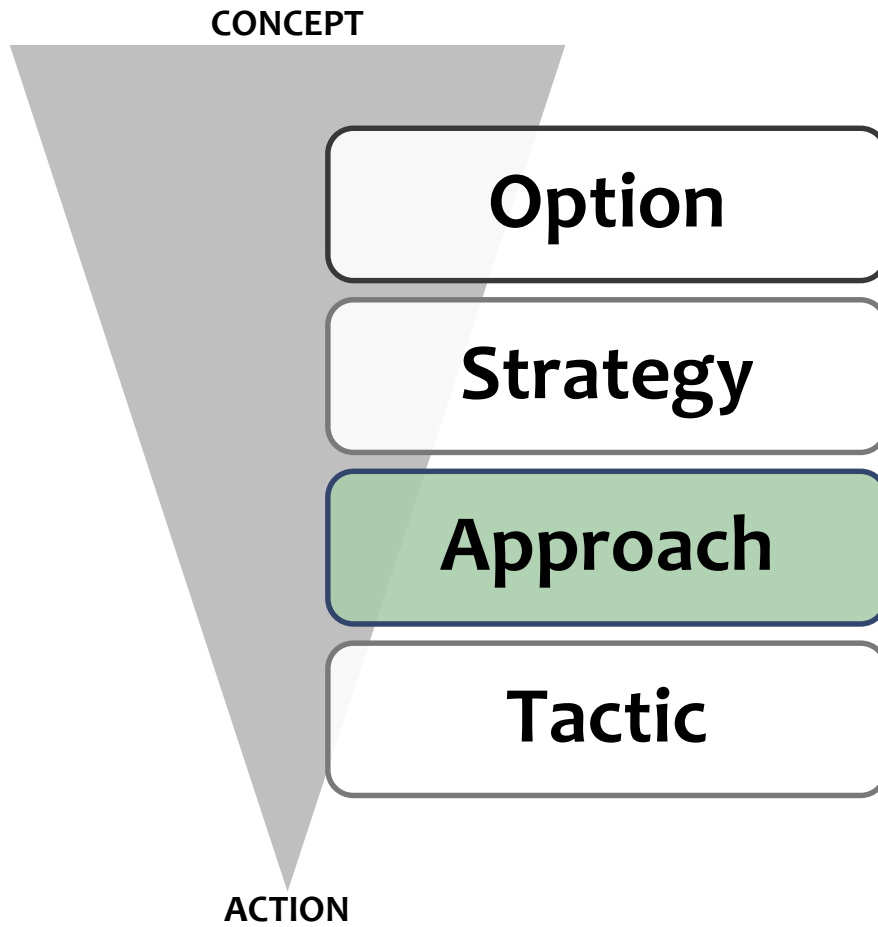
Adaptation Strategies & Approaches



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

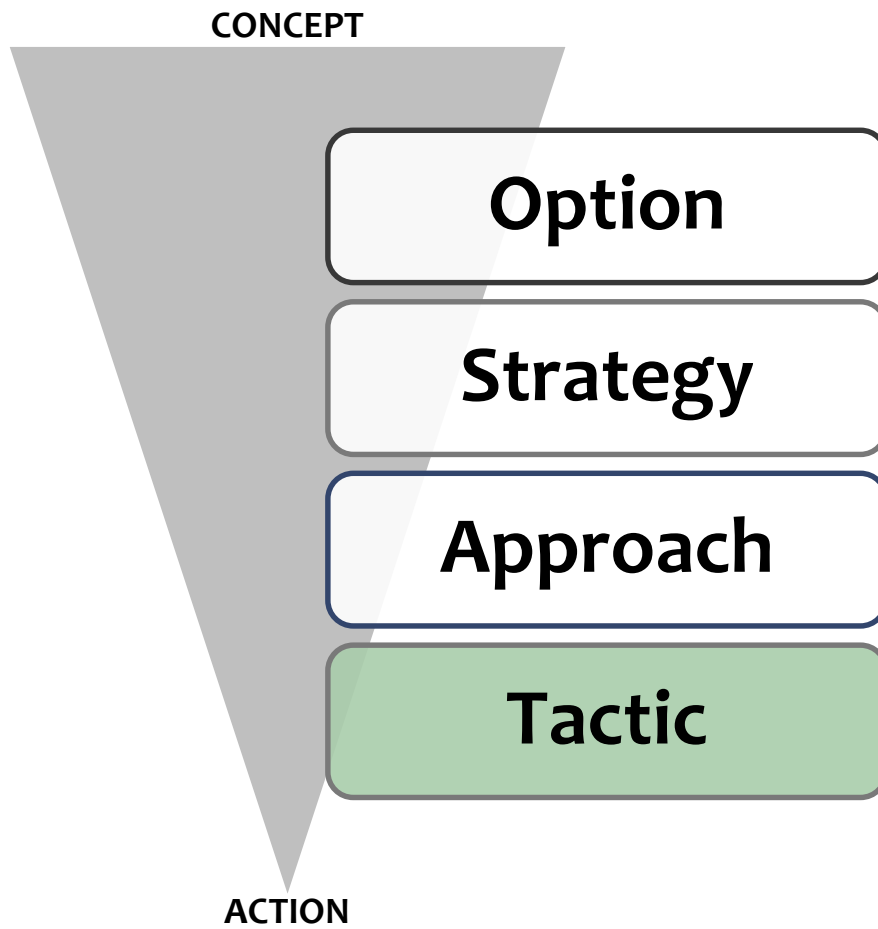
Adaptation Strategies & Approaches



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**)

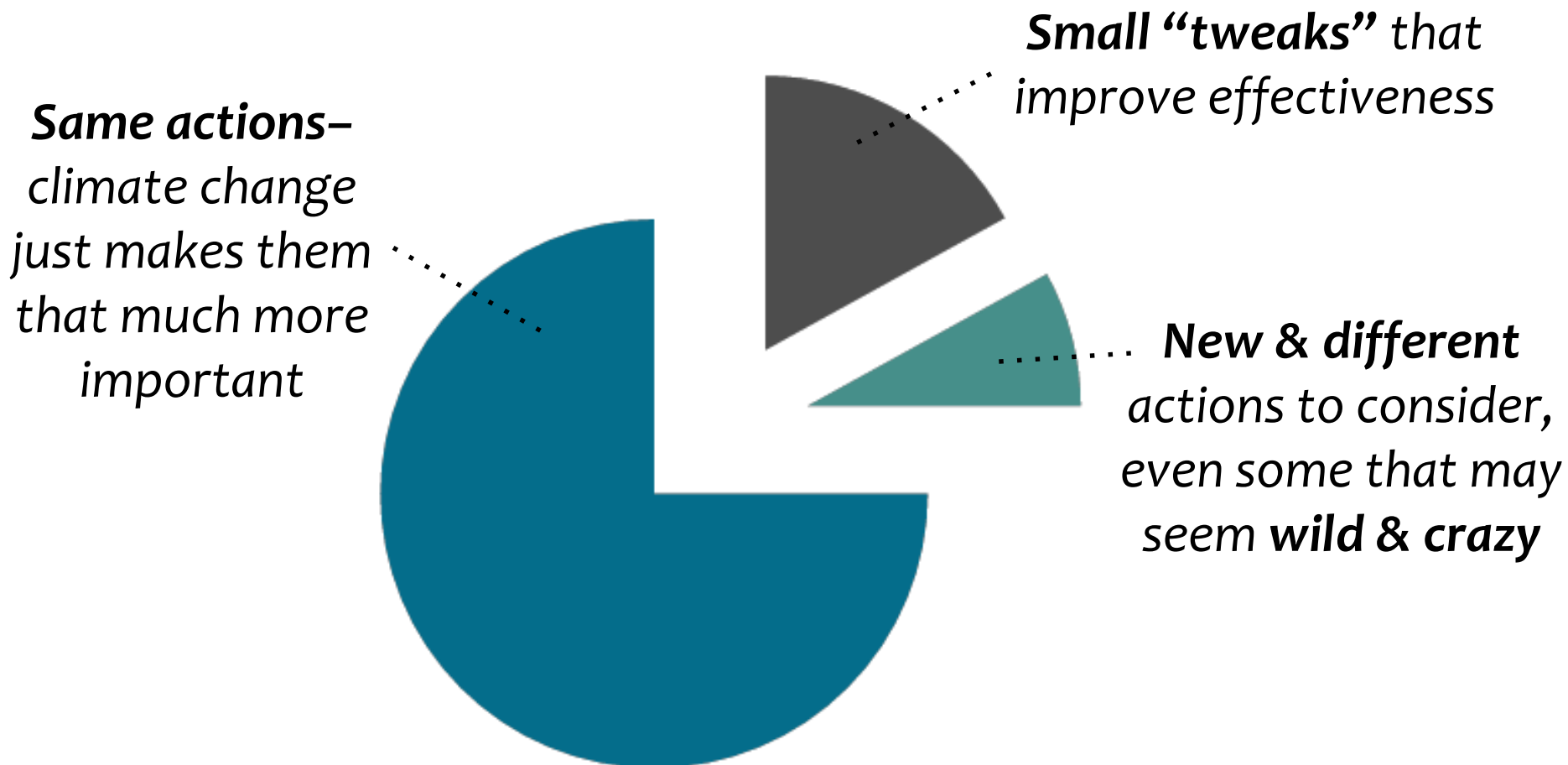


Action to Implement
(**Tactic**)



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

The screenshot displays the 'Adaptation Workbook' interface. On the left is a dark sidebar menu with the following items: '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' (highlighted with an orange arrow), 'Tactic Recommendations', 'Homework 4', 'Step 5', and 'Monitoring Plans'. The main content area is titled 'Adaptation Actions instructions' and contains a section for 'Step 4 Course Materials'. This section includes text about identifying and evaluating tactics, a video link, and a link to read summaries or view videos. Below the text is a large grey area with an 'Add A Tactic' button. At the bottom, there are navigation links: '« Previous Homework 3' and 'Next » Tactic Recommendations'. An orange callout box with the text 'Course materials' and a large orange arrow points to the 'Step 4 Course Materials' section.

Forestadaptation.org/demos

Climate Change Response Framework

Home Our Approach Projects Demos Products Partners Resources Contact

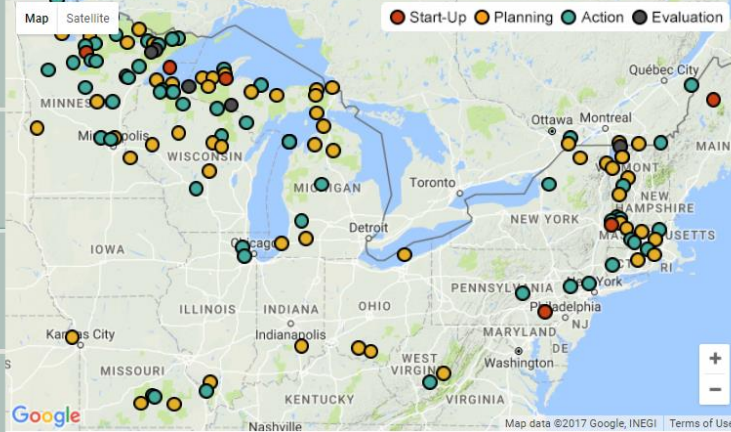
Central Appalachians

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

-- Any --

Landowner Type

-- Any --

Status

-- Any --

Go

Reset

Kestrel Land Trust: Buffam Brook Community Forest

Filter for Urban
Scroll to find it
under
“Other Ecosystems”

Filter for Urban Projects

Climate Change Response Framework

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Central Appalachians

Central Hardwoods

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Map Satellite

● Start-Up ● Planning ● Action ● Evaluation



Demonstration Projects

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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
 - 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

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.

Workbook
Tool for conservation
book.org

1 fi...
gboard.
storms and pest
d require less pruning.
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ds are partially complete
ticular item

Next »
Tactic Recommendations

Links to tools and publications

Adaptation Workbook: Step 4

The screenshot displays the 'Adaptation Workbook' interface. On the left is a dark sidebar with a navigation menu. The main content area is titled 'Adaptation Tactics' and shows '0 tactics'. A callout box with an orange border and background is overlaid on the interface, containing text about reviewing adaptation strategies. An orange arrow points from the callout box to a button in the interface that says 'View a Menu of Urban Adaptation Strategies and Approaches'. The sidebar menu includes items like 'My dashboard', 'Log out', 'Resources', 'Chicago project', 'Progress Summary', and a series of steps from Step 1 to Step 5. The 'Adaptation Actions' item is highlighted with a right-pointing arrow. At the bottom of the main content area, there are navigation links: '<< Previous Homework 3' and 'Next >> Tactic Recommendations'.

Review the Menu of Adaptation Strategies and Approaches

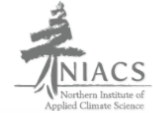
Find all menus at:
adaptationworkbook.org/strategies

Adaptation Strategies and Approaches 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 stressors
 - Prevent the introduction and establishment of nonnative species
 - Manage herbivory to promote regeneration, growth, and health
 - Strategy 3: Reduce the risk and long-term impacts of disturbance
 - Alter forest structure or composition to reduce risk
 - Maintain trees and remove hazards to reduce 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 diversity and structure
 - 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 conditions
 - Expand or buffer the boundaries of reserves to increase redundancy
 - Strategy 7: Promote landscape connectivity
 - Reduce landscape fragmentation
 - Maintain and create habitat corridors through the landscape
 - Strategy 8: Maintain and enhance genetic diversity
 - Use seeds, germplasm, and other genetic material
 - Favor existing genotypes that are better adapted to future 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:

Adaptation Strategies and Approaches Watershed Menu



Adaptation Strategies and Approaches (Forested watershed)

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

Created using the NIACS Adaptation Workbook



- Strategy 1: Sustain fundamental hydrologic processes
 - Maintain and enhance infiltration and water storage capacity of forest soils
 - Maintain and restore hydrology
 - Maintain and restore stream channels
 - Maintain and restore floodplains
 - Maintain and restore forest cover
- Strategy 2: Maintain and enhance riparian habitat
 - Moderate surface water temperature
 - Reduce export and loading of sediment
 - Reduce soil erosion and sedimentation
- Strategy 3: Maintain or restore forest cover
 - Maintain or restore forest cover
 - Promptly revegetate areas
 - Maintain or improve the quality of forest cover
 - Prevent invasive species establishment
 - Prioritize and maintain unfragmented forest cover
 - Enhance species age class diversity
 - Identify, maintain, and enhance forest cover
- Strategy 4: Facilitate forest ecosystem resilience
 - Favor or restore native species
 - Establish or encourage native species
 - Disfavor species that are vulnerable
 - Introduce species that are resilient
 - Move at-risk species to locations
- Strategy 5: Accommodate altered hydrologic processes
 - Manage systems to cope with decreased water levels and limited water availability
 - Enhance the ability of systems to retain water
 - Adjust systems to cope with increased water abundance, and high water levels
 - Respond to or prepare for excessive overland flows (surface runoff)
- Strategy 6: Design and modify infrastructure to accommodate future conditions
 - Reinforce infrastructure to meet expected conditions
 - Reroute or relocate infrastructure, or use temporary structures
 - Incorporate natural or low impact development into designs
 - Remove infrastructure and readjust system

Strategy 1: Sustain fundamental hydrologic processes

This strategy seeks to sustain fundamental watershed functions, addressing the maintenance of and restoration of soil-water connections and hydrologic function. A shift in climate may amplify and exacerbate existing ecosystem challenges resulting from land-uses that have fragmented, altered or obstructed water flow pathways. Sustaining hydrologic and ecosystem functions into the future is likely to depend on management planning that seeks to maintain the long-term conveyance of water through unobstructed hydrologic pathways, most notably actions that promote the enhancement of water infiltration by porous forest soils (Creed et al. 2011; Furniss et al. 2010).

Maintain and enhance infiltration and water storage capacity of forest soils

Undisturbed forest floors with porous soils capture, absorb, and slowly release water to groundwater, and downstream sources, providing critical regulation of water quality, and quantity, including the attenuation of flood flows (Neary et al. 2009; Smith et al. 2016). Climate change is expected to cause more frequent and intense rain events, increasing rates of erosion, runoff and soil losses (Nearing et al. 2004). This further increases the need to minimize soil exposure and to protect soil properties that enhance infiltration. Many existing guidelines and best management practices describe actions that can be used to enhance soil-water infiltration; and many of these actions are also likely to be beneficial in the context of climate adaptation, either in their current form or with modifications to address potential climate change impacts.

Examples

- Leave dead and downed wood (coarse woody debris) in the uplands and riparian areas to enhance moisture, and soil
- Modify forest operations techniques and equipment with pallets, debris mats, or float bridges, to minimize soil compaction, rutting, or other impacts to sensitive ecosystems, surface water bodies, soils and residual trees.
- Enhance soil structure in highly compacted areas with mechanical treatments such as tilling, soil ripping, or chisel plowing; promptly revegetate.
- 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).
- In open spaces adjacent to wetlands, incorporate deep-rooted perennials to reduce runoff and improve infiltration (Union of Concerned Scientists 2017).

Review Goals and Objectives

The image shows a screenshot of a web application interface. On the left is a dark sidebar with a navigation menu. The main content area is white and contains a section titled 'Adaptation Tactics' with '0 tactics' listed below it. A button labeled 'View a Menu of Urban Adaptation Strategies and Approaches' is highlighted with an orange border. Below this is a dark grey button labeled 'Review Goals and Objectives'. A callout box with an orange border and a large orange arrow points from the 'Review Goals and Objectives' button to the right. The sidebar menu includes items like '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', 'Homework 4', and 'Step 5'. At the bottom of the main content area, there are navigation links: '<< Previous Homework 3' and 'Next >> Tactic Recommendations'.

Adaptation Workbook

Adaptation Actions instructions

Step 4 Course Materials

Adaptation Tactics

0 tactics

View a Menu of Urban Adaptation Strategies and Approaches

Review Goals and Objectives

Expand/contract

Add A Tactic

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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

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Adaptation Actions instructions ▾

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Adaptation Tactics

0 tactics

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

Review Goals and Objectives

[Add A Tactic](#)

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Select a Strategy

Adaptation Work **New Tactic**

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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

at, when, how, and where you will implement the actions.

Timeframe Time Frame

Practicability 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

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Next »
Tactic Recommendations

Add Strategy/Approach +

Add A Tactic +

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.

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.

Time Frame

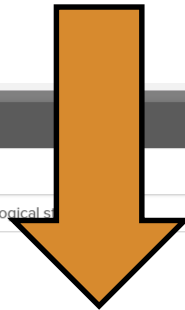
Practicability ⓘ ⓘ

Save

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Tactic Recommendations

Describe your Tactic



Add Strategy/Approach

Open Strategies and Approaches

New Tactic

Strategy

Strategy 2: Reduce the impact of biological...

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 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

Time Frame

Practicability

Save

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Tactic Recommendations

Step 4: IDENTIFY adaptation approaches and tactics for implementation.

Timeframe – Specify when you will implement the tactic.

For example:

- Summer 2016
- Winter 2016-7
- 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

[Add Strategy/Approach](#)

Tactical Details

Plant Dutch elm disease-resistant elm cultivars such as Princeton elm and Accolade elm. Treat ash trees with insecticides to reduce ash dieback. Treat ash trees with fungicides to reduce ash dieback. Treat ash trees with fungicides to reduce ash dieback.

Timeframe [Timeframe](#)

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.

Practicability [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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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](#)

[Add A Tactic](#)

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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

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 Describe specifically the action you can take. These details should ideally answer what, when, how, and where you will implement the actions. **Timeframe** Time Frame

Benefits List any benefits associated with using this tactic. For example, note if a tactic addresses address... already part of your business as usual management. **Practicability**

Low
Medium
High

Drawbacks and Barriers List any drawbacks associated with this tactic, such as harmful ecosystem impacts, potential confl... institutional l... [Save](#)

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Apply tactics to objectives

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Adaptation Tactics

1 tactics

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

Review Goals and Objectives

Tactic: qew

Applicable to 1 objectives

Benefits

Costs

Feedbacks and Barriers

gww

Timeframe

<Empty>

Practicability

Medium

Does this tactic apply to these objectives?

No

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

No

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.

Edit tactic

Apply tactic to multiple objectives

Add another tactic

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Tactic Recommendations

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?

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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 forests and pathogens

Benefits
werw

Drawbacks and Barriers
gew


Recommended
Not recommended

Recommend tactic?


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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

Finding a list of climate impacts

Reminder!

NIACS Climate Viewer

<https://adaptationworkbook.org/niacs-browser>

USGS NCCV

https://www2.usgs.gov/climate_landuse/clu_rd/nccv.asp

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Climate Change Impacts for Northern WI and western UP

This area includes the Laurentian Mixed Forest Ecological Province within northern Wisconsin and the western Upper Peninsula of Michigan. The area covers Albert's Ecological Sections VIII, IX, and X in Wisconsin and Ecological Section IX in Michigan.

<http://www.nrs.fs.fed.us/pubs/46393>
http://forestadaptation.org/presentations/wisconsin/Janowiak_WIWUP2013.evas.html

General Forest impacts Forested watershed impacts

Temperatures in northern Wisconsin and western Michigan will increase between 3 °F and 9 °F by the end of the century, with more warming during winter.

Evidence: Robust Agreement: High

All global climate models project that temperatures will increase with continued increases in atmospheric greenhouse gas concentrations.

M. Janowiak, L. Iverson, and others. 2014. [Forest Ecosystem Vulnerability Assessment for northern Wisconsin and western Upper Michigan](#). USDA Forest Service Northern Research Station.
D. Lorenz and M. Notaro. 2014. [LCC Statistical Downscaling](#). Nelson Center for Climatic Research - University of Wisconsin-Madison.

Total snowfall, snow depth, and snowpack duration are all expected to decline substantially in northern Wisconsin and western Michigan by the end of the century.

Evidence: Robust Agreement: High

A variety of models project that across the Upper Midwest, more winter precipitation will be delivered as rain, more snow will

USGS science for a changing world

Climate Research and Development

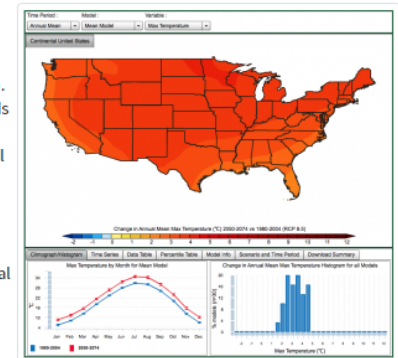
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National Climate Change Viewer (NCCV)

[Viewer](#) || [Tutorial \(PDF\)](#) || [Updates](#)

12-09-2016: The National Climate Change Viewer has been updated with all new hydroclimate modeling data.

Worldwide climate modeling centers participating in the 5th Climate Model Intercomparison Program (CMIP5) are providing climate information for the ongoing Fifth Assessment Report (AR5) of the Intergovernmental Panel on Climate Change (IPCC). The output from the CMIP5 models is typically provided on grids of ~1 to 3 degrees in latitude and longitude (roughly 80 to 230 km at 45° latitude). To derive higher resolution data for regional climate change assessments, NASA applied a statistical technique to downscale maximum and minimum air temperature and precipitation from 33 of the CMIP5 climate models to a very fine, 800-m grid over the contiguous United States (CONUS). The full NEX-DCP30 dataset covers the historical period (1950-2005) and 21st century (2006-2099) under four Representative Concentration Pathways (RCP) emission scenarios developed for AR5.



The USGS National Climate Change Viewer (NCCV) includes the historical and future climate projections from 30 of the downscaled models for two of the RCP emission scenarios, RCP4.5 and RCP8.5. RCP4.5 is one of the possible emissions scenarios in which atmospheric GHG concentrations are stabilized so as not to exceed a radiative equivalent of 4.5 Wm⁻² after 2100, about 650 ppm CO₂ equivalent. RCP8.5 is the most aggressive emissions scenario in which GHGs continue to rise unchecked through the end of the century leading to an equivalent radiative forcing of 8.5 Wm⁻², about 1370 ppm CO₂ equivalent. To create a manageable number of permutations for the viewer, we averaged the climate and water balance data into four climatology periods: 1981-2010, 2025-2049, 2050-2074, and 2075-2099.

Reminder!

Finding a list of climate impacts

NOAA Climate Explorer

<https://crt-climate-explorer.nemac.org/>



Menu

Tour This Page About Definitions FAQ Credits

The screenshot shows the NOAA Climate Explorer interface. At the top, there is a navigation bar with the U.S. Climate Resilience Toolkit logo and a menu icon. The main area features a satellite-style map of Lake County, Oregon, with the text "THE CLIMATE EXPLORER" overlaid. A blue sidebar on the right contains navigation options: "Select a location", "View by variable", "Weather & Tidal Stations", and "New here? Take the tour". Below the map, a chart titled "Chart: Lake County Days w/ > 1 in" is displayed. The chart shows a significant increase in the number of days with more than 1 inch of precipitation starting around 2010. The y-axis represents "Days per year with more than 1 in (avg)" ranging from 0 to 16. The x-axis shows years from 1950 to 2100. The chart includes a legend for "Observations", "Historical (mid-high)", "Lower Emissions", "Higher Emissions", and "Average". A timeline at the bottom of the chart allows for navigation between 1950 and 2100.



4th National Climate Assessment

<https://nca2018.globalchange.gov/>

FOURTH NATIONAL CLIMATE ASSESSMENT

Volume II: Impacts, Risks, and Adaptation in the United States

The National Climate Assessment (NCA) assesses the science of climate change and variability and its impacts across the United States, now and throughout this century.

SUMMARY FINDINGS

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OVERVIEW

DOWNLOADS

Volume I presents an assessment of the physical science underlying this report: science2017.globalchange.gov



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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"/>	<input type="radio"/>	<input type="radio"/>	<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"/>	<input type="radio"/>	<input type="radio"/>	<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"/>	<input type="radio"/>	<input type="radio"/>	<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"/>	<input type="radio"/>	<input type="radio"/>	<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?

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Monitoring Plan

To-do list for next week:

- 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** (Tuesday, December 4) ready to discuss your approaches and actions!

Thanks everyone!

Troubleshooting? Stay on the line.