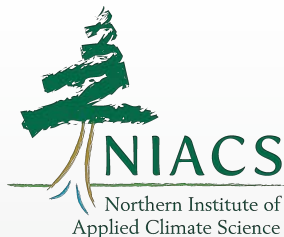


Colorado State Forest Service Forest Action Plan Climate Adaptation Workshop



**FOREST AND RANGELAND
STEWARDSHIP**
COLORADO STATE UNIVERSITY



NIACS
Northern Institute of
Applied Climate Science



**COLORADO STATE
FOREST SERVICE**
COLORADO STATE
UNIVERSITY

June 13-14, 2019
Colorado State University
Fort Collins, CO

Hello, good morning!

- Name
- What is your role in Forest Action Plan (FAP) Process?
- What are your goals for the FAP workshop?



Northern Institute of Applied Climate Science



Climate
Carbon

Practical
information

Adaptation
resources

Technical
assistance

Regional multi-institutional partnership among:



Michigan
Technological
University

ncasi



THE
TRUST
FOR
PUBLIC
LAND



UNIVERSITY OF MINNESOTA




AMERICAN FORESTS



The
UNIVERSITY
of VERMONT



ADAPTIVE SILVICULTURE FOR CLIMATE CHANGE

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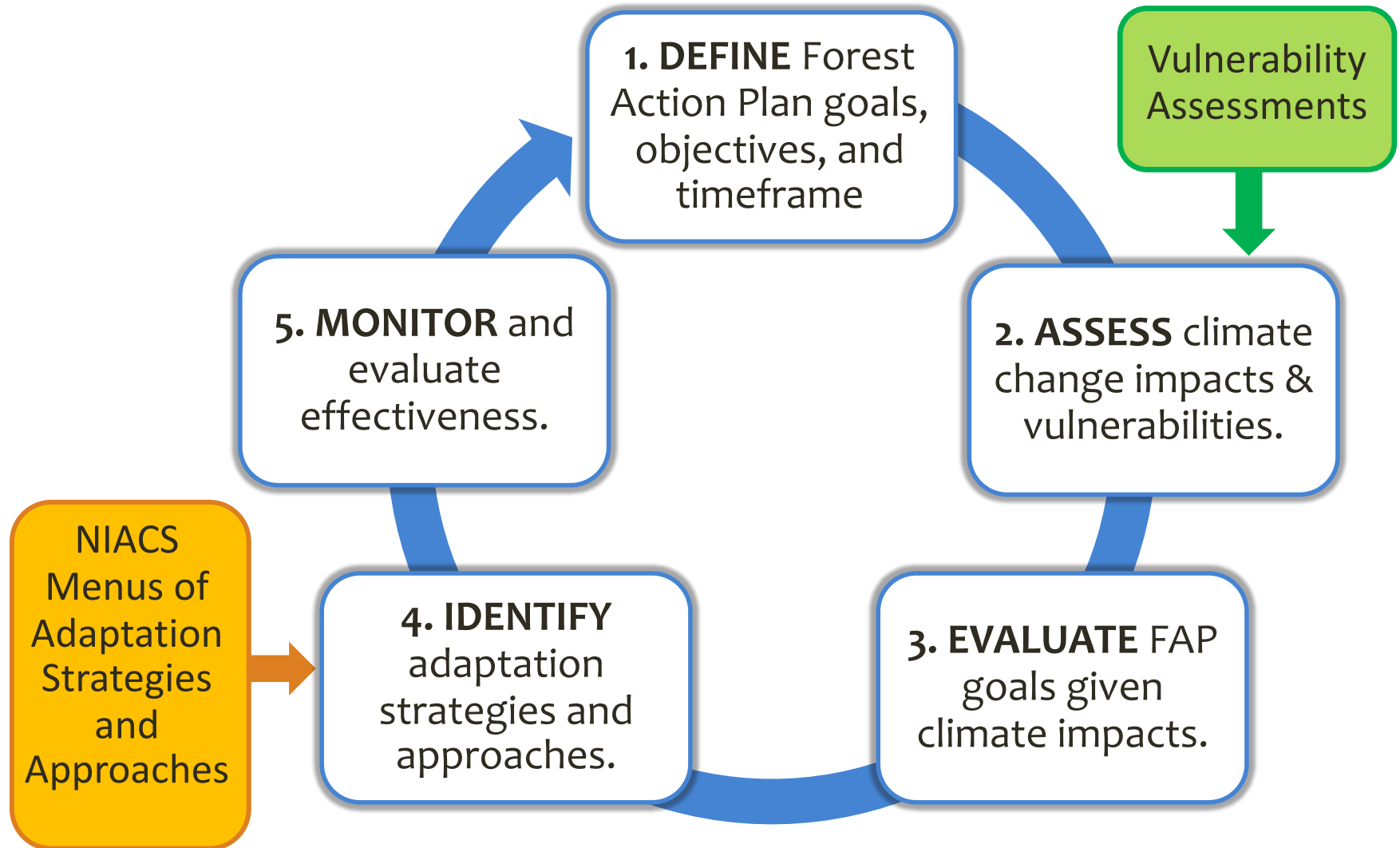


Questions to answer today...

1. How might climate change effect the Colorado Forest Action Plan Themes?
2. What management actions could help prepare for those effects?

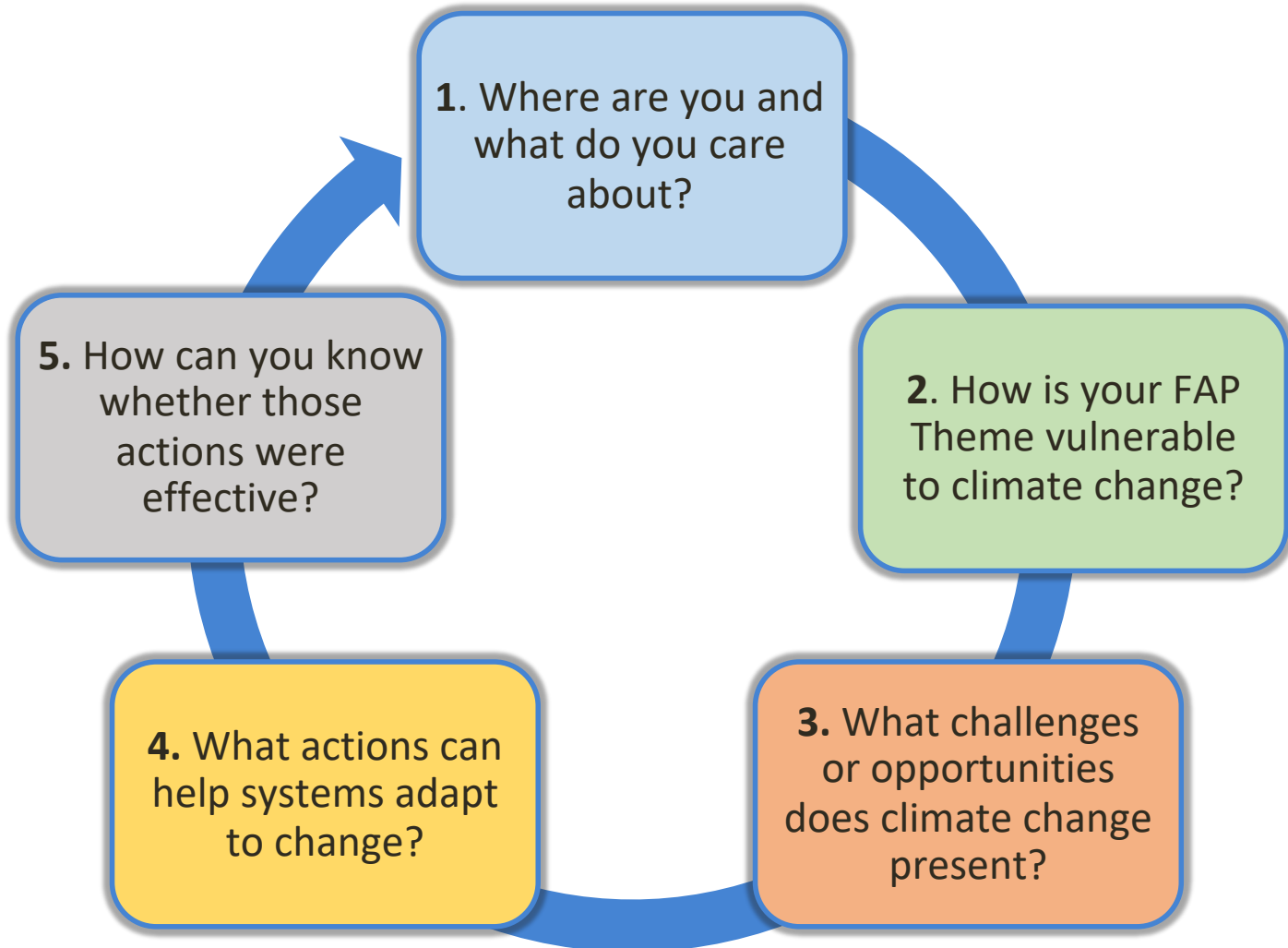
Focus of today's and tomorrow's discussions!

Workshop Agenda



Deciphered

Adaptation Workbook



Adaptation Workbook

Structured process to identify adaptation actions

Step 1

Forest Action Plan Theme	Forest Type(s)/Key Species	Management Goals	Management Objectives	Time Frames

Step 4

Adaptation Actions			Benefits	Drawbacks/ Barriers	Recommend Tactic?
Strategy/Approach (From Chapter 3)	Tactic	Time Frame			

Worksheets!

Worksheets!

Worksheets!

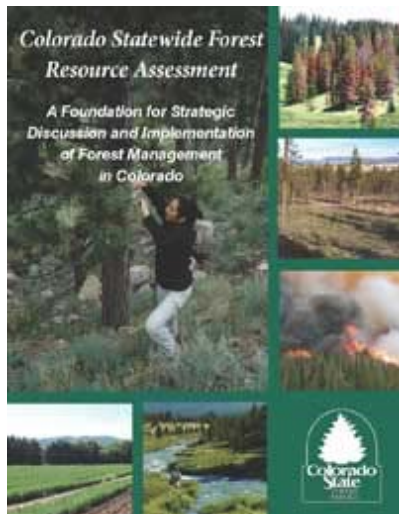
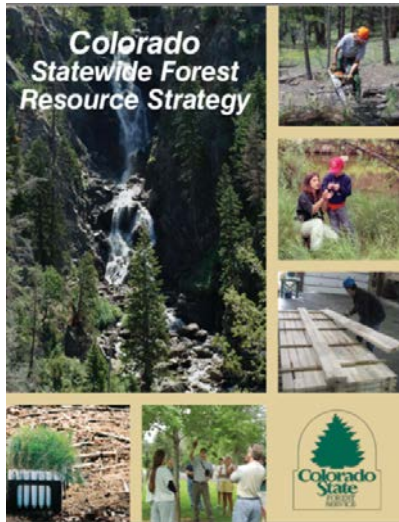
Worksheets!

Intentionality

- Explicitly consider and address climate change
- Sure we might get lucky...
- Intentionally assessing risk and vulnerabilities **makes our plans more robust!**



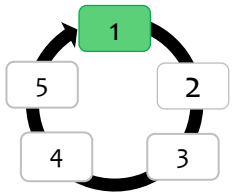
Colorado's Forest Action Plan



- What is the Forest Action Plan?
- What is Colorado's charge and the role of the CSFS?
- What are the next steps required for public scoping?
- How does this workshop tie in with the CO Forest Action Plan?



Step 1: DEFINE Forest Action Plan goals, objectives, and timeframes.



Step 1: DEFINE Forest Action Plan goals, objectives, and timeframes.

Purpose: Introduce FAP Themes & Goals

Take **5 minutes max.** to give a quick summary of your Theme. Focus on your overarching goals in regards to how this theme fits in with the 2020 FAP Update.

- What is your key FAP Theme?
- What is the timeframe?
- What are your main goals for this theme under the FAP Strategies of Conserve, Enhance, and Protect that address climate change adaptation into the future?

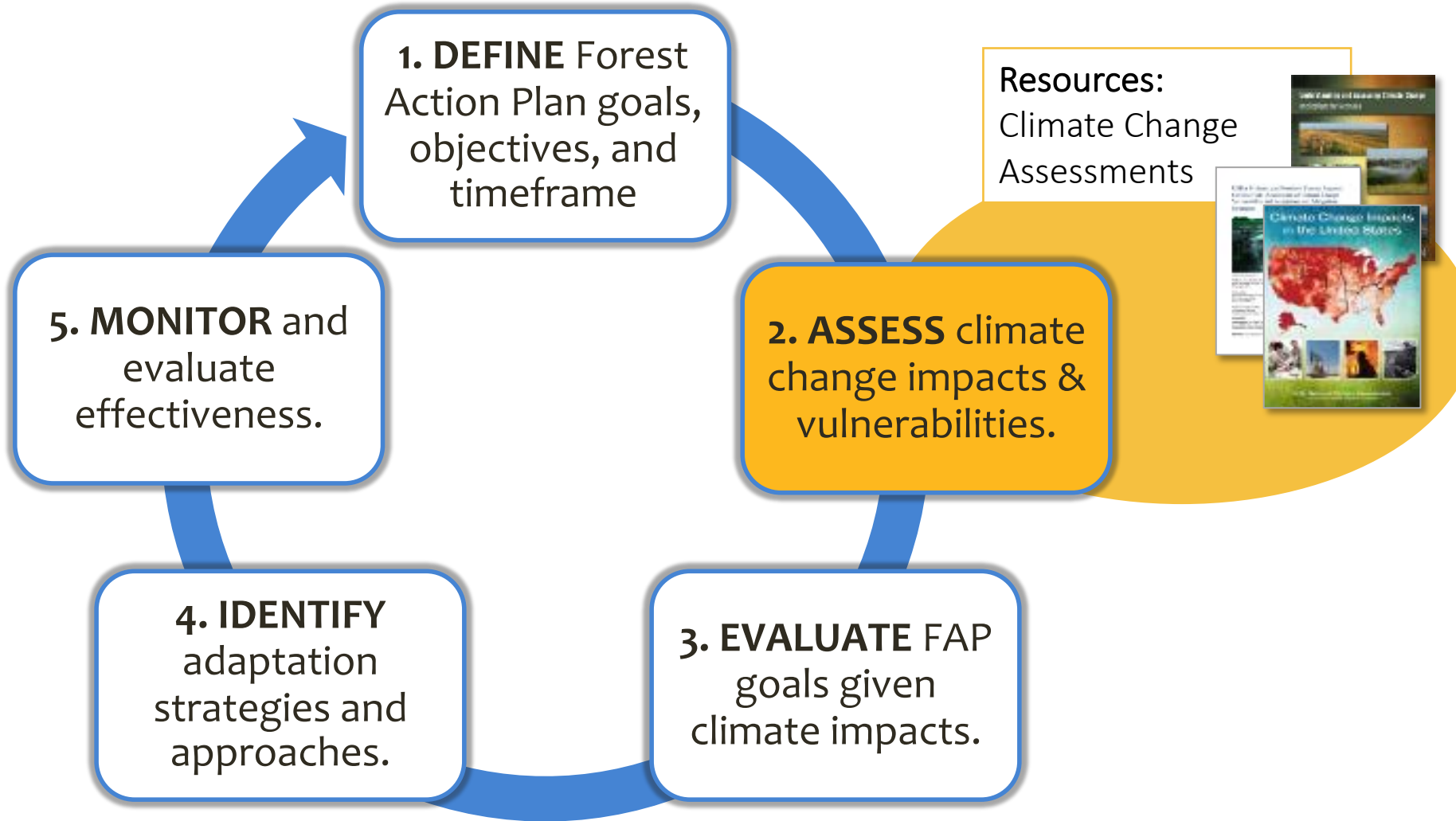


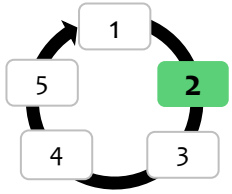
BREAK!



Step 2: ASSESS climate change impacts & vulnerabilities

Workbook Cycle: Step 2



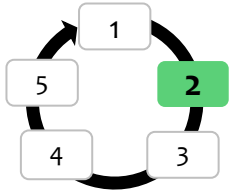


Step 2: ASSESS climate change impacts and vulnerabilities.

Purpose:

- Consider how climate change may specifically affect your Forest Action Plan themes.

- Climate Impacts and Vulnerability

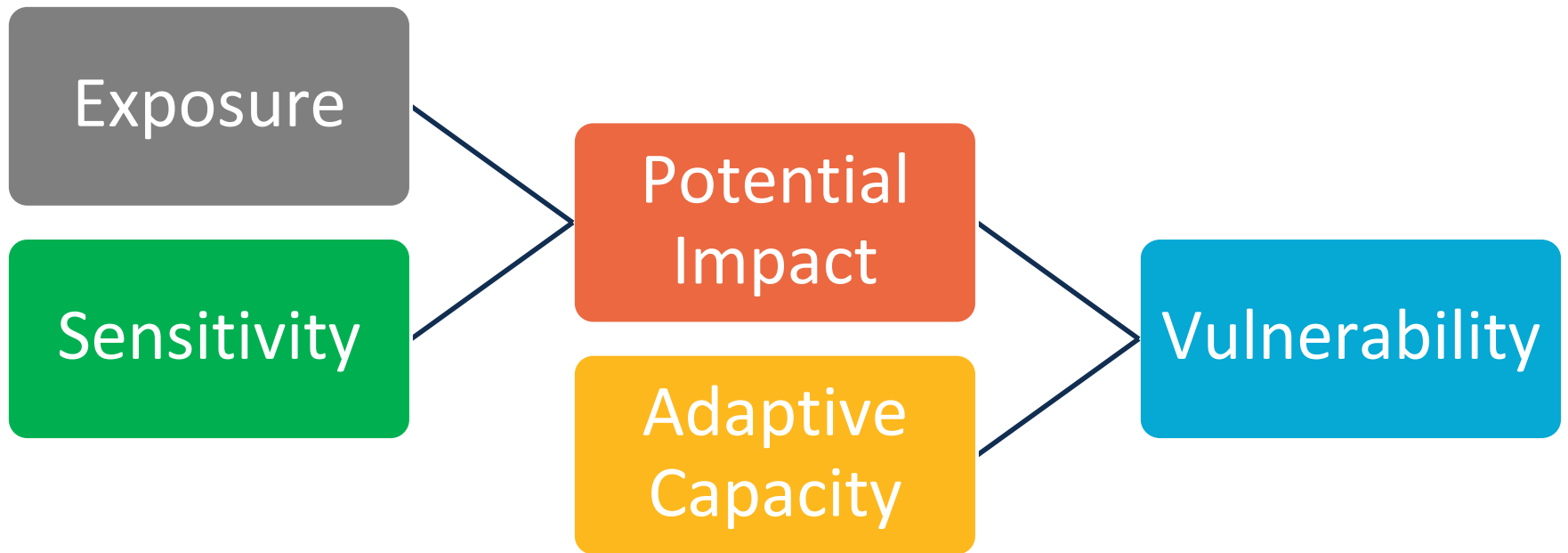


Step 2: ASSESS climate change impacts and vulnerabilities.

Key Questions:

- How might your FAP theme be uniquely affected by climatic change and subsequent impacts?
- How might regional impacts be different for your FAP theme?

Vulnerability of ecosystems



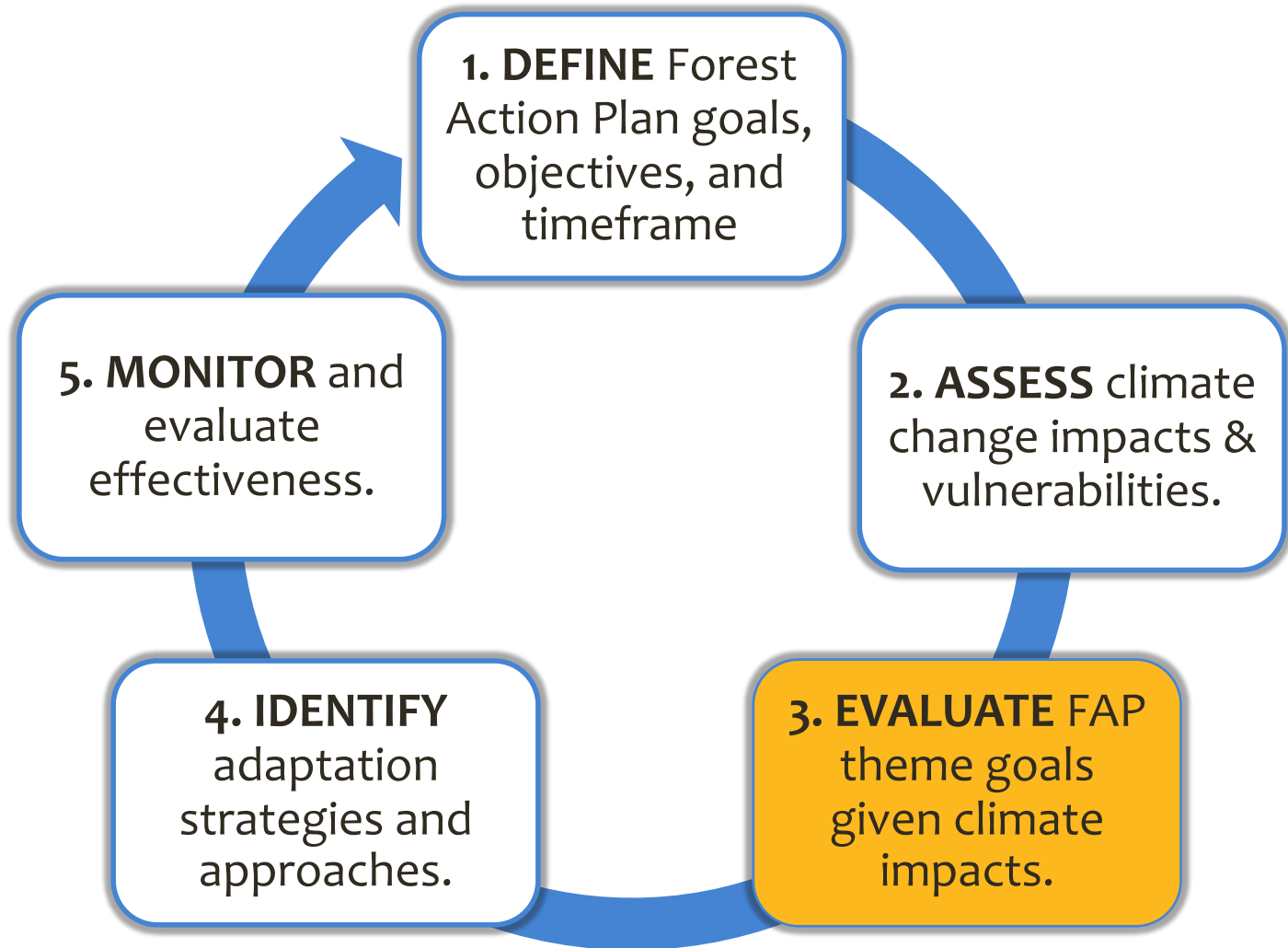


BREAK!



Step 3: EVALUATE risk to Forest Action Plan themes given projected impacts and vulnerabilities.

Workbook Cycle: Step 3



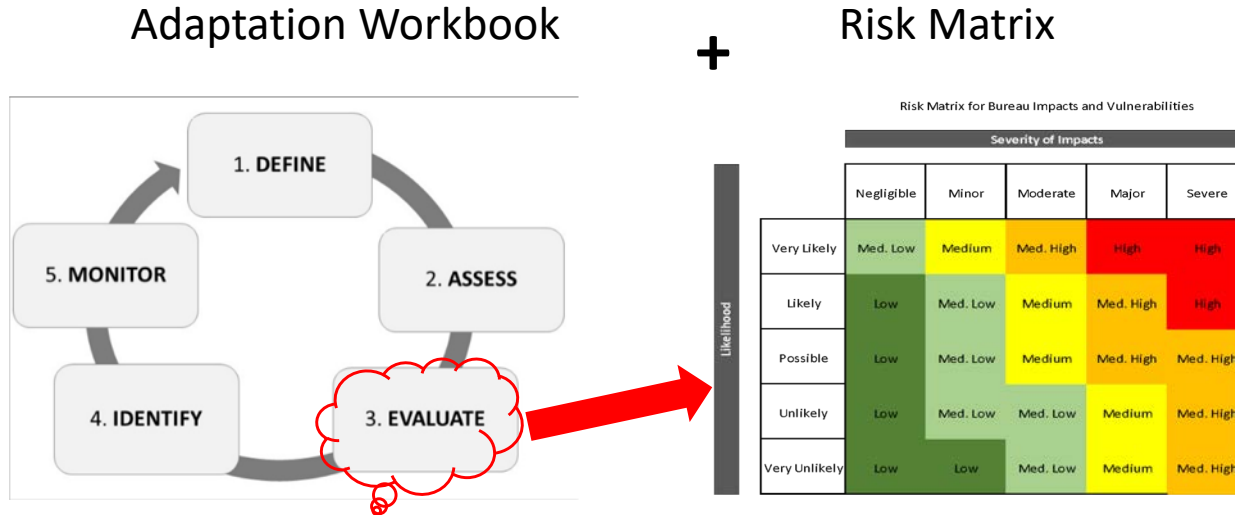
Risk Matrix Prioritizing Process

		Severity of Impacts				
		Negligible	Minor	Moderate	Major	Severe
Likelihood	Very Likely	Med. Low	Medium	Med. High	High	High
	Likely	Low	Med. Low	Medium	Med. High	High
	Possible	Low	Med. Low	Medium	Med. High	Med. High
	Unlikely	Low	Med. Low	Med. Low	Medium	Med. High
	Very Unlikely	Low	Low	Med. Low	Medium	Med. High

Adapted from EHS (2018)

"Triage" is one example of a risk management approach; it helps us prioritize impacts and resource vulnerabilities by considering the urgency of action and the capacity to act (Millar et al. 2007).

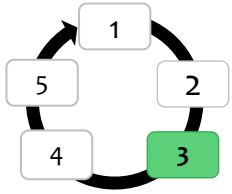
Risk Matrix



From our list of many impacts and vulnerabilities, we **will identify high priority issues using the matrix** to consider both the severity of the impact if the impact does occur, and the likelihood of the impact occurring.

Risk Matrix

- **What is the likelihood of the listed impact or vulnerability?**
 1. Very likely: it's already beginning or has already happened
 2. Likely: it's imminent that it will happen
 3. Possible: there's evidence to support it happening, but depends on other factors
 4. Unlikely: there's evidence predominately supporting that it won't happen
 5. Very unlikely: it would be against all odds to see it happen, but it's still possible
- **What is the severity of the impact if it does happen?**
 1. Negligible: there is little visible, functional, or economic consequence
 2. Minor: there is some visible, functional, or economic consequence, but within the range of normal variability
 3. Moderate: visible, functional, or economic consequence is slightly outside the range of normal variability
 4. Major: visible, functional, or economic consequence is detrimental to operations and must be addressed for operations to continue
 5. Severe: visible, functional, or economic consequence that results in mission failure and requires intervention by other state or federal agencies
- **What is the risk rating for each impact or vulnerability: low, medium-low, medium, medium-high, high?**



Step 3: EVALUATE FAP themes given projected impacts and vulnerabilities.

Climate Change Impact



Severity

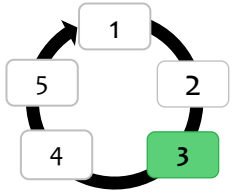
Likelihood

Overall Risk

Prioritize?

From Step 2

Example: Increased flooding and stormwater runoff is expected to result in stress on surface water quality, damage to equipment and facilities, such as dams, trails, roads and bridges



Step 3: EVALUATE FAP themes given projected impacts and vulnerabilities.

Climate Change Impact

Severity



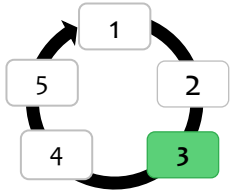
Likelihood

Overall Risk

Prioritize

What is the severity of the impact if it does happen?

*Example: **MAJOR**: Increasing costs for infrastructure repair; evacuation/closing dangerous areas; less public access; increased drinking water treatment; runoff into state forest water features; reservoirs and dams.*



Step 3: EVALUATE FAP themes given projected impacts and vulnerabilities.

Climate Change Impact

Severity

Likelihood

Overall Risk

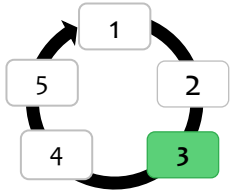
Prioritize



In the timeframe of the FAP, how likely will we see this impact actually affect a theme?

Example:

VERY LIKELY: *Several roads and bridges have washed out repeatedly in recent years.*



Step 3: EVALUATE FAP themes given projected impacts and vulnerabilities.

Climate Change Impact

Severity

Likelihood

Overall Risk

Prioritize?

Use the Matrix to assign a Risk Rating

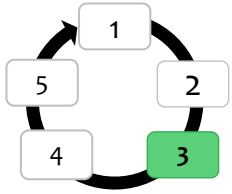
High

Medium High

Medium

Medium-Low

Low



Step 3: EVALUATE FAP themes given projected impacts and vulnerabilities.

Climate Change Impact

Severity

Likelihood

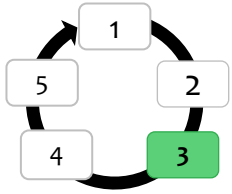
Overall Risk

Prioritize? →

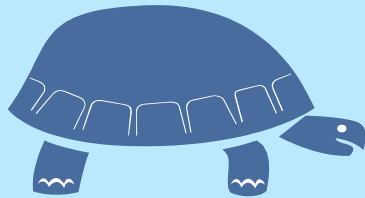
After Overall Risk has been assigned to each impact, define how to prioritize actions.

For, example, “select with an “x” the impacts that are:

- high risk*
- impacts that are not high risk but otherwise require an immediate response (ie. business as usual)*
- Impacts that are low risk but are easy to accomplish*

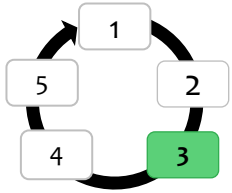


Step 3: EVALUATE FAP themes given projected impacts and vulnerabilities.

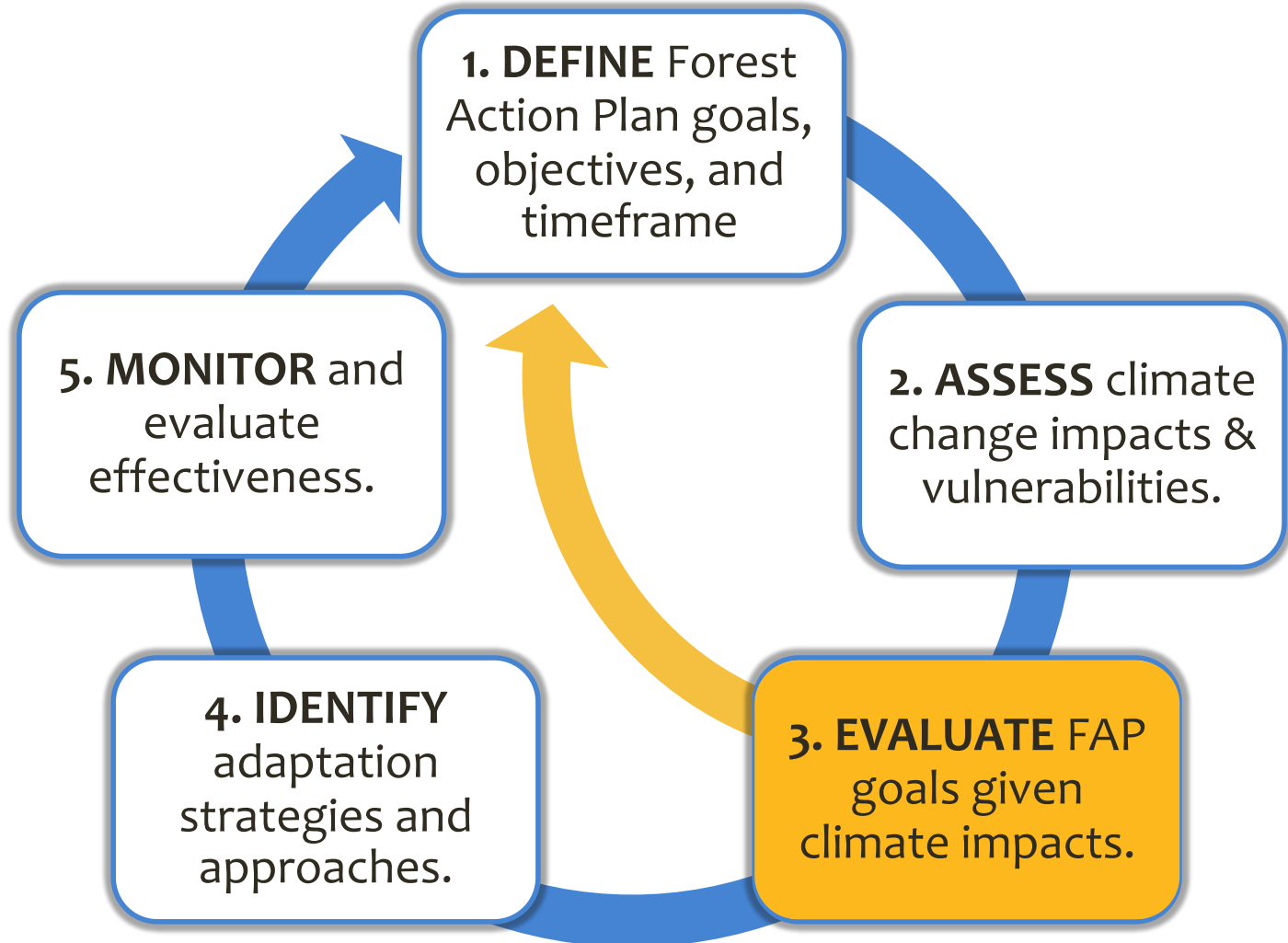


Slow down!

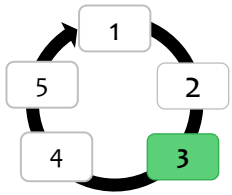
Are you going to continue with the FAP goals and objectives that you have identified?



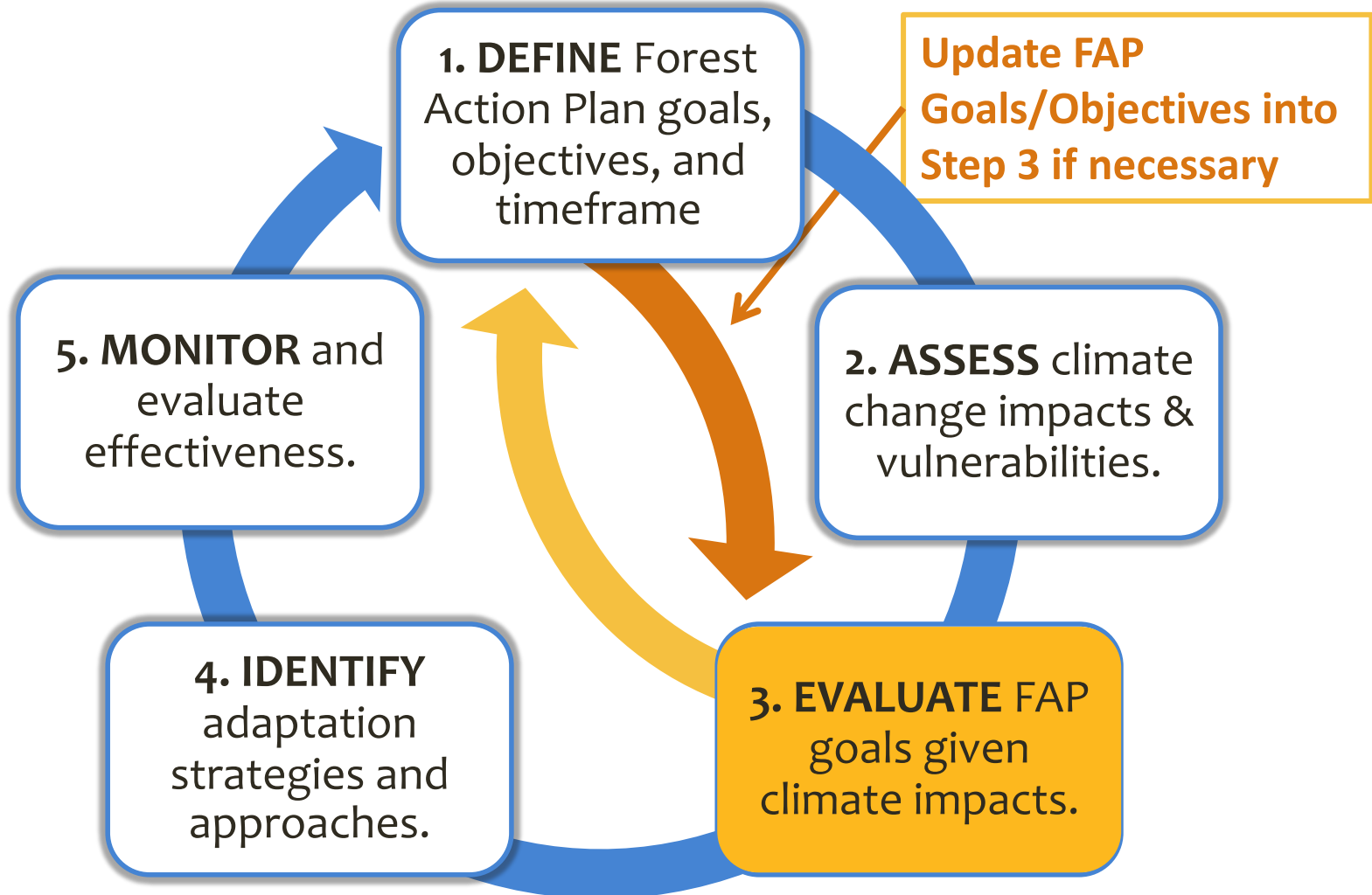
Step 3: EVALUATE FAP themes given projected impacts and vulnerabilities.



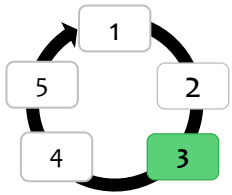
...or, RE-EVALUATE



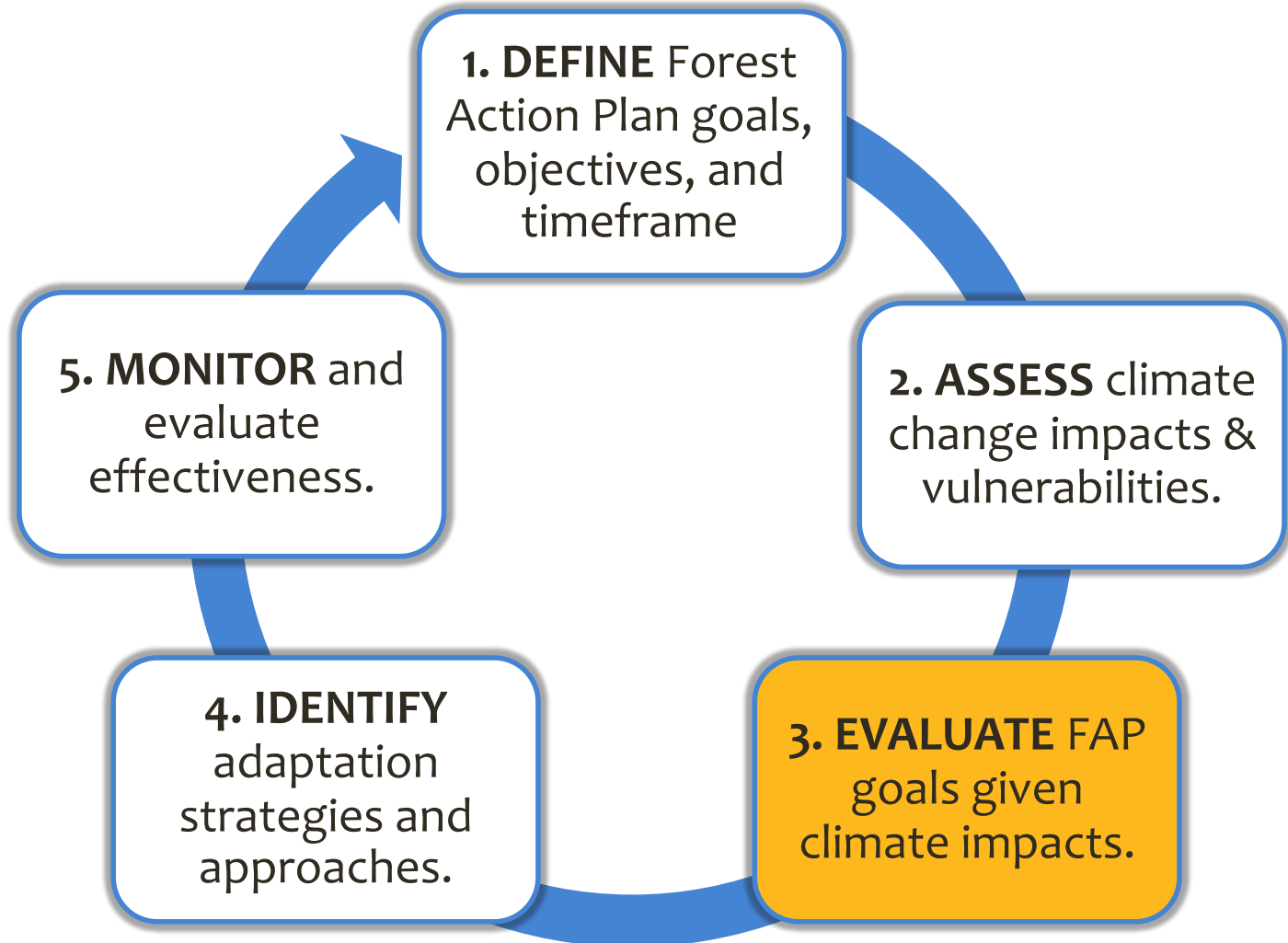
Step 3: EVALUATE FAP themes given projected impacts and vulnerabilities.



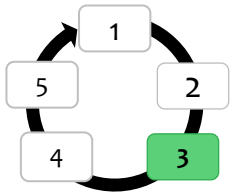
...or, RE-EVALUATE



Step 3: EVALUATE FAP themes given projected impacts and vulnerabilities.



...or, RE-EVALUATE



Step 3: EVALUATE FAP themes given projected impacts and vulnerabilities.

Evaluate the feasibility of meeting your Forest Action Plan goals using current management.

Determine feasibility

- Short term (10 yrs)
- Long term (50-100yrs)

High feasibility = Existing management options can overcome the challenges presented by climate change. **Opportunities likely outweigh challenges.**

Moderate feasibility = Some challenges have been identified, but challenges can likely be overcome using existing management options.

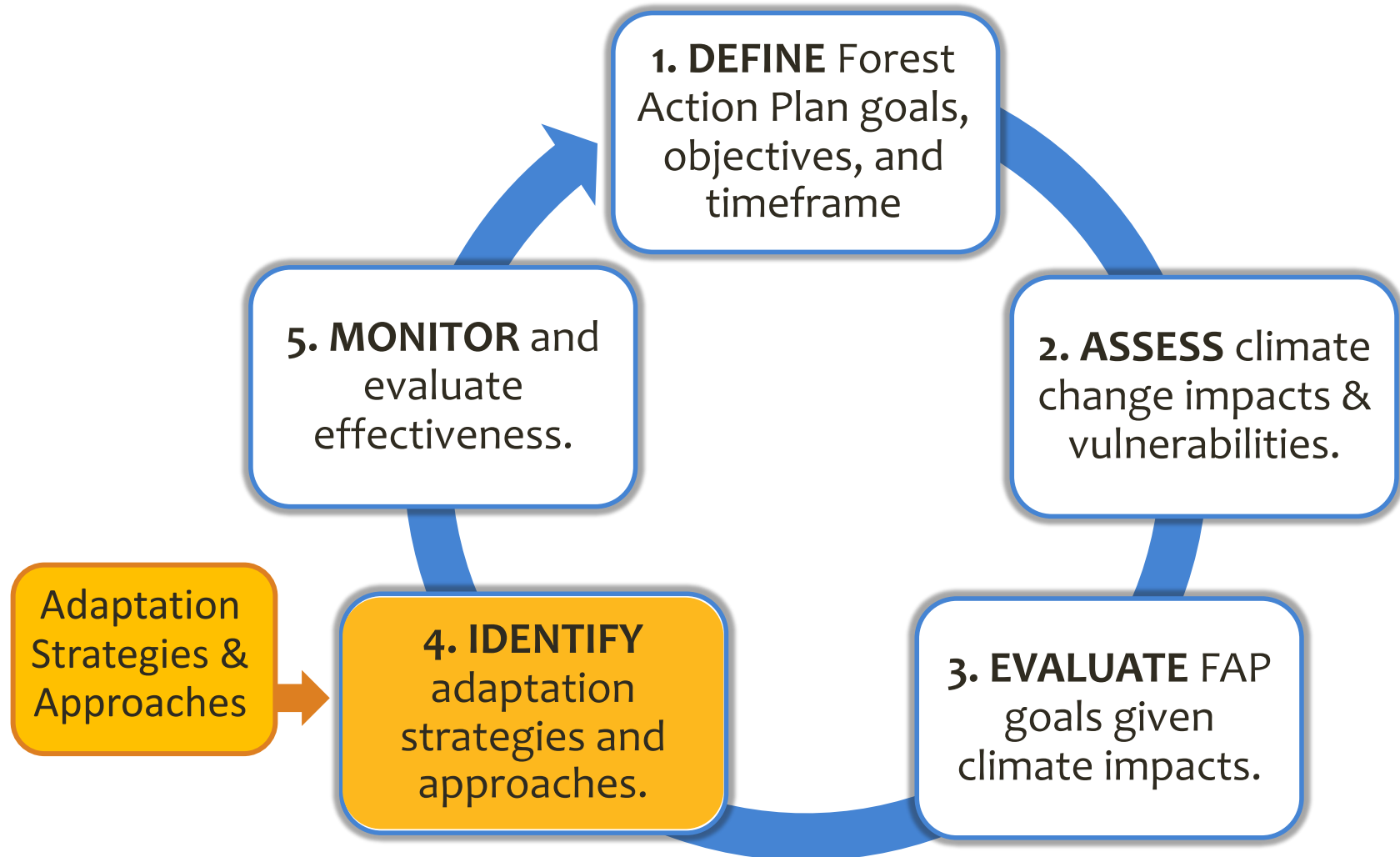
Additional resources or enhanced efforts may be necessary to counteract key challenges or promote new opportunities.

Low feasibility = Existing management may not be sufficient to overcome challenges presented by climate change. **Additional resources or enhanced efforts will be necessary** to counteract key challenges or promote new opportunities.



Step 4: Identify adaptation strategies and approaches for Colorado FAP Themes.

Workshop Agenda

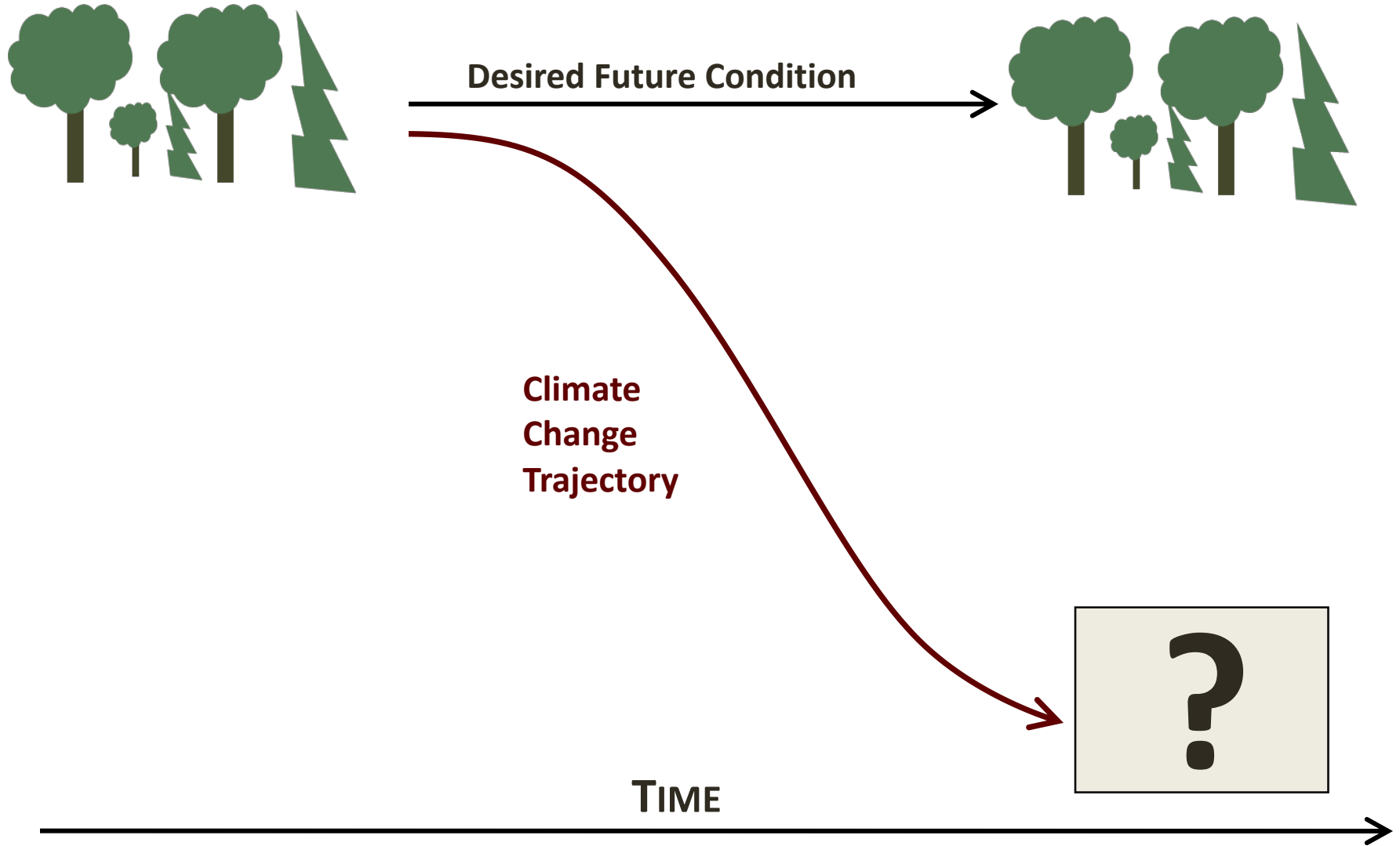


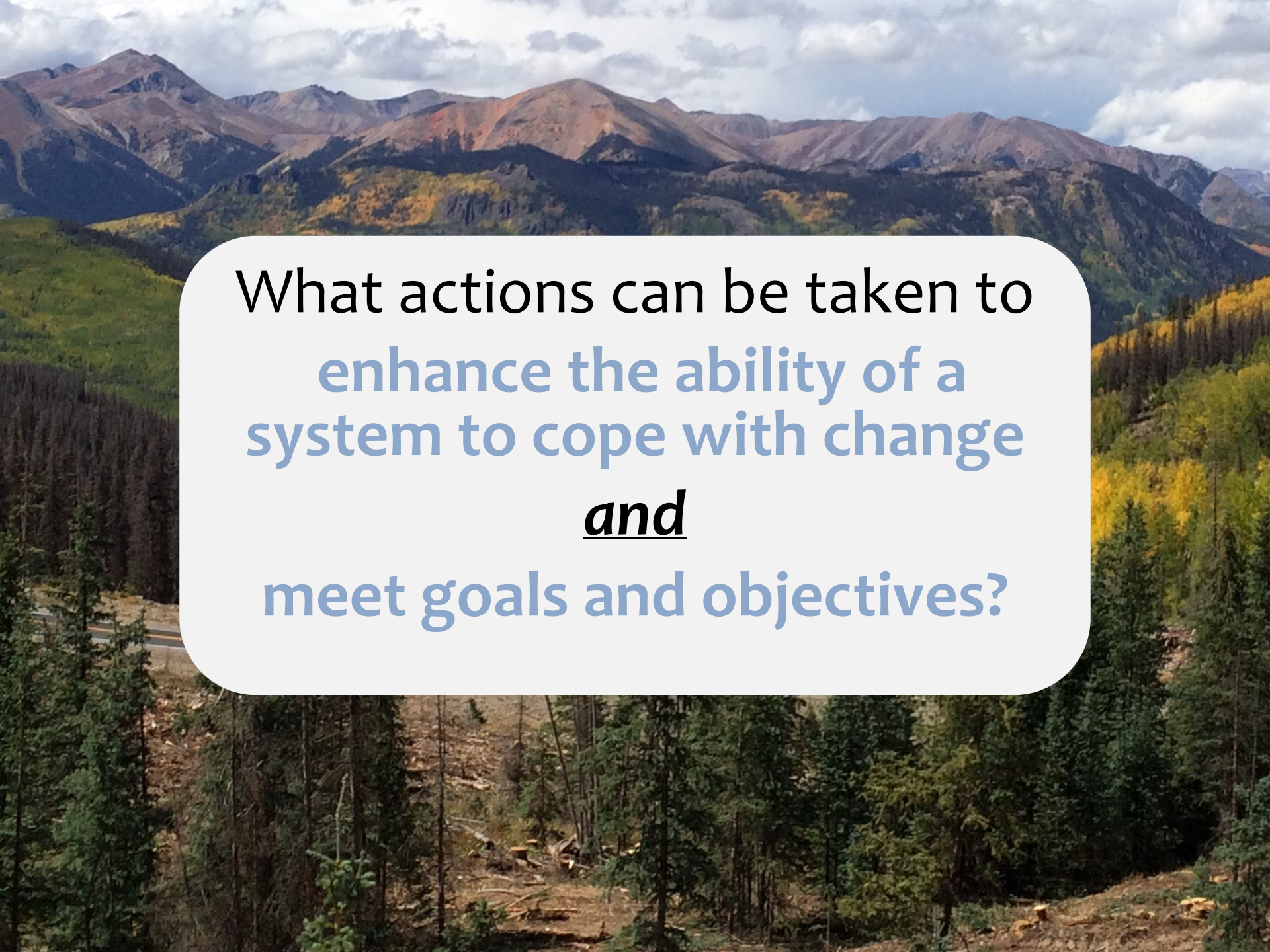
Intentionality

- Explicitly consider and address climate change
- Sure we might get lucky...
- Intentionally assessing risk and vulnerabilities **makes our plans more robust!**



Climate-Driven Changes





What actions can be taken to
enhance the ability of a
system to cope with change
and
meet goals and objectives?

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



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

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



- What do you **value**?
- How much **risk** are you willing to tolerate?

Adaptation Concepts

Manage for Persistence:

Ecosystems are still recognizable as being the same system (character)

Manage for Change:

Ecosystems have fundamentally changed to something different

Resistance

Resilience

Transition

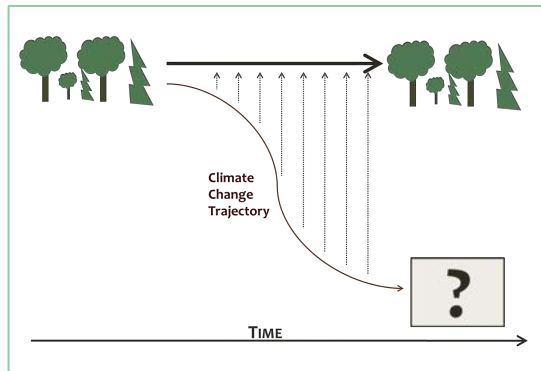


Reduce impacts/ Maintain
current conditions

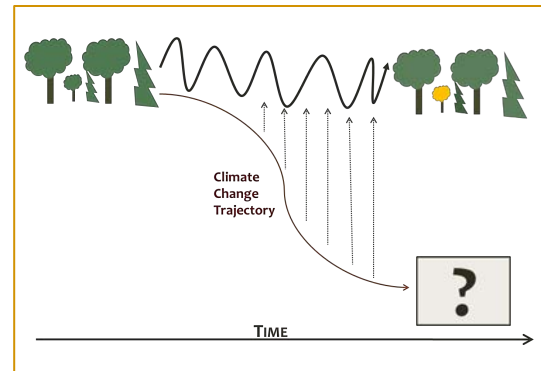
Forward-looking/
Promote change

Manage Risk

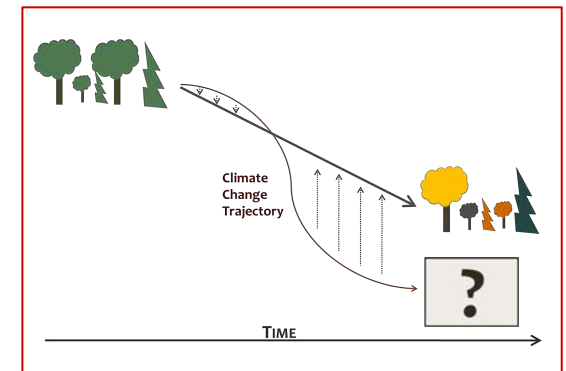
RESISTANCE



RESILIENCE



TRANSITION



Design actions that are **robust across a range of potential future conditions**

Adaptation Strategies & Approaches

**Management Goals
& Objectives**



Climate Change
Impacts



Challenges &
Opportunities



Intent of Adaptation
(**Option**)



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

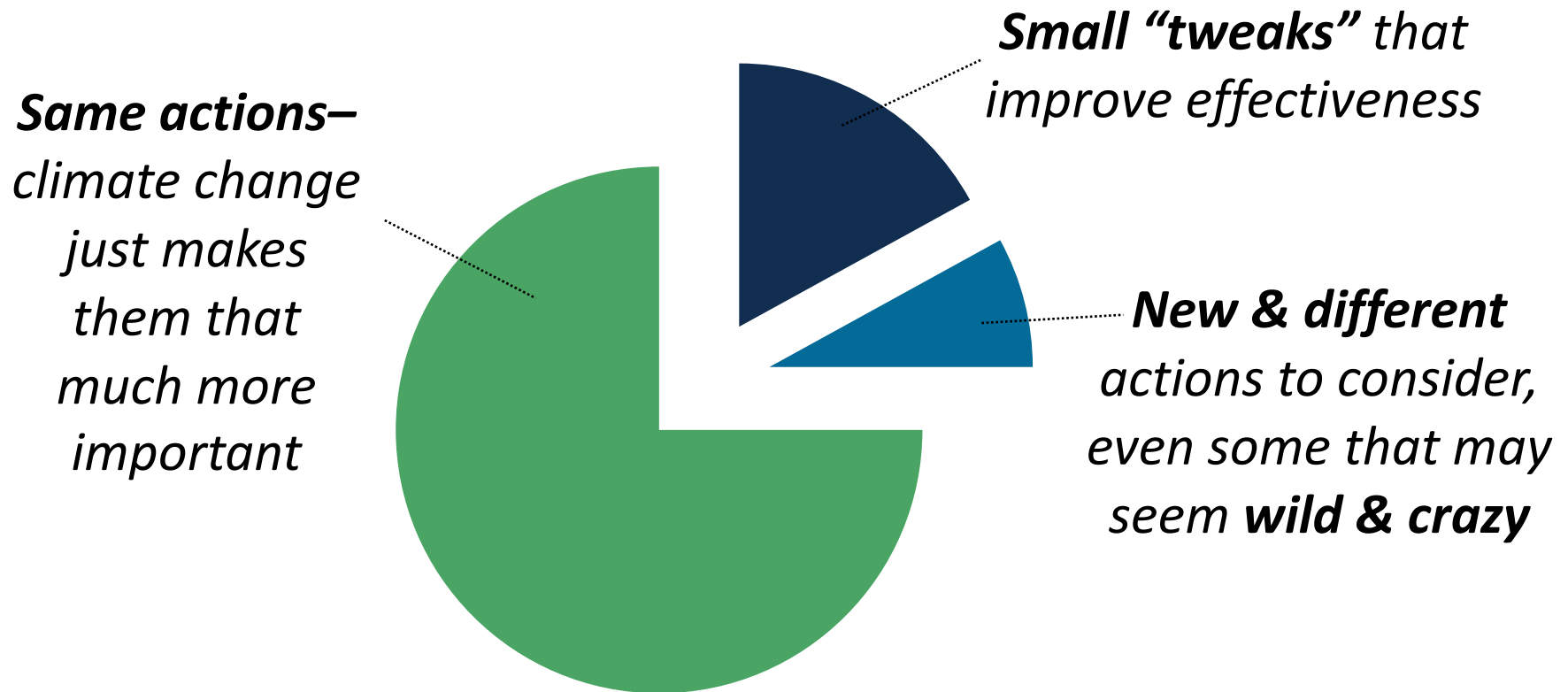


Action to Implement
(**Tactic**)



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

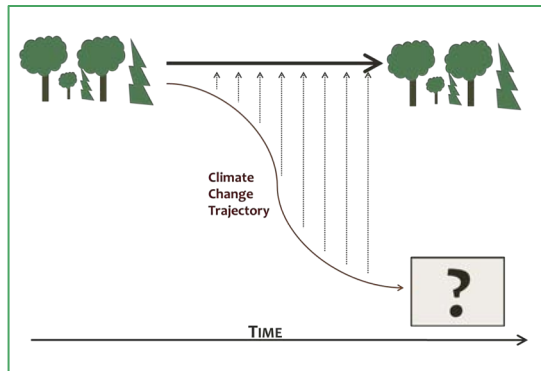
Adaptation: The Real Story*



**individual results will vary*

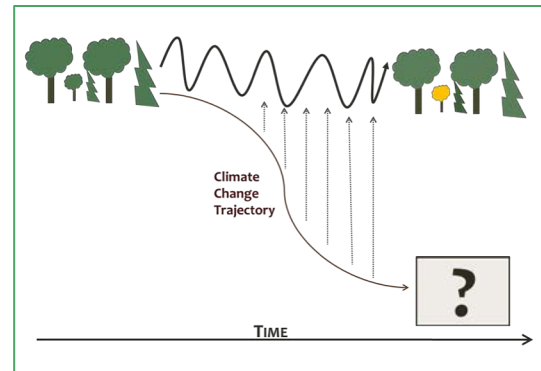
Which Adaptation Options Did you Select?

RESISTANCE



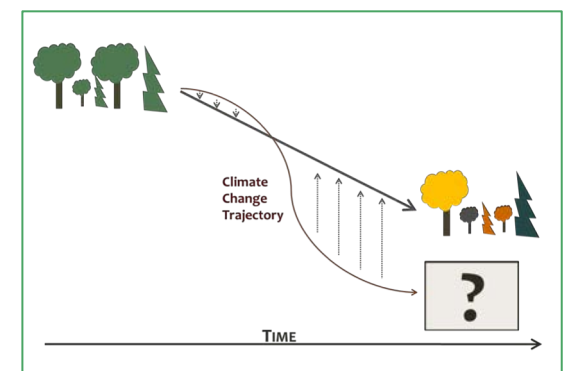
- Improve defenses of forest against change
- Maintain relatively unchanged conditions

RESILIENCE



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

TRANSITION



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

Colorado Adaptive Silviculture for Climate Change: Dry mixed conifer forests



Adaptive Silviculture for Climate Change (ASCC) Network



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Colorado State University



Mike Battaglia, CO
USFS, Rocky Mountain Research Station



Elaine Kennedy-Sutherland, MT
USFS, Rocky Mountain Research Station



Jim Guldin, Lead FS PI
USFS, Southern Research Station



Matt Tuten, CO
San Juan National Forest



Terrie Jain, MT
USFS, Rocky Mountain Research Station



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NIACS



Seth Bigelow, GA
J.W. Jones Ecological Research Center



Melissa Jenkins, MT
Flathead National Forest



Chris Looney, Postdoc
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University of Vermont



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USFS, Northern Research Station
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Mary Hammes, Urban MN
Mississippi National River and Recreation Area



Chris Woodall, NH
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Maria Janowiak, Co-PI
USFS, Northern Research Station
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Leslie Brandt, Urban MN
USFS, Northern Research Station
NIACS

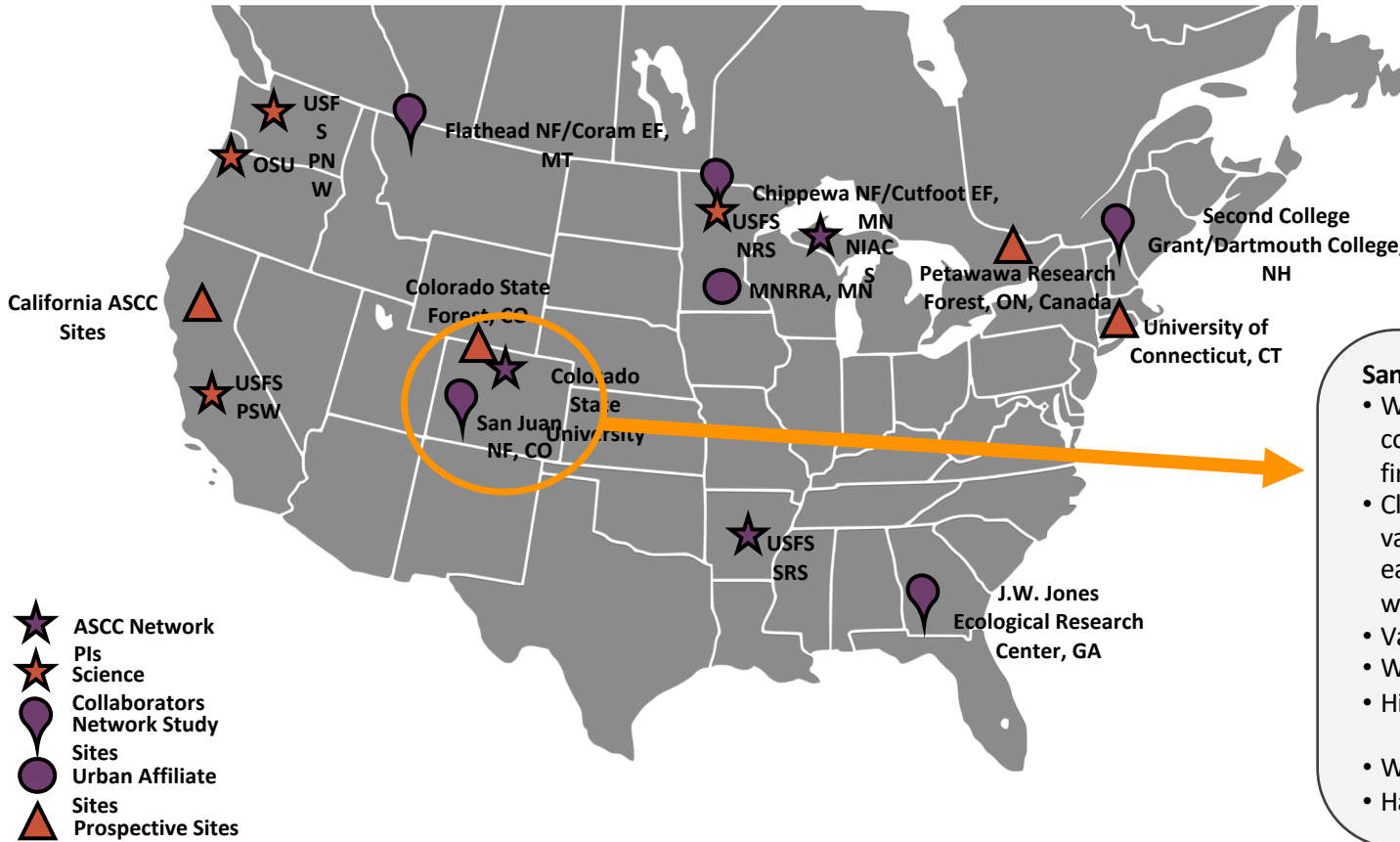


Kevin Evans, NH
Dartmouth University

The San Juan NF Site



Adaptive Silviculture for Climate Change

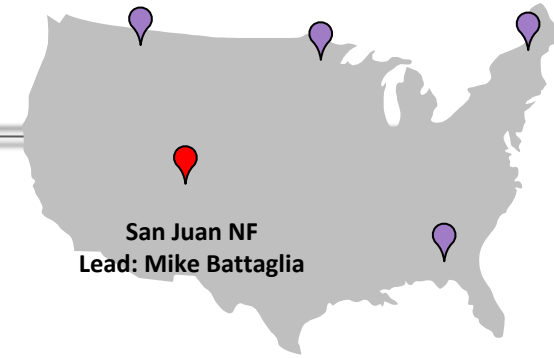


San Juan National Forest, CO

- Warm-dry mixed conifer (ponderosa pine, Douglas-fir, white fir, aspen, gambel oak)
- Climate concerns: warming, variable precipitation patterns, earlier snowmelt, increased risk of wildfire and insect outbreaks
- Variable topography
- Wildland-urban interface (WUI)
- Historically frequent fire

- Workshop in March 2014
- Harvest planned for fall 2019

CO: SAN JUAN NATIONAL FOREST



ALL TREATMENTS

- Rx burn every 5-10 years
- Rx burn to raise canopy height and reduce ladder fuels (0 to 5 inch size class)



Status: workshop March 2014, pre-treatment measurements, planned harvest for 2018/2019



Resistance

Thin to 60-90 ft²/ac (14-21 m²/ha)
PP > DF > WF
Even spacing



Resilience

Thin to 60-80 ft²/ac (14-18 m²/ha)
↑ drought-tolerant spp
PP > DF > Aspen > WF
Clumpy, multi-cohort, openings up to 1 ac (0.4 ha)



Transition

Canopy openness target 30-40%, expand existing gaps
↑ drought and fire-tolerant spp
Retain PP, Aspen in clumps, remove all WF



BREAK!

Adaptation Strategies & Approaches

CONCEPT

Translating broad **concepts** to **actions**

STRATEGIES

APPROACHES

TACTICS

ACTION

Options (concepts):

- Resistance, Resilience, Transition

Strategies:

- Regionally specific conditions

Approaches:

- Actions for a specific ecosystem

Tactics:

- Prescriptions for local conditions and mgmt. objectives

Example:

Strategy 3: Reduce the risk and long-term impacts of severe disturbances.



Approach 3.1: Alter forest structure or composition to reduce risk or severity of wildfire.



Tactics 3.1.1: Using prescribed fire and thinning to reduce surface fuels, increase height to live crown, decrease crown closure, and create a more open forest structure that is expected to be less vulnerable to severe wildfire.

NIACS Menu

Menu of Adaptation Strategies and Approaches Developed for forests

- Strategy 1: Sustain fundamental ecological functions.**
- 1.1. Reduce impacts to soils and nutrient cycling.
 - 1.2. Maintain or restore hydrology.
 - 1.3. Maintain or restore riparian areas.
 - 1.4. Reduce competition for moisture, nutrients, and light.
 - 1.5. Restore or maintain fire or fire-adapted ecosystems.
- Strategy 2: Reduce the impact of biological stressors.**
- 2.1. Maintain or improve the ability of forests to resist pests and pathogens.
 - 2.2. Prevent the introduction and establishment of invasive plant species and remove existing invasive species.
 - 2.3. Manage herbivory to promote regeneration of desired species.
- Strategy 3: Reduce the risk and long term impacts of severe disturbances.**
- 3.1. Assess forest structure to show the extent of catastrophic risk or severity of wildfire.
 - 3.2. Establish fuelbreaks to slow the spread of catastrophic fire.
 - 3.3. Alter forest structure to reduce severity or extent of wind and ice damage.
 - 3.4. Identify vulnerable sites after disturbance.
- Strategy 4: Maintain or create refugia.**
- 4.1. Prioritize and maintain unique sites.
 - 4.2. Identify and maintain sensitive or at-risk species or communities.
 - 4.3. Establish artificial reserves for at-risk and displaced species.
- Strategy 5: Maintain and enhance species and structural diversity.**
- 5.1. Promote diverse site classes.
 - 5.2. Maintain and restore genetic diversity.
 - 5.3. Manage biological regimes.
 - 5.4. Establish reserves to maintain diversity.
- Strategy 6: Increase ecosystem redundancy across the landscape.**
- 6.1. Manage habitats to increase diversity.
 - 6.2. Expand the boundaries of reserves to increase diversity.
- Strategy 7: Promote landscape connectivity.**
- 7.1. Restore landscape connectivity.
 - 7.2. Maintain and create habitat corridors through reforestation or restoration.
- Strategy 8: Maintain and enhance genetic diversity.**
- 8.1. Use local, geographic, and other genetic material from within a greater geographic range.
 - 8.2. Favor existing genotypes that are better adapted to future conditions.
- Strategy 9: Facilitate community adjustments through species transitions.**
- 9.1. Favor or restore native species that are expected to be adapted to future conditions.
 - 9.2. Establish or encourage new niches at early stages of stand development.
 - 9.3. Establish changes in species composition and timing.
 - 9.4. Protect future adapted species with wide moisture and temperature tolerances.
 - 9.5. Consider species that are expected to be adapted to future conditions.
 - 9.6. Manage for species and genotypes that are expected to be adapted to future habitat.
 - 9.7. Monitor species that are expected to be adapted to future habitat.
 - 9.8. Move at-risk species to locations that are expected to be adapted to future conditions.
- Strategy 10: Realign ecosystems after disturbance.**
- 10.1. Prioritize regeneration sites after disturbance.
 - 10.2. Allow for areas of natural regeneration to meet expected forest conditions.
 - 10.3. Realign significantly damaged ecosystems to meet expected forest conditions.



Swanson et al., 2016. Forest Adaptation Resources: Climate Change Tools and Approaches for Land Managers, 2nd edition. <http://www.treesearch.itf.gov/jsp/abstract/abstract.jsp?doi=10.5555/527201>

Menu of Adaptation Strategies and Approaches Developed for Urban Forests

- Strategy 1: Sustain or restore fundamental ecological functions.**
- 1.1. Maintain or restore soils and nutrient cycling in urban areas.
 - 1.2. Maintain or restore hydrology.
 - 1.3. Maintain or restore riparian areas.
 - 1.4. Reduce competition for moisture, nutrients, and light.
 - 1.5. Restore or maintain fire or fire-adapted ecosystems.
- Strategy 2: Reduce the impact of biological stressors.**
- 2.1. Maintain or improve the ability of forests to resist pests and pathogens.
 - 2.2. Prevent the introduction and establishment of invasive plant species and remove existing invasive species.
 - 2.3. Manage herbivory to promote regeneration of desired species.
- Strategy 3: Reduce the risk and long term impacts of severe disturbances.**
- 3.1. Assess forest structure to show the extent of catastrophic risk or severity of wildfire.
 - 3.2. Establish fuelbreaks to slow the spread of catastrophic fire.
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 - 4.3. Establish artificial reserves for at-risk and displaced species.
- Strategy 5: Maintain and enhance species and structural diversity.**
- 5.1. Promote diverse site classes.
 - 5.2. Maintain and restore genetic diversity.
 - 5.3. Manage biological regimes.
 - 5.4. Establish reserves to maintain diversity.
- Strategy 6: Increase ecosystem redundancy across the landscape.**
- 6.1. Manage habitats to increase diversity.
 - 6.2. Expand or buffer the boundaries of reserves to increase diversity.
- Strategy 7: Promote landscape connectivity.**
- 7.1. Restore landscape connectivity.
 - 7.2. Maintain and create habitat corridors through reforestation or restoration.
- Strategy 8: Maintain and enhance genetic diversity.**
- 8.1. Use local, geographic, and other genetic material from within a greater geographic range.
 - 8.2. Favor existing genotypes that are better adapted to future conditions.
 - 8.3. Use new genotypes that are better adapted to future conditions.
- Strategy 9: Facilitate community adjustments through species transitions.**
- 9.1. Favor or restore native species that are expected to be adapted to future conditions.
 - 9.2. Establish or encourage new niches at early stages of stand development.
 - 9.3. Establish changes in species composition and timing.
 - 9.4. Protect future adapted species with wide moisture and temperature tolerances.
 - 9.5. Consider species that are expected to be adapted to future conditions.
 - 9.6. Manage for species and genotypes that are expected to be adapted to future habitat.
 - 9.7. Monitor species that are expected to be adapted to future habitat.
 - 9.8. Move at-risk species to locations that are expected to be adapted to future conditions.
- Strategy 10: Realign ecosystems after disturbance.**
- 10.1. Prioritize regeneration sites after disturbance.
 - 10.2. Allow for areas of natural regeneration to meet expected forest conditions.
 - 10.3. Realign significantly damaged ecosystems to meet expected forest conditions.



Swanson et al., 2016. Forest Adaptation Resources: Climate Change Tools and Approaches for Land Managers, 2nd edition. <http://www.treesearch.itf.gov/jsp/abstract/abstract.jsp?doi=10.5555/527201>

Culturally relevant tribal adaptation menu: Strategies 1-3

Strategy 1: Consider cultural practices and seek spiritual guidance

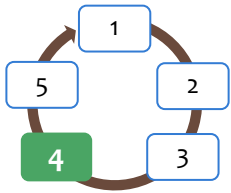
Strategy 2: Learn through careful and respectful observation (gikinawaabi)

Strategy 3: Support tribal engagement in the environment

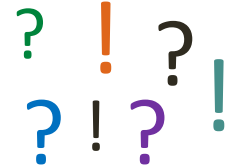
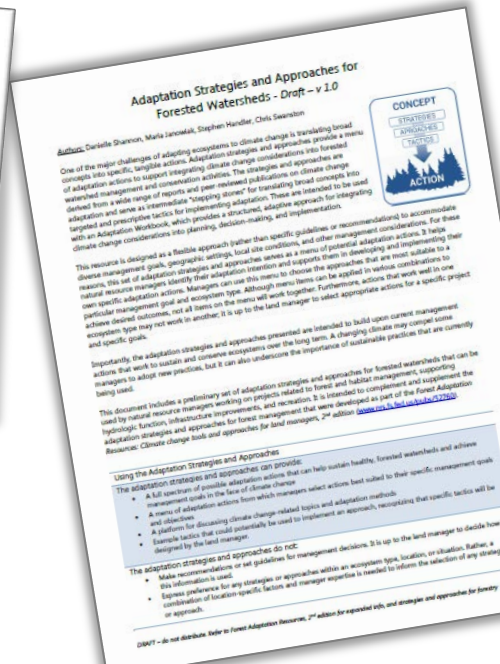
The first several strategies and approaches in the Tribal Adaptation Menu describe how cultural & spiritual knowledge and tribal engagement can help support climate adaptation.

Courtney can share a copy (*not for distribution*)

Indicate how you are (or would like to) incorporate these ideas into the CO Forest Action Plan.



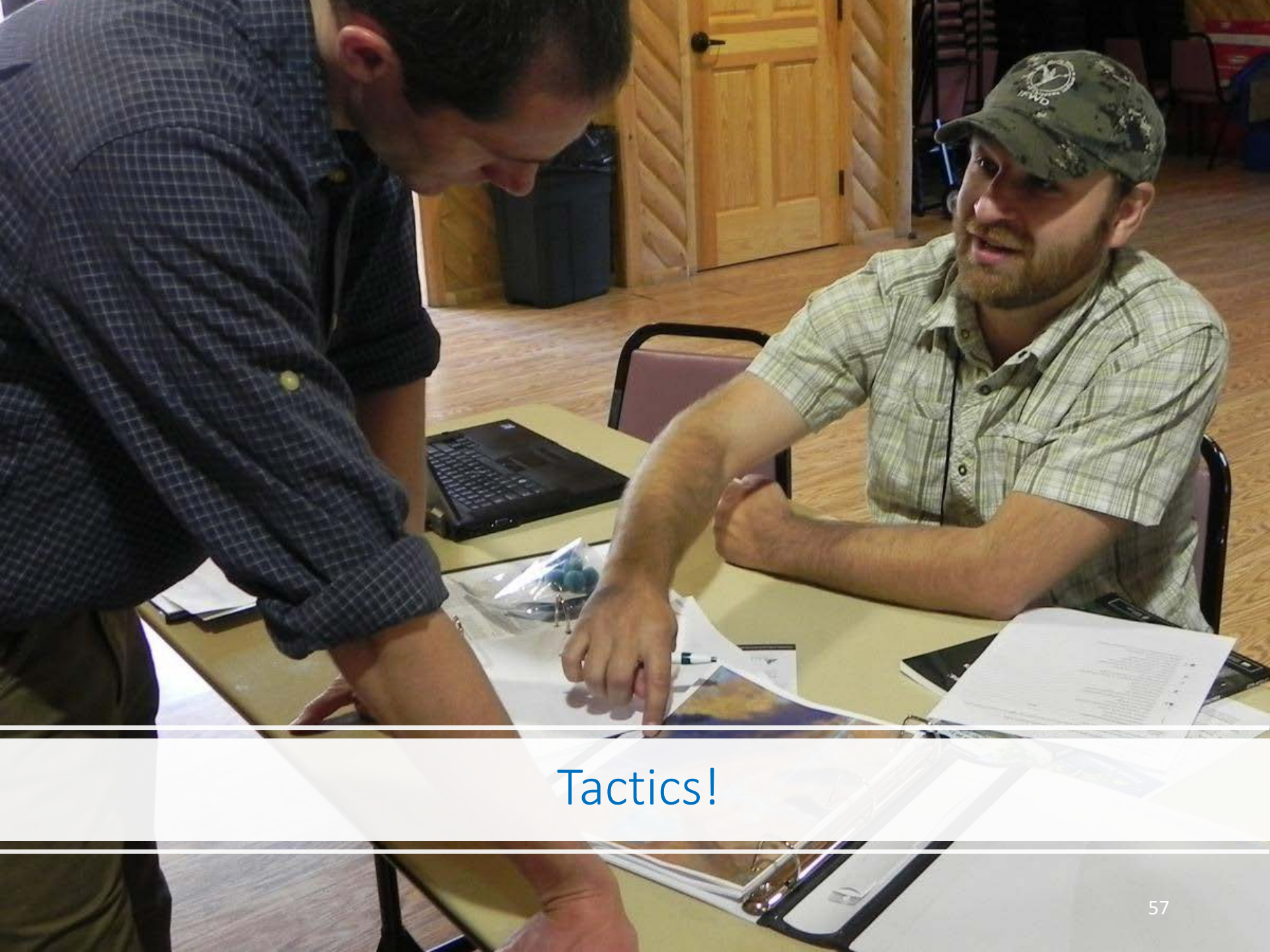
Step 4: IDENTIFY adaptation strategies, approaches, and actions for Colorado FAP Themes.



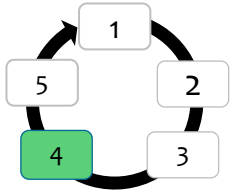
1. Split into FAP Theme groups and explore the different NIACS menus of strategies and approaches (forest, urban, forested watersheds, wildlife)

2. Think about some Colorado examples that support the list of strategies and approaches.

3. Are there any approaches you did not come up with Colorado-specific examples for? Does anyone have a Colorado-specific example of an approach that was not on any of the menus?



Tactics!



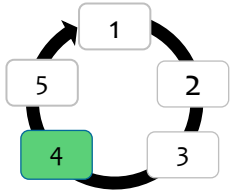
Step 4: IDENTIFY adaptation strategies, approaches, and actions for Colorado FAP Themes.

Approach – think about specific tactics/actions for on-the-ground management pertaining to your FAP Theme that relate to the list of strategies and approaches.

Tactic – Describe a specific action you can take. Identify management actions that can help prepare Colorado’s forests for changing conditions given risk ratings discussed yesterday.

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



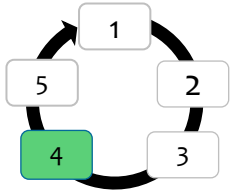


Step 4: IDENTIFY adaptation strategies, approaches, and actions for Colorado FAP Themes.

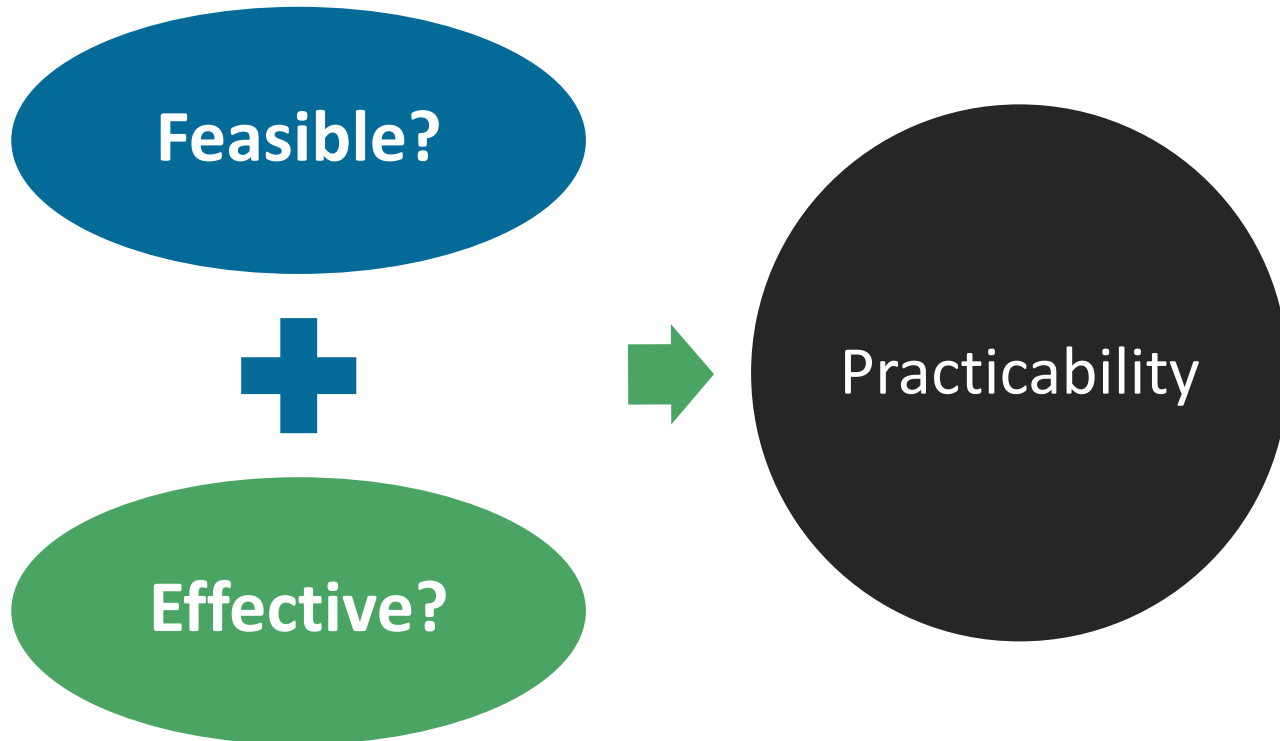
Use this step to rigorously define tactics you think are suitable given your FAP theme vulnerabilities to climate change, and choose to “not recommend.” This can help provide context for the future and document your thought process and actions.

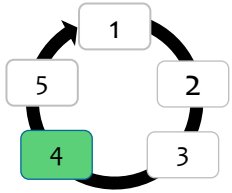
Don't forget to denote the approach number you use.





Step 4: IDENTIFY adaptation strategies, approaches, and actions for Colorado FAP Themes.

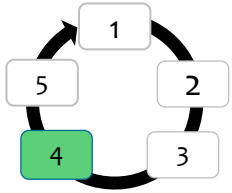




Step 4: IDENTIFY adaptation strategies, approaches, and actions for Colorado FAP Themes.

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.



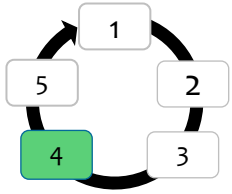
Step 4: IDENTIFY adaptation strategies, approaches, and actions for Colorado FAP Themes.

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



Step 4: IDENTIFY adaptation strategies, approaches, and actions for Colorado FAP Themes.

Key Questions:

What actions can enhance the ability of the ecosystem to adapt to anticipated changes *and* meet management goals?

Will future managers know what we were trying to do?

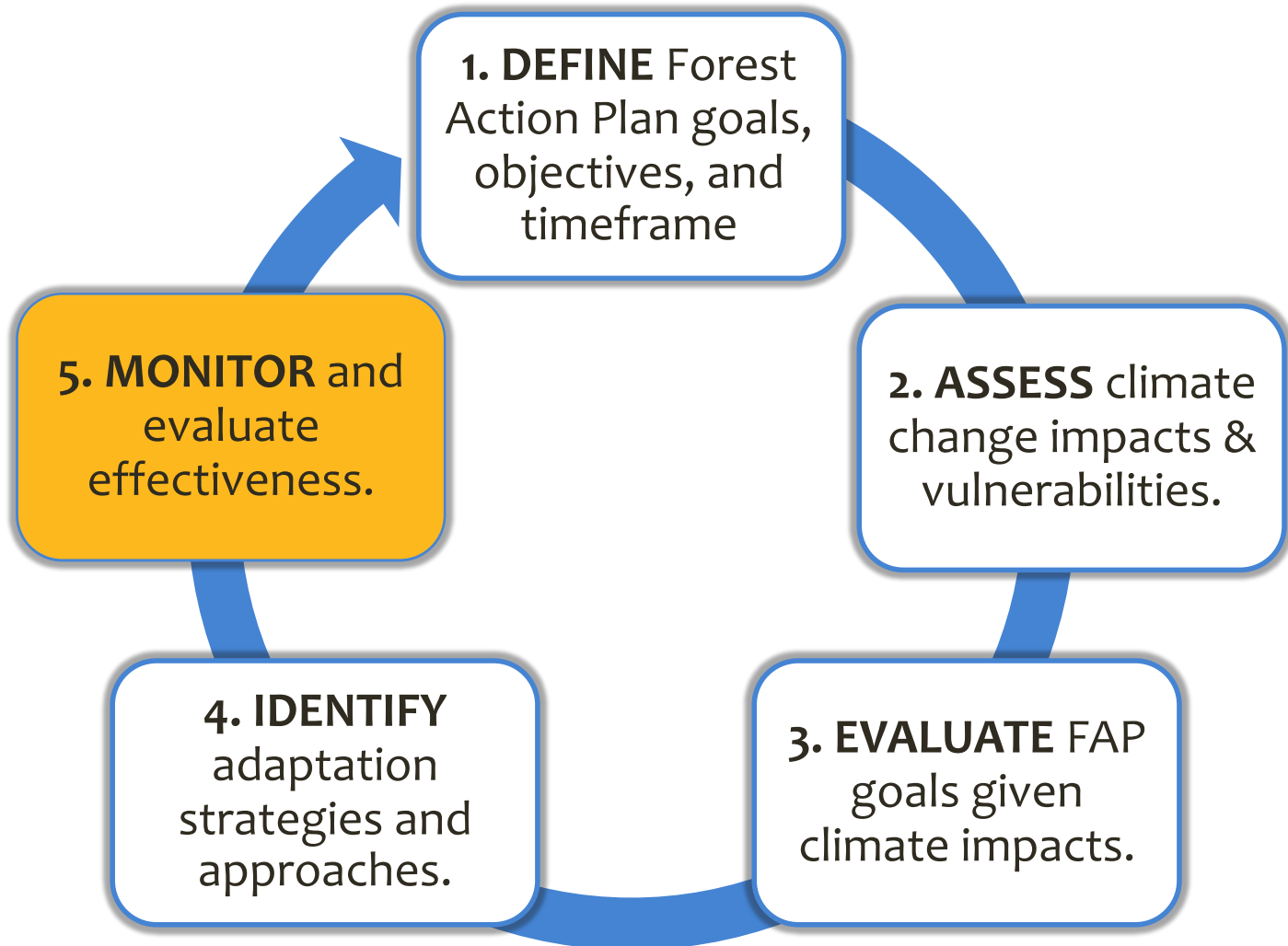


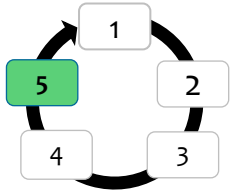
BREAK!



Step 5: MONITOR and evaluate effectiveness of implemented actions.

Workbook Cycle: Step 5





Step 5: MONITOR and evaluate effectiveness of implemented actions.

Purpose:

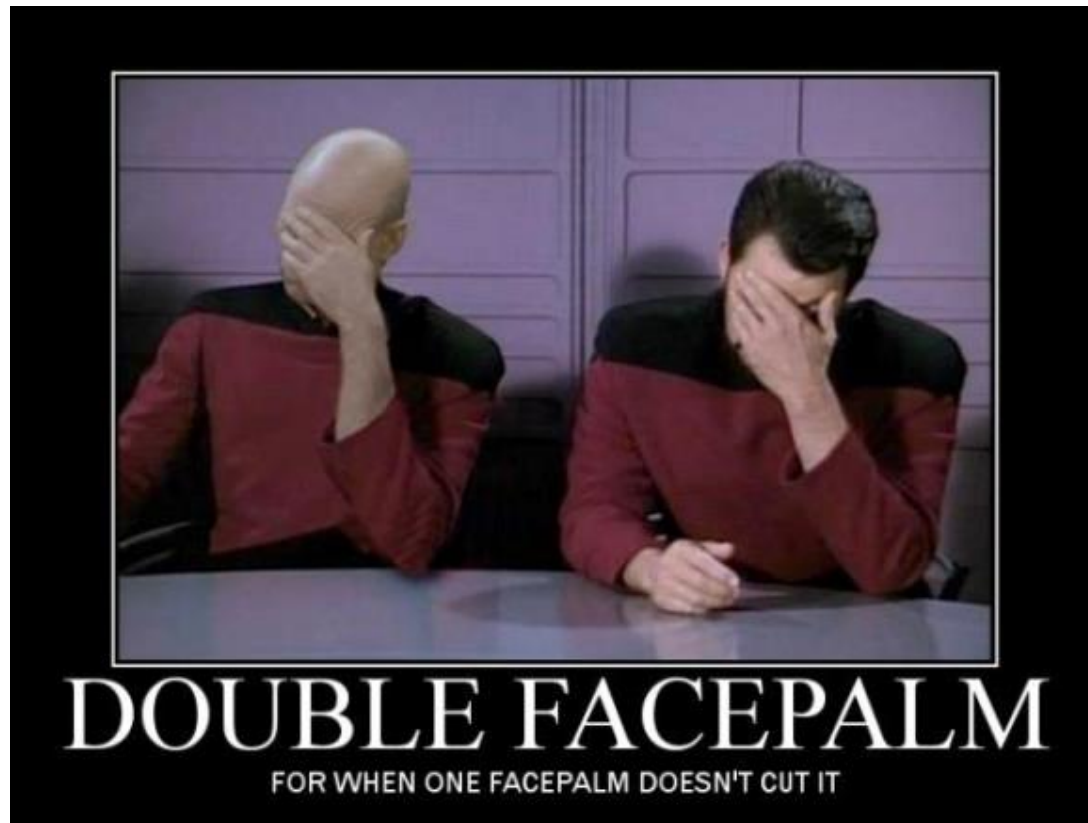
- Practice adaptive management

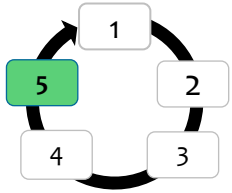
How do we know if the selected actions were effective?

What can we learn from these actions to inform future management?

A Few Thoughts About Monitoring...

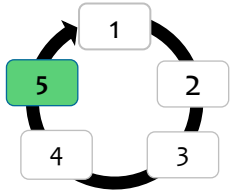
- Learning about our actions is useful
- Our track record is not very good





Step 5: MONITOR and evaluate effectiveness of implemented actions.

- How do we know if the selected actions were **effective**?
- What can we **learn** from these actions to **inform future management**?



Step 5: MONITOR and evaluate effectiveness of implemented actions.

OUTCOME:

Realistic and feasible monitoring scheme that can be used to help determine whether **management** should be **altered in the future to account for new information and observations.**

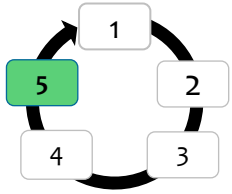
A Few Thoughts About Monitoring...

Be very clear about your **objectives**! What question you are asking **guides** your monitoring approach:

- **Scientific research** = Is this outcome statistically significant compared to a control? Could we expect similar results elsewhere?
- **Impact/ response monitoring** = What changes are occurring?
- **Implementation monitoring** = Did we do the action?
- **Effectiveness monitoring** = Did our actions actually have the desired effect?

“Climate change monitoring”

- Are you going to monitor climate change?
 - Nope.
- Are you going to monitor climate change impacts?
 - Not necessarily.
- Are you going to monitor the success of your management?
 - That’s the ticket!
 - You’re already doing that (or trying).
- “Climate change monitoring” is not climate science



Step 5: MONITOR and evaluate effectiveness of implemented actions.

Adaptation Monitoring Variable – What you will measure

- *Items that can tell you whether you have achieved your **management goals & objectives**.*
- *If possible, use an item that also helps evaluate a particular tactic.*

For example:

- *Planted seedling survival at 1, 2, 5, and 10 years after planting*

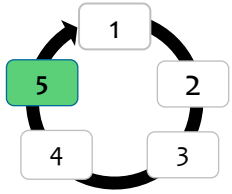
Step 5: MONITOR and evaluate effectiveness of implemented actions.

Criteria for Evaluation – a value or threshold that is meaningful for assessing effectiveness or informing future decisions

- *What is success?*
- *What you're monitoring or measuring: **What are the units on your data?***

For example:

- *60% survival of non-local genotypes*
- *Eradication of invasive species*



Step 5: MONITOR and evaluate effectiveness of implemented actions.

Monitoring Implementation— How you will gather the information

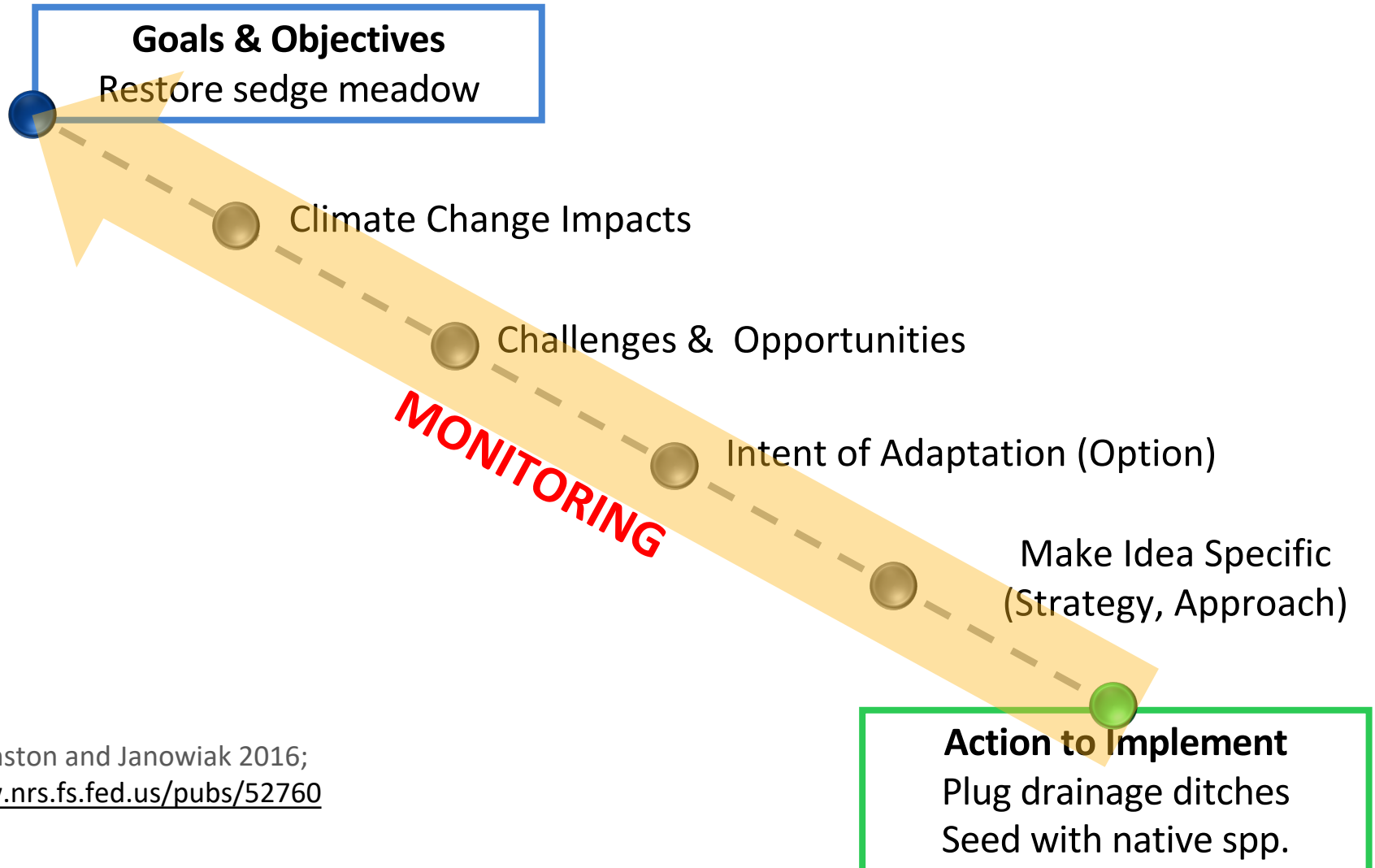
- *How, and when the monitoring will actually get done.*
- ***Take advantage of existing monitoring when possible!***

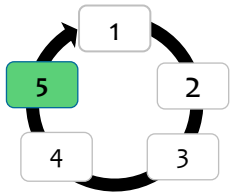
For example:

- *Regular post-planting stocking surveys.*
- *Supplemental surveys at 10 years.*
- *Annual fish surveys, # of fish, size*

Connecting the Dots

A clear train of thought shows *intentionality*





Step 5: MONITOR and evaluate effectiveness of implemented actions.

Examples

Adaptation Monitoring Variable	Criteria for Evaluation	Monitoring Implementation
Invasive species control	Areas identified for control have <20% cover from invasive species	Annual invasive species surveys (late-fall)
Regeneration success	More than 200 trees per acre of acceptable/desirable species in 0.5-2" class	Regeneration survey 2-4 years after harvest
Forest canopy cover	Forested conditions (at least 60% canopy cover is maintained across all forested areas)	Forest inventory every 5 years



Presentation Time!



Telling Your Adaptation Story

- FAP Thematic Area
- Who is your audience?
- Goals/objectives
- Key climate change impacts
- Key adaptation strategies/approaches to meet your goals/obj's
- One idea on measuring effectiveness/monitoring



YOU MADE IT!
(Congrats!)