

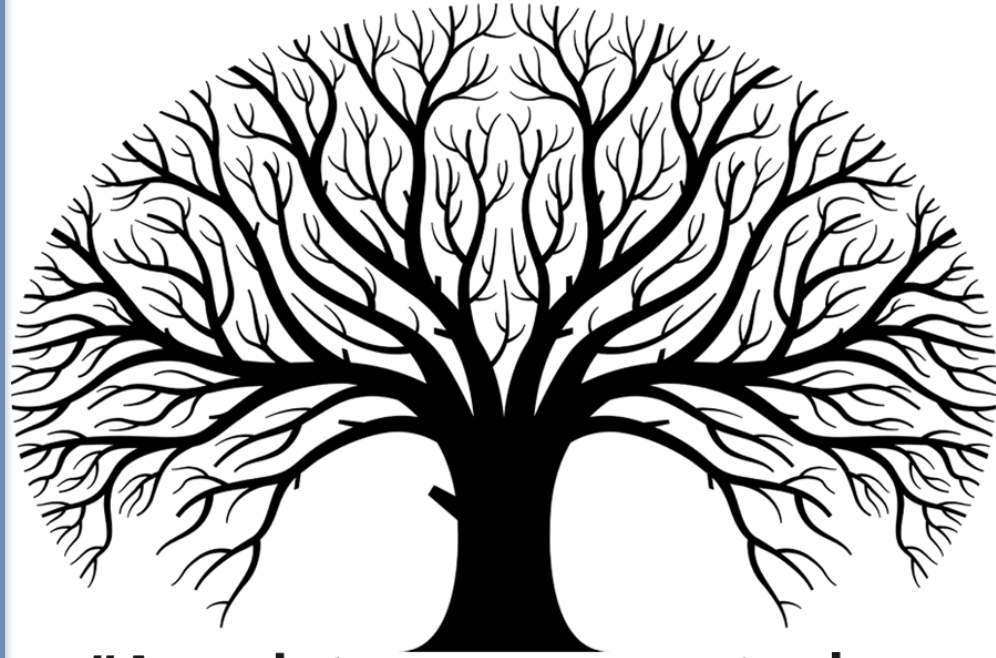
Introduction to Climate Change Adaptation Planning



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Need to incorporate climate change into near-, medium-, and long-term planning

- Minimize risk of wasting time, money, and effort
- Maximize likelihood of success



"A society grows great when old men plant trees whose shade they know they shall never sit in." Greek Proverb



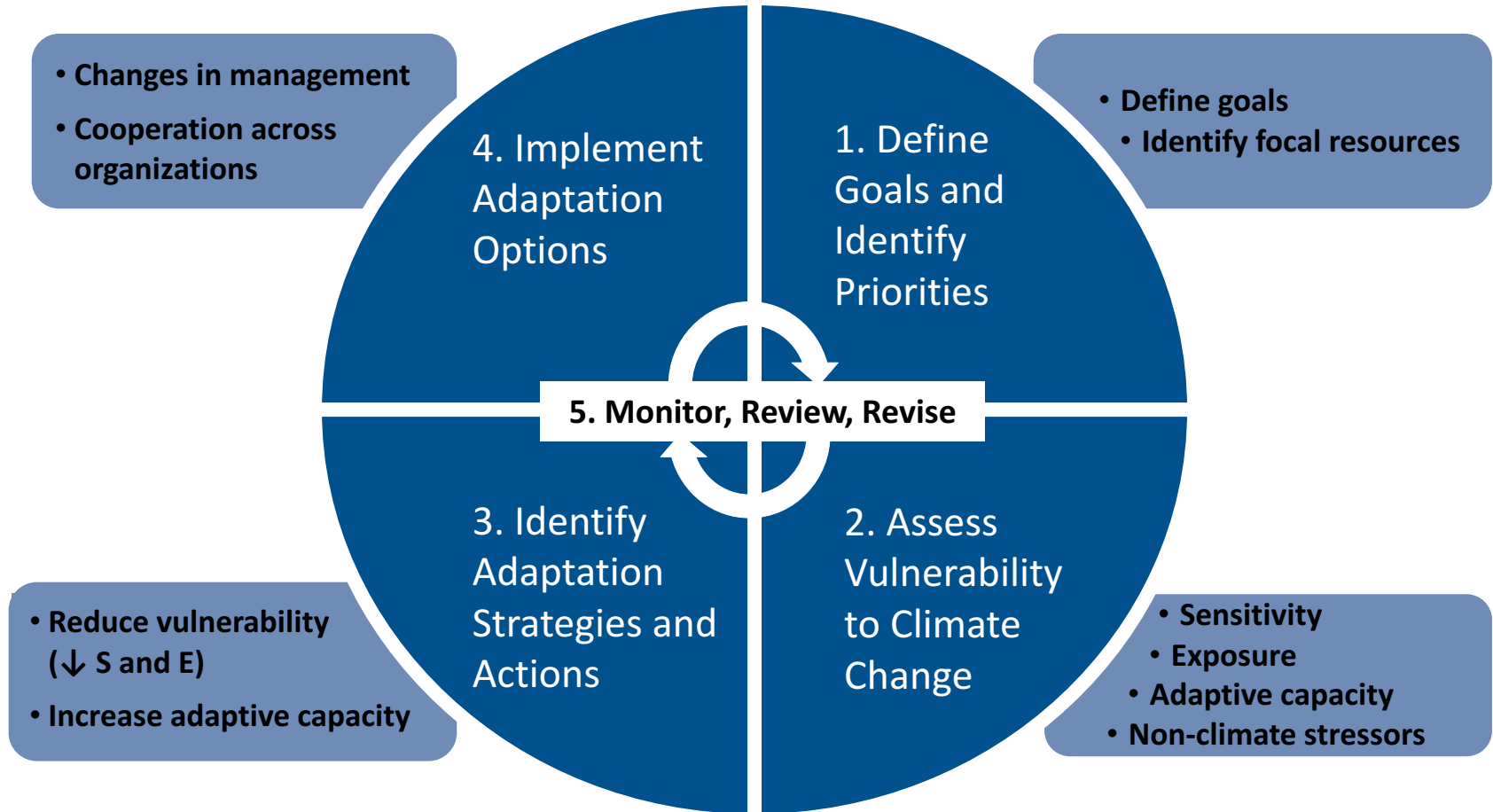
Responding to Climate Change

Mitigation is what we do to decrease the potential of climate change itself.

Adaptation is how we prepare for and respond to the changes that we are already experiencing/expected to experience.



Climate Adaptation Framework



Defining Vulnerability

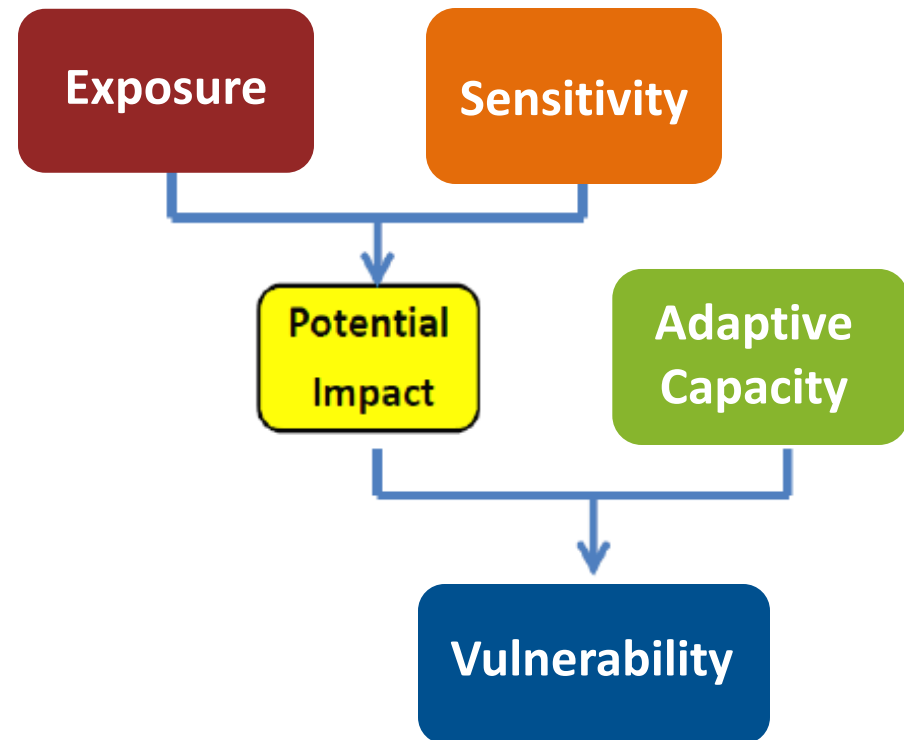
Climate change vulnerability refers to the degree to which a resource is susceptible to, and unable to cope with adverse impacts of climate change



Defining Vulnerability

IPCC 2007

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Exposure

Degree of change a resource is likely to experience

+1°C vs. +5°C



Assessing Exposure

Climate Variable	Projected Future Trends
Air temperature	↑ annual temperature
Extreme heat events	↑ frequency
Precipitation	Variable
Drought	↑ frequency; ↑ risk of multi-year drought
Snowpack	↓ annual depth
Timing of snowmelt	Shift ~10-30 days earlier by 2100
Wildfire	↑ total area burned

Factors to consider when assessing exposure:

- Climate models
 - Shifts in temperature, precipitation
- Ecological response models
 - Climate related vegetation shifts
 - Hydrologic projections

Measure of how much of a change in climate or other environmental factor(s) a resource is likely to experience



Defining Vulnerability

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Sensitivity

Whether and how a resource reacts to climate change

E.g., does an increase in temperature matter?

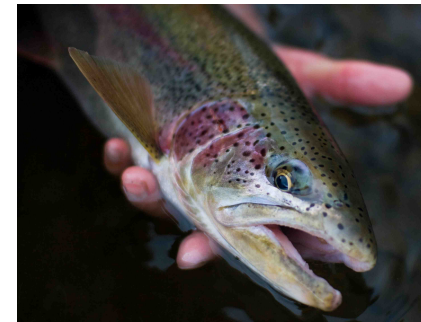


Assessing Sensitivity

Measure of whether and how a resource is likely to be affected by a given change in climate

Factors affecting sensitivity of species, habitats:

- Narrow environmental tolerances
- Specialized habitat or microhabitat requirements
- Impacts of non-climate stressors



Defining Vulnerability

IPCC 2007

Vulnerability is the degree to which a resource is susceptible to, and unable to cope with adverse impacts of climate change.

**Adaptive
Capacity**

**Ability of a resource to
accommodate or cope with
climate impacts**



Assessing Adaptive Capacity

Ability of a resource to accommodate or cope with climate change impacts with minimal disruption

Factors that can influence amount of adaptive capacity of your species or habitat:

- Intrinsic factors
 - “Plasticity”
 - Ability to resist or recover from stressors
- Extrinsic factors
 - Barriers to dispersal/migration
 - Institutional capabilities



Assessing Vulnerability

(Should I take my umbrella?)



Exposure: What is the likelihood of rain today?



Sensitivity: Will it be detrimental if I get wet?

Adaptive Capacity: Can I get out of the rain?



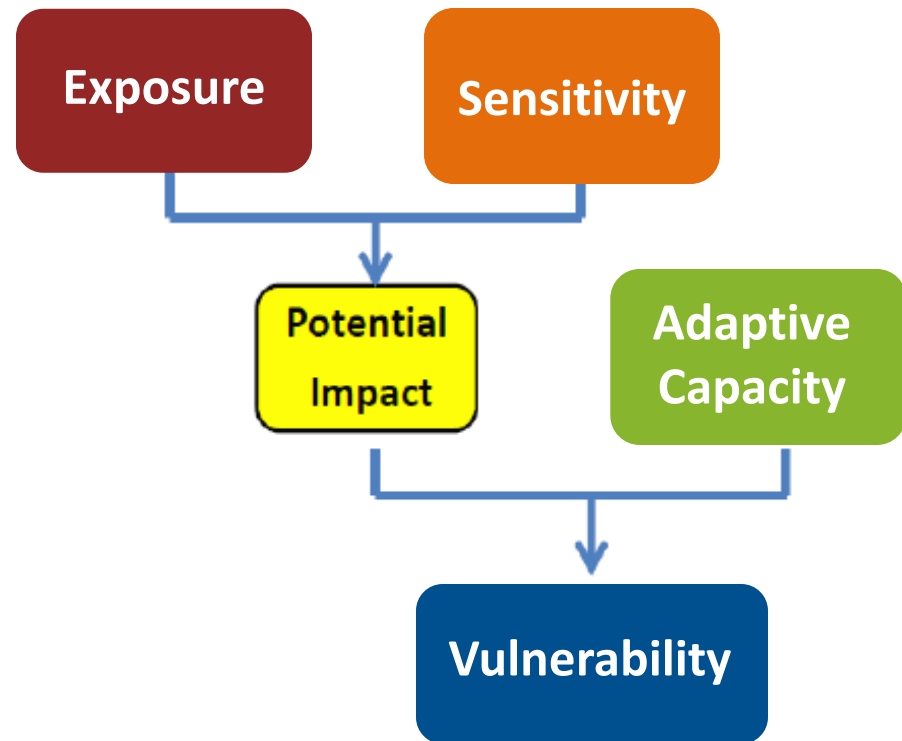
Defining Vulnerability

IPCC 2007

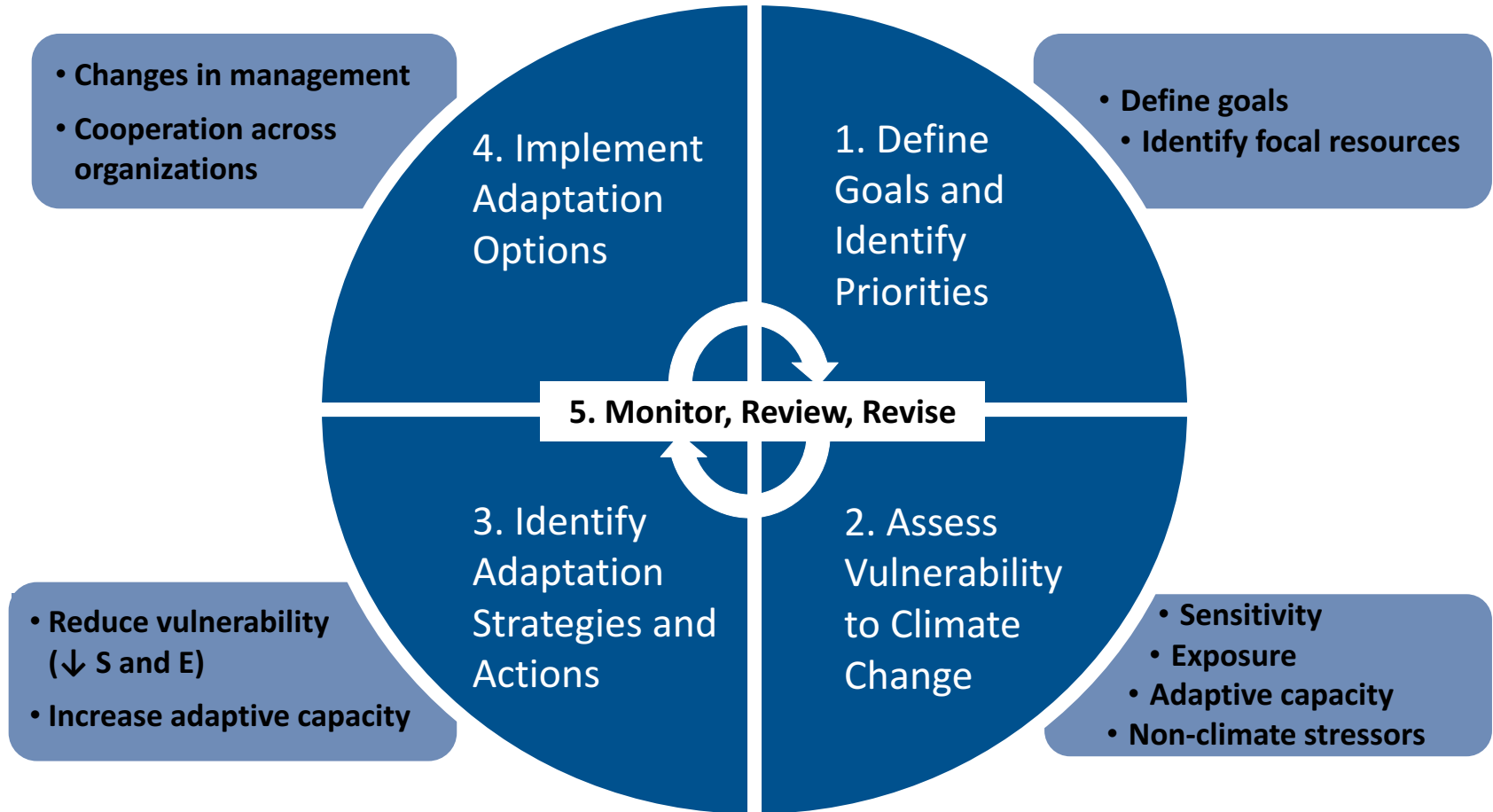
Vulnerability is the degree to which a resource is susceptible to, and unable to cope with adverse impacts of climate change.

Purpose of a vulnerability assessment:

Identify *what* resources are most vulnerable and *why*



Climate Adaptation Framework



Defining Adaptation

Climate change adaptation refers to natural or human adjustments in an ecosystem in response to changing climate conditions

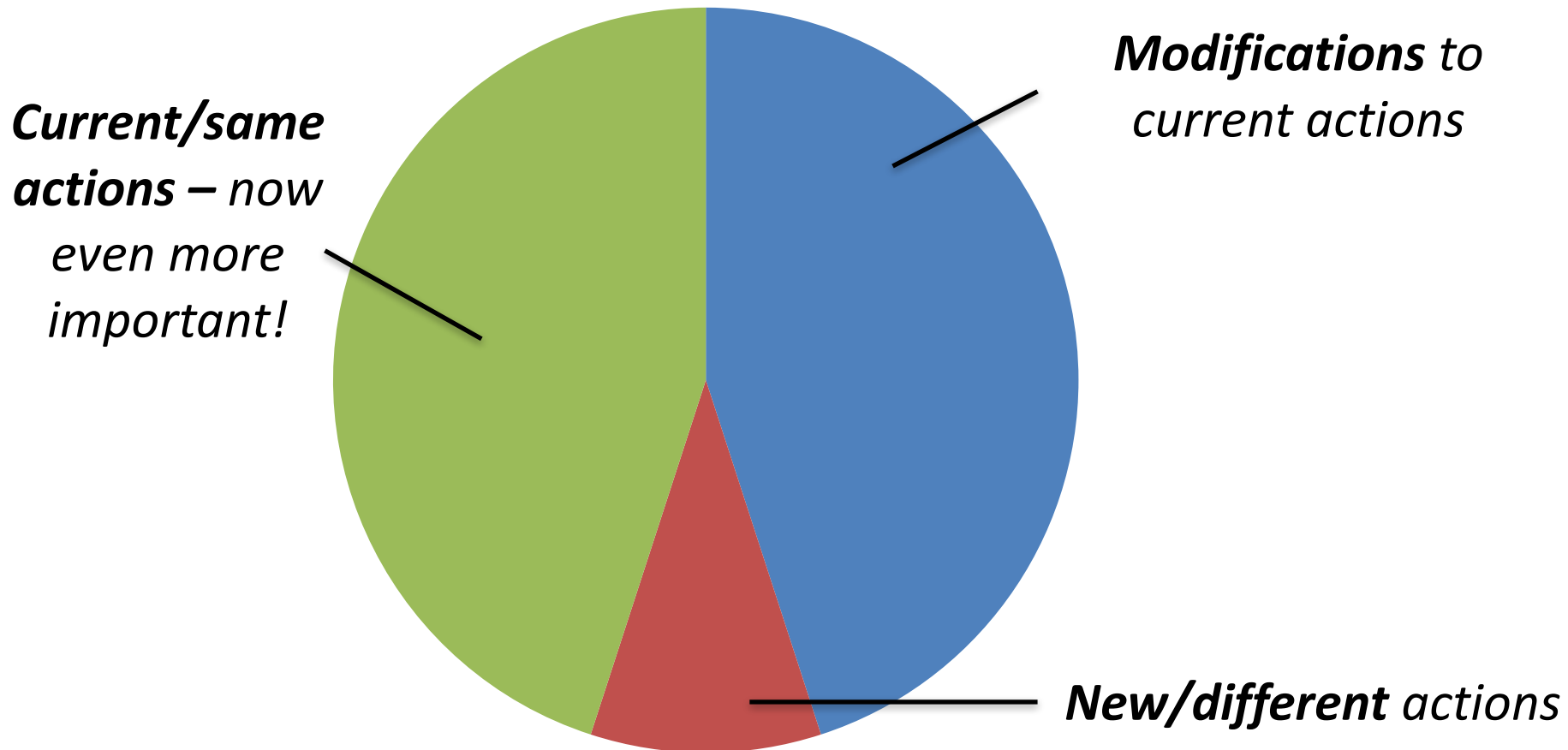


Adaptation strategies attempt to reduce the negative effects of or respond to climate change



Decision Making in a Changing Climate

Climate adaptation actions reflect the **intentional** integration of climate change



Applying Vulnerability Assessment Results in Adaptation Planning

$$\text{Vulnerability} = \text{Exposure} * \text{Sensitivity} - \text{Adaptive Capacity}$$

↓ Exposure

↓ Sensitivity

↑ Adaptive capacity



Applying Vulnerability Assessment Results in Adaptation Planning

$$\text{Vulnerability} = \text{Exposure} * \text{Sensitivity} - \text{Adaptive Capacity}$$

↓ Exposure



Example: Protect resources and infrastructure from flood damage



Applying Vulnerability Assessment Results in Adaptation Planning

$$\text{Vulnerability} = \text{Exposure} * \text{Sensitivity} - \text{Adaptive Capacity}$$

↓ **Sensitivity**



Example: Reduce or eliminate invasive species that outcompete native species



Applying Vulnerability Assessment Results in Adaptation Planning

$$\text{Vulnerability} = \text{Exposure} * \text{Sensitivity} - \text{Adaptive Capacity}$$

↑ Adaptive capacity

Example: Adjust recreation timing or route of access



Adaptation Strategies



Resistance



Resilience



Response



Knowledge



Collaboration



Resistance Strategies



Prevent the effects of climate change from reaching or affecting you.

Examples:

- Increase proactive management to prevent invasive weeds
- Reduce erosion potential to protect municipal water supplies and sensitive aquatic habitats
- Identify and protect aquifer recharge zones
- Focus thinning activities in areas where fire is most likely to carry up from neighboring habitats



Resilience Strategies



Weather the impacts of climate change by avoiding the effects of or recovering from changes.

Examples:

- Remove or modify infrastructure to allow channel migration within the floodplain
- Promote native genotypes and adapted genotypes of native species
- Employ a risk-diversification approach to forest management and silvicultural practices



Response Strategies



Intentionally accommodate change and enable resources to adaptively respond to changing and new conditions.

Examples:

- Facilitate change to desired species assemblages
- Promote connected landscapes that can facilitate species migration along climatic gradients
- Identify and protect refugia
- Accept loss of recreation sites and/or adjust the timing or route of access



Knowledge Strategies



Gather more information about climate changes, impacts, or the effectiveness of management actions in addressing climate change.

Examples:

- Map water sources and aquifers to improve understanding about spatial and temporal connections between surface flows and groundwater
- Learn more about fire return intervals in subalpine habitat and the effects of fire suppression
- Research and identify regional drought-adapted ecotypes



Collaboration Strategies



Coordinate efforts and/or capacity across jurisdictional and political boundaries to create holistic approaches to adaptation.

Examples:

- Coordinate management actions across land management designations to meet mutual goals for conifer habitats
- Implement a landscape-scale monitoring program designed to increase the identification, detection, and prediction of insect and disease outbreaks
- Coordinate invasive species management, funding, and support between agencies



Why Engage in Adaptation Planning?

Adaptation planning **can help:**

- Shift the *way* you are implementing current actions
- Identify new approaches to management or new actions
- Prioritize no-regrets actions with high likelihood of success/impact
- Identify cross-resource opportunities that:
 - Accomplish objectives across a range of resources
 - Can be used to leverage funding, partnerships, etc.



Key Considerations

Context

- Focus on what you manage and what you can do

Creativity

- Think outside the box!

Collaboration

- Work with traditional and non-traditional partners to develop and implement solutions

Awareness

- Be aware of unintended consequences/impacts on other sectors and resources

Flexibility

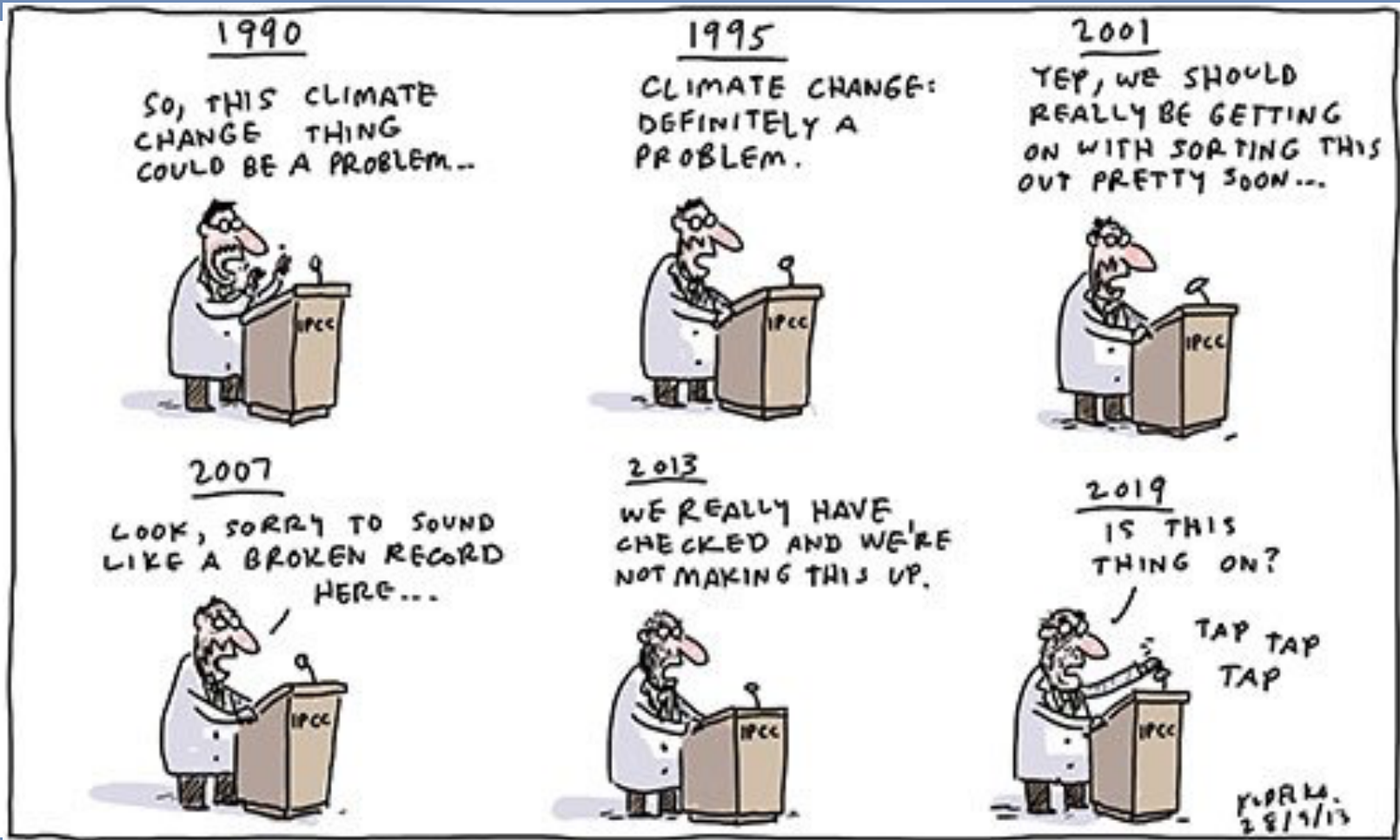
- Embrace flexibility to make changes as needed

Planning Horizon

- Consider short-, medium-, and long-term time frames within a portfolio of adaptation strategies



Questions?



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