Unit 2: Presentation 6

Adaptive Capacity

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Session Goals

- Review the concept of adaptive capacity
- Introduce roots of concept and its applications
- Understand factors affecting adaptive capacity
- Recognizing adaptive capacity and its limits

Definitions

- "…the ability of a system to adjust to climate change (including climate variability and extremes) to moderate potential damages, to take advantage of opportunities, or to cope with the consequences."

  » IPCC 2007

- "Coping range" or "coping capacity"
  - Ability for a system to reconfigure without significant declines in crucial functions

Social System Applications

- Rooted in biological/ecological concept of "adaptability"
- Embraced in assessing vulnerability and adaptation of social/human systems
- Key adaptive capacity attributes in social systems include:
  - Health
  - Literacy
  - Governance
  - Economic wealth

Resilience and Adaptive Capacity

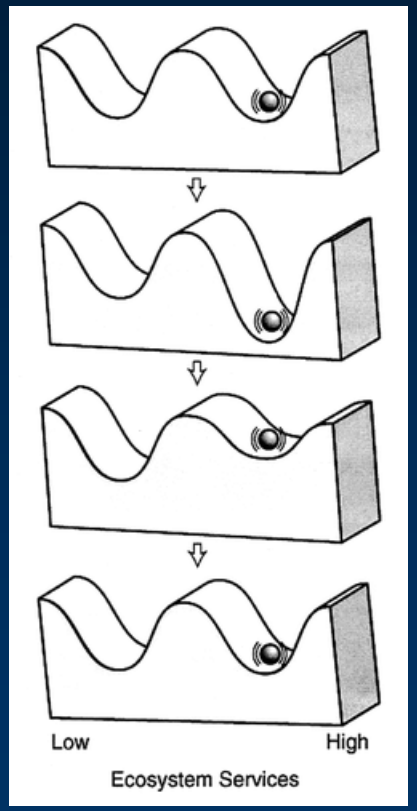
- Resilience
  - often regarded as the capacity to return to a prior functional state after disturbance
  - “temporary” change
- Adaptive Capacity
  - retain functionality during a shift
  - “directional” change
  - adjust to a new “normal”

"the capacity for self-renewal"

-- Aldo Leopold

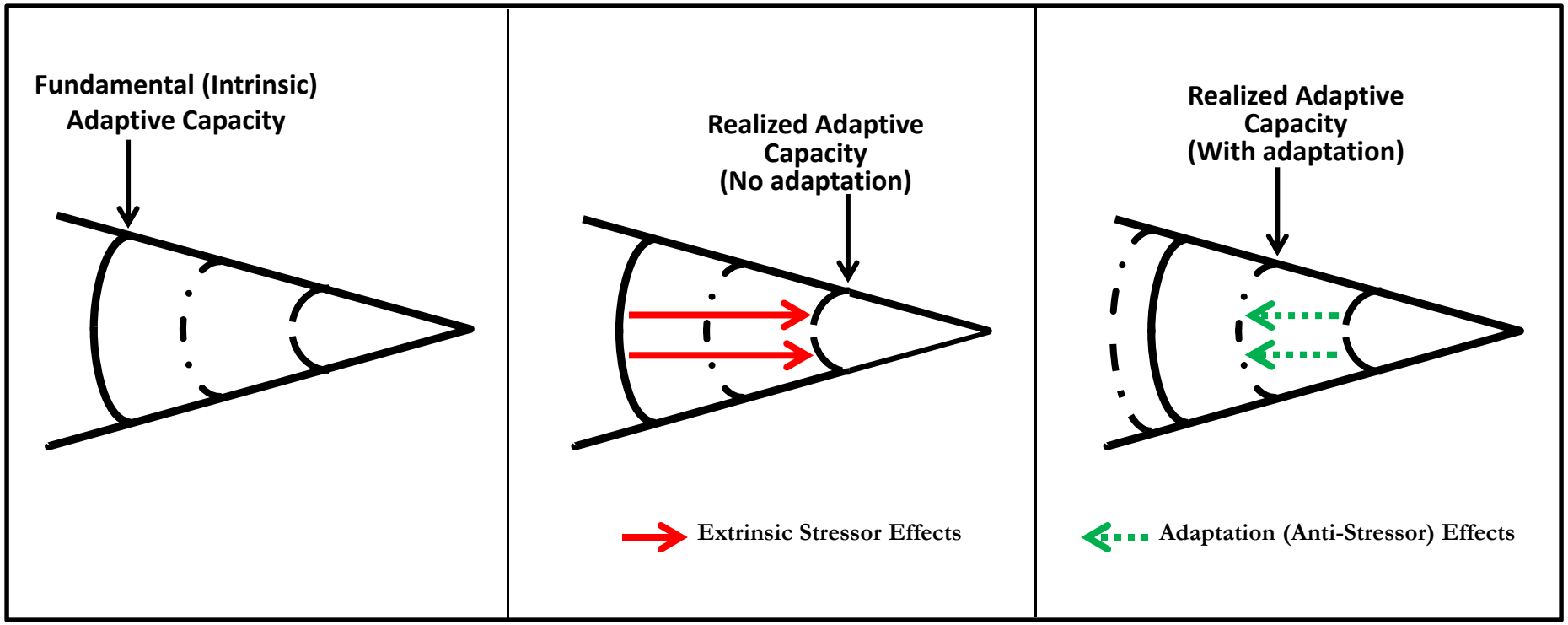
Ecological Thresholds

- Ecological regimes often described using “ball and cup” metaphor
- Peaks represent thresholds between alternate states
- Thresholds can be thought of as conditions that exceed a system’s adaptive capacity



From Carpenter & Gunderson 2001

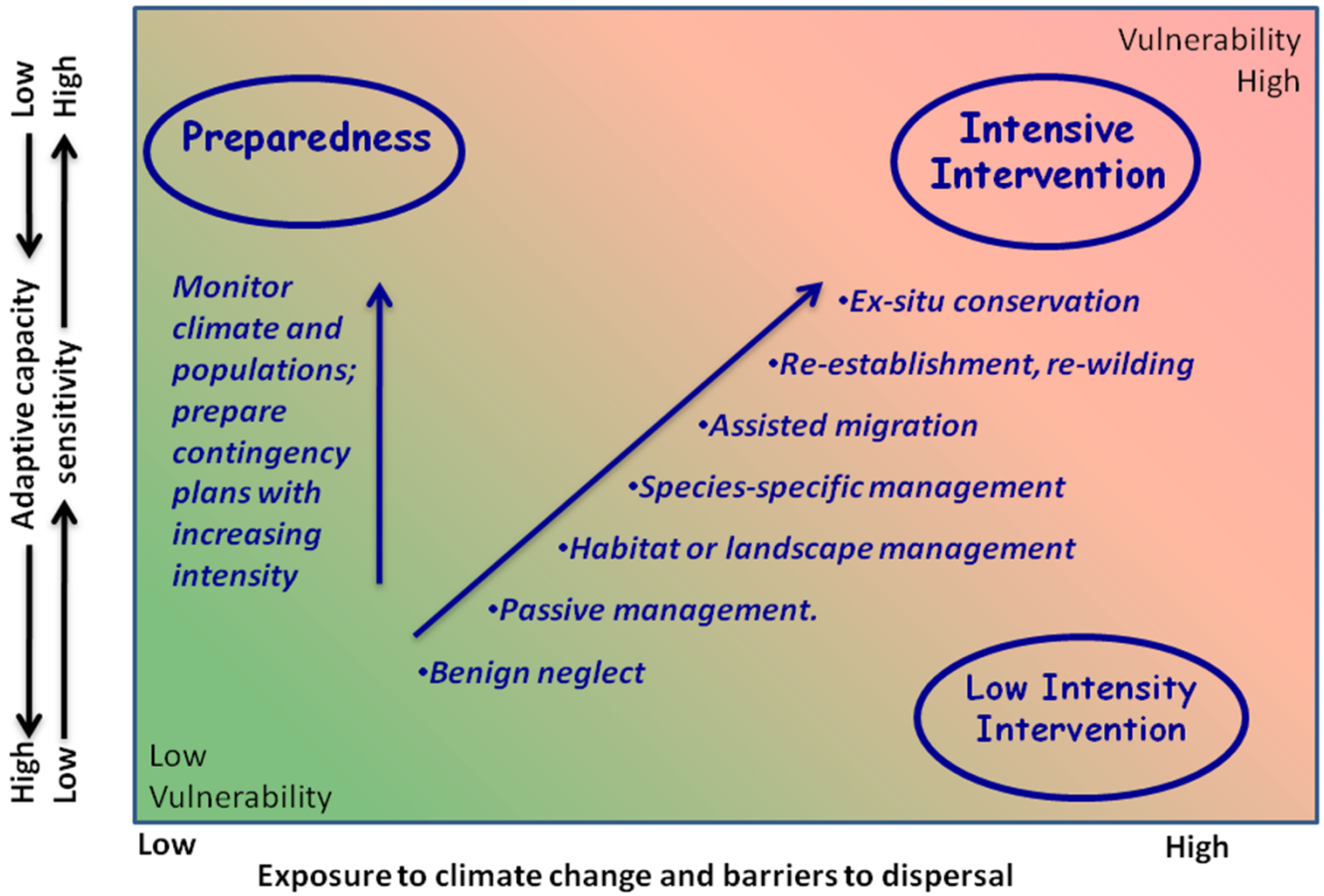
Fundamental vs. Realized Adaptive Capacity



Courtesy Jordan West & Susan Julius

Institutional Aspects of Adaptive Capacity

- Important to think about the adaptive capacity of institutions, not just species and ecosystems
- What is the ability of our institutions to adjust to and respond to change?
  - How prepared are our institutions to reconsider conservation goals and management objectives, and to truly put adaptive management into practice?



Source: Dawson et al. 2011

Factors Affecting Adaptive Capacity

- Genetic diversity
- Phenotypic plasticity
- Behavioral plasticity
- Dispersal ability
- Landscape permeability
- Management potential

Recognizing the Limits of Adaptive Capacity

From Zhu et al 2011 based on FIA Data

Overall Range expansion:

Offspring will have greater latitudinal extent than adults at both range limits

Northward range shift:

If a species is expanding north and retreating from southern limits: offspring will extend north of adults at northern limit and adults will extend south of offspring at southern range limit

Overall range contraction:

offspring have less latitudinal extent than adults

Southern range shift:

adults extend north of offspring at northern range limit offspring extend south of adults at southern range limit

Caution!

From Rushing and Primack 2008

Black birch/grey birch flowering

2.83 days earlier for each degree C for black birch and no relationship for grey birch

Rough stemmed goldenrod/ lance leaved goldenrod flowering

11.7 days earlier for rough stemmed goldenrod and no relationship and no relationship for lance leaved or most other goldenrod species