

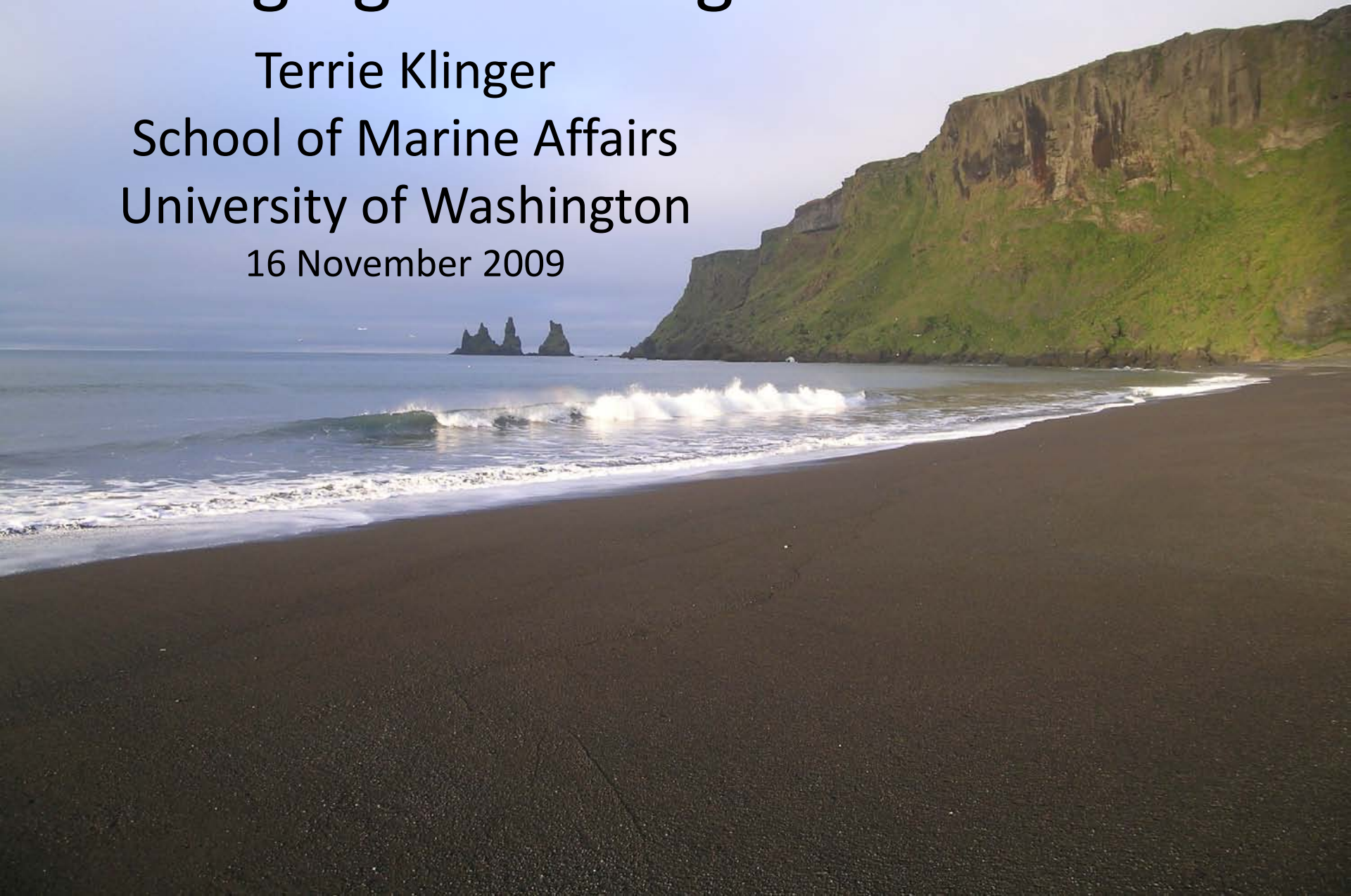
Managing for Change

Terrie Klinger

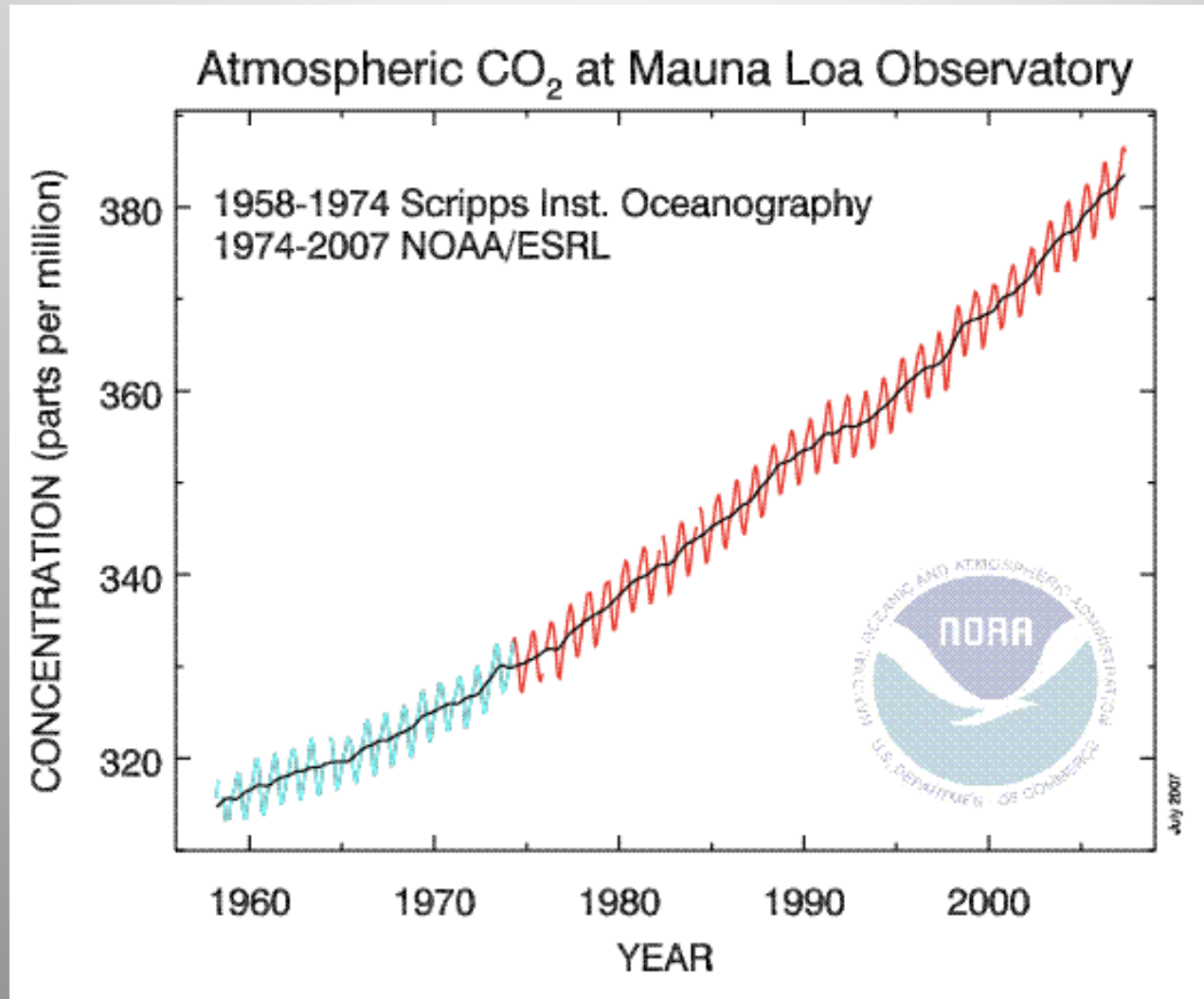
School of Marine Affairs

University of Washington

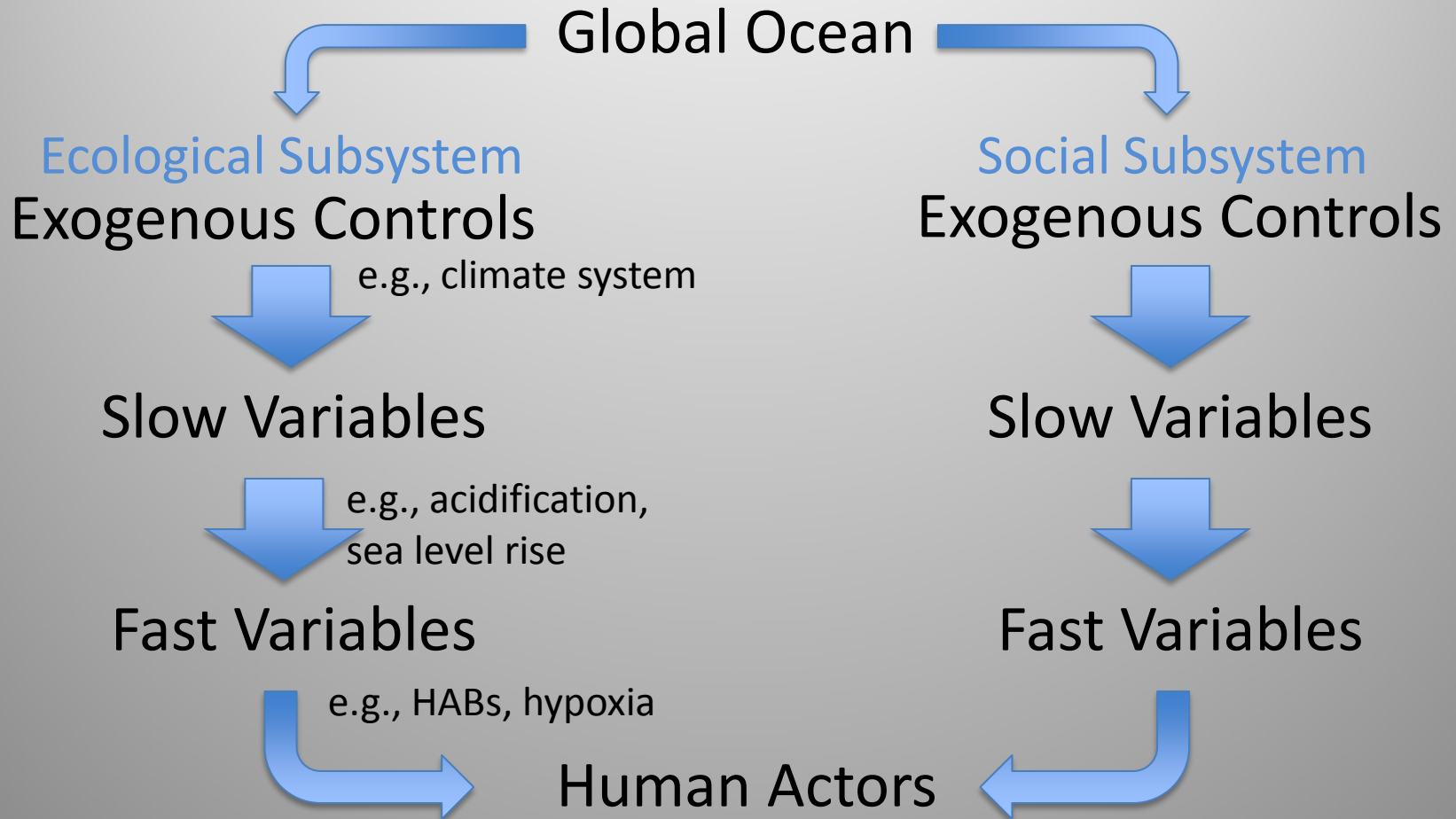
16 November 2009



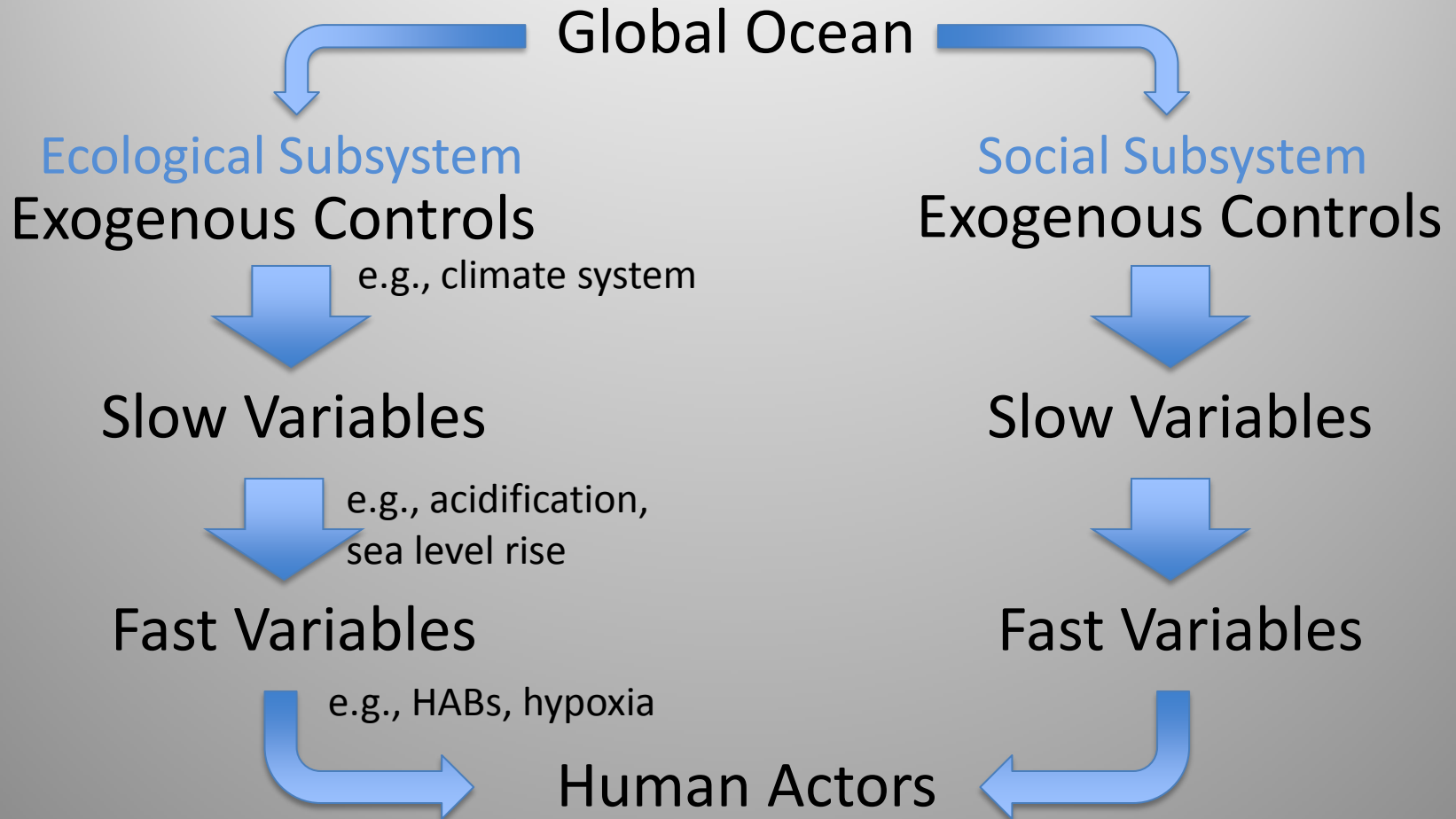
The atmosphere and oceans are changing



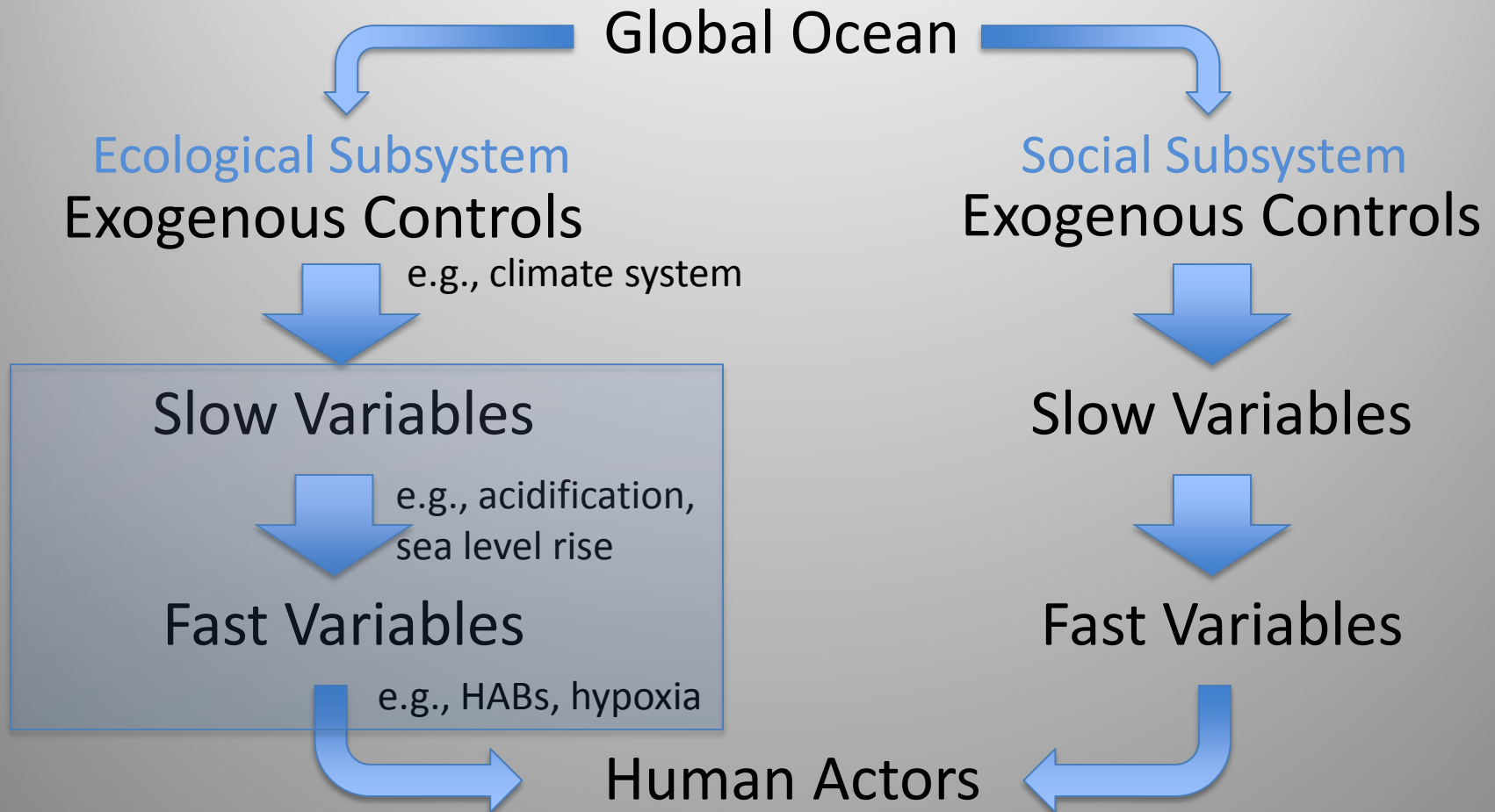
Social-Ecological Systems Will Interact with Changes in Atmosphere and Oceans



Complex Dynamics Create Uncertainties In Ecological Response



Response Diversity Buffers Disturbance and Contributes to Resilience



Response Diversity:

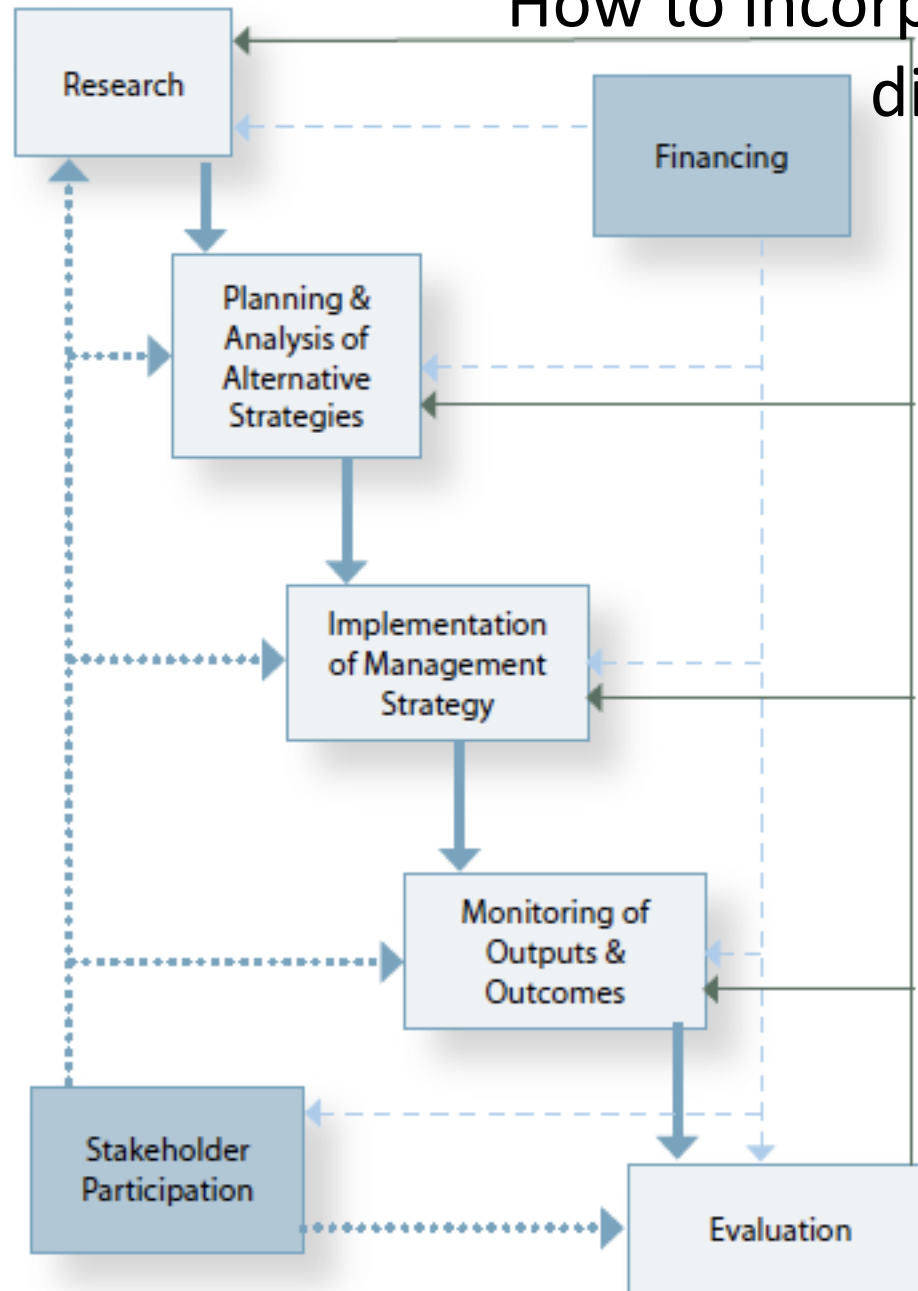
Range of reactions to environmental change among species contributing to the same ecosystem function (Elmqvist et al. 2003)

Provides 'natural insurance capital' (Folke et al. 1996)

Functional diversity promotes response diversity

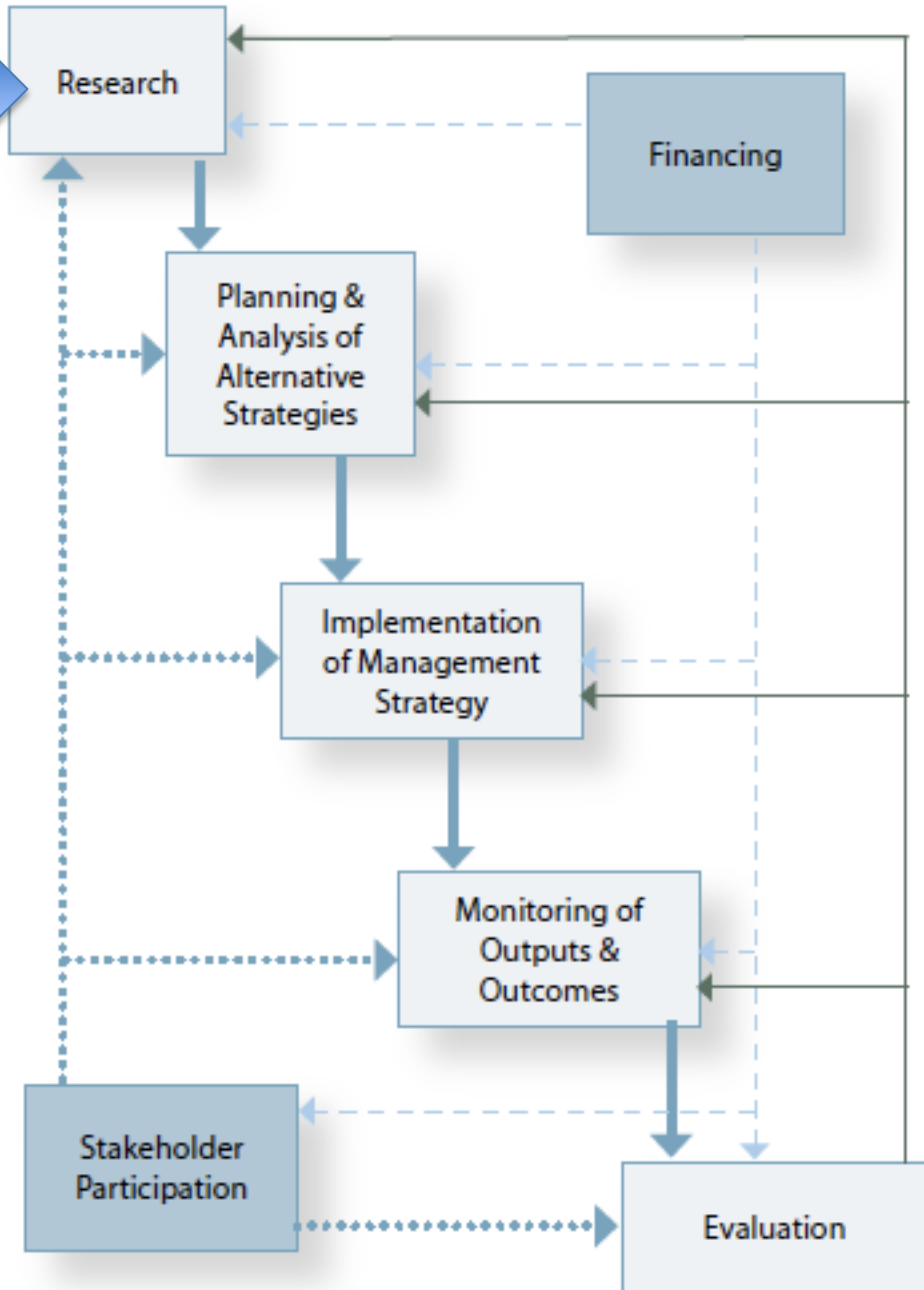
Response diversity helps maintain resilience

How to incorporate response diversity in MSP?

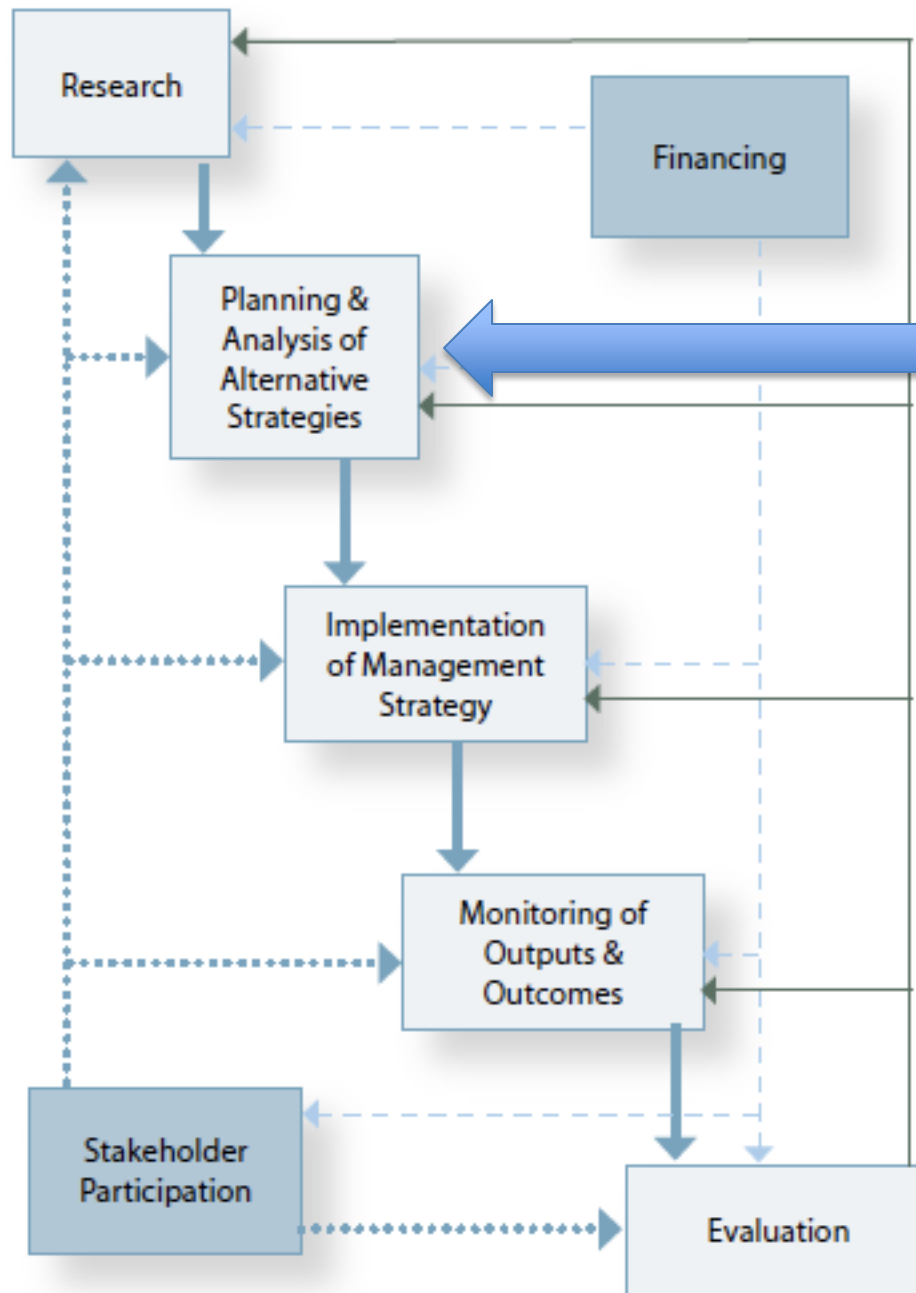


Source: Ehler and Douverem UNESCO, 2007

include
research and
modeling of
environmental
change

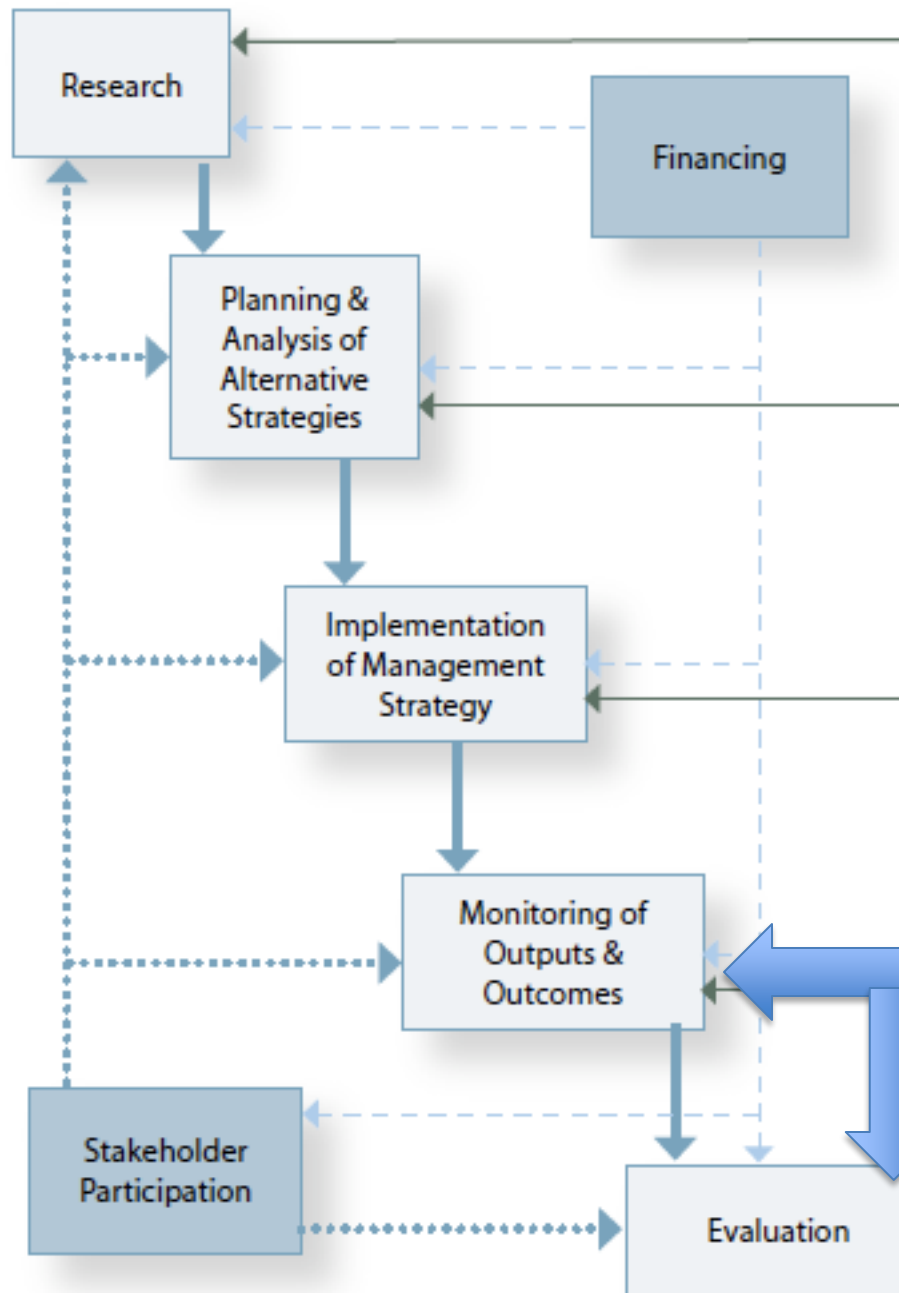


Source: Ehler and Douverem UNESCO, 2007



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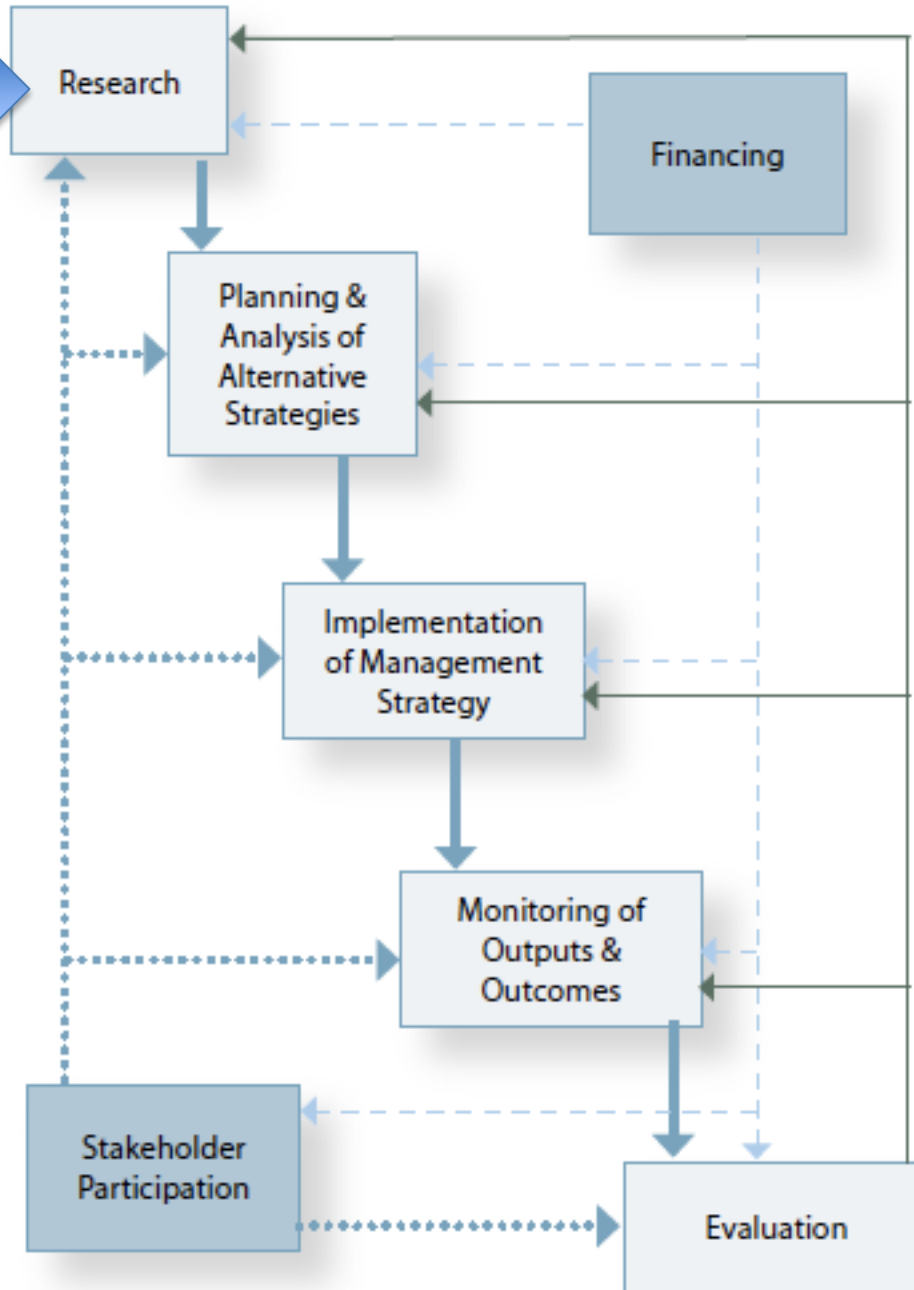
explicitly
incorporate
potential for
response to
environmental
change



Source: Ehler and Douverem UNESCO, 2007

adapt strategies as change occurs

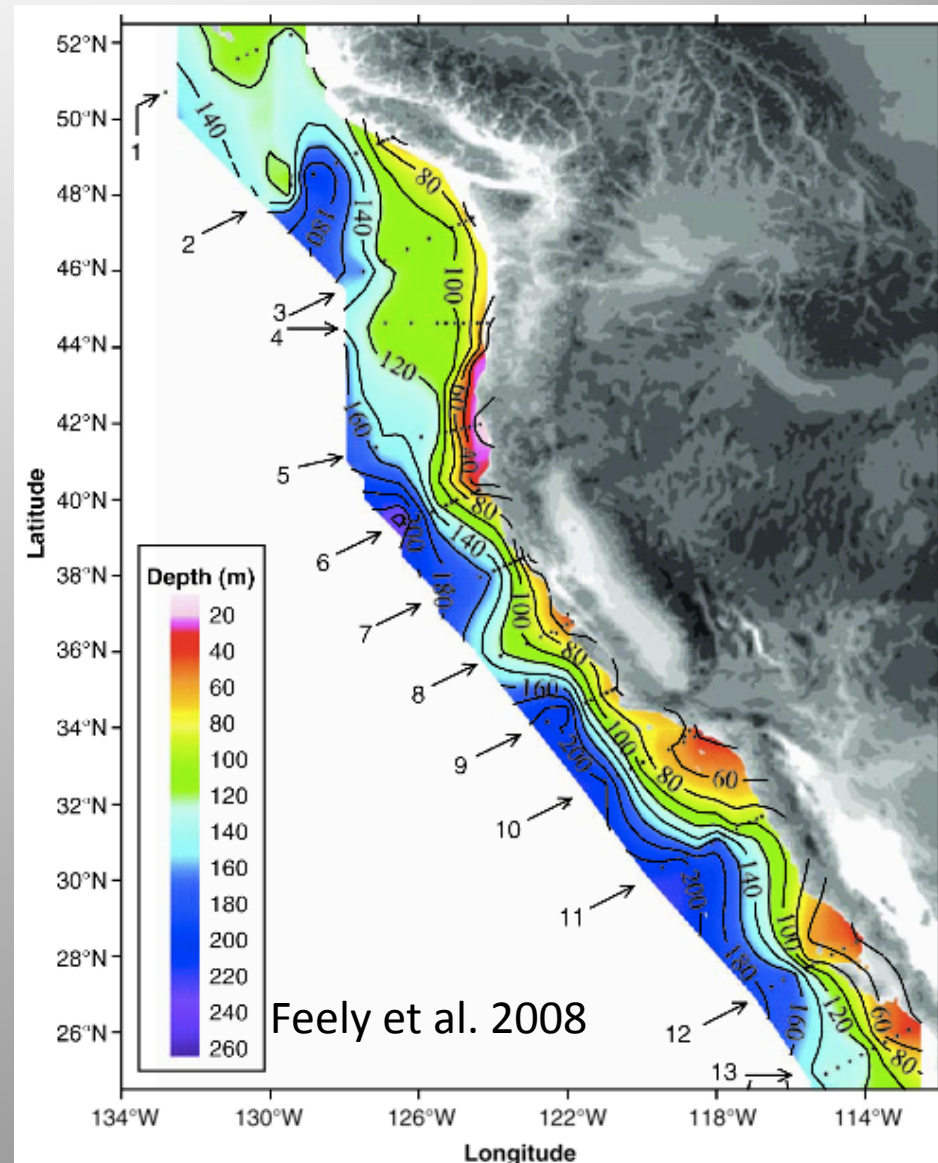
continue
research and
modeling of
environmental
change



Source: Ehler and Douverem UNESCO, 2007

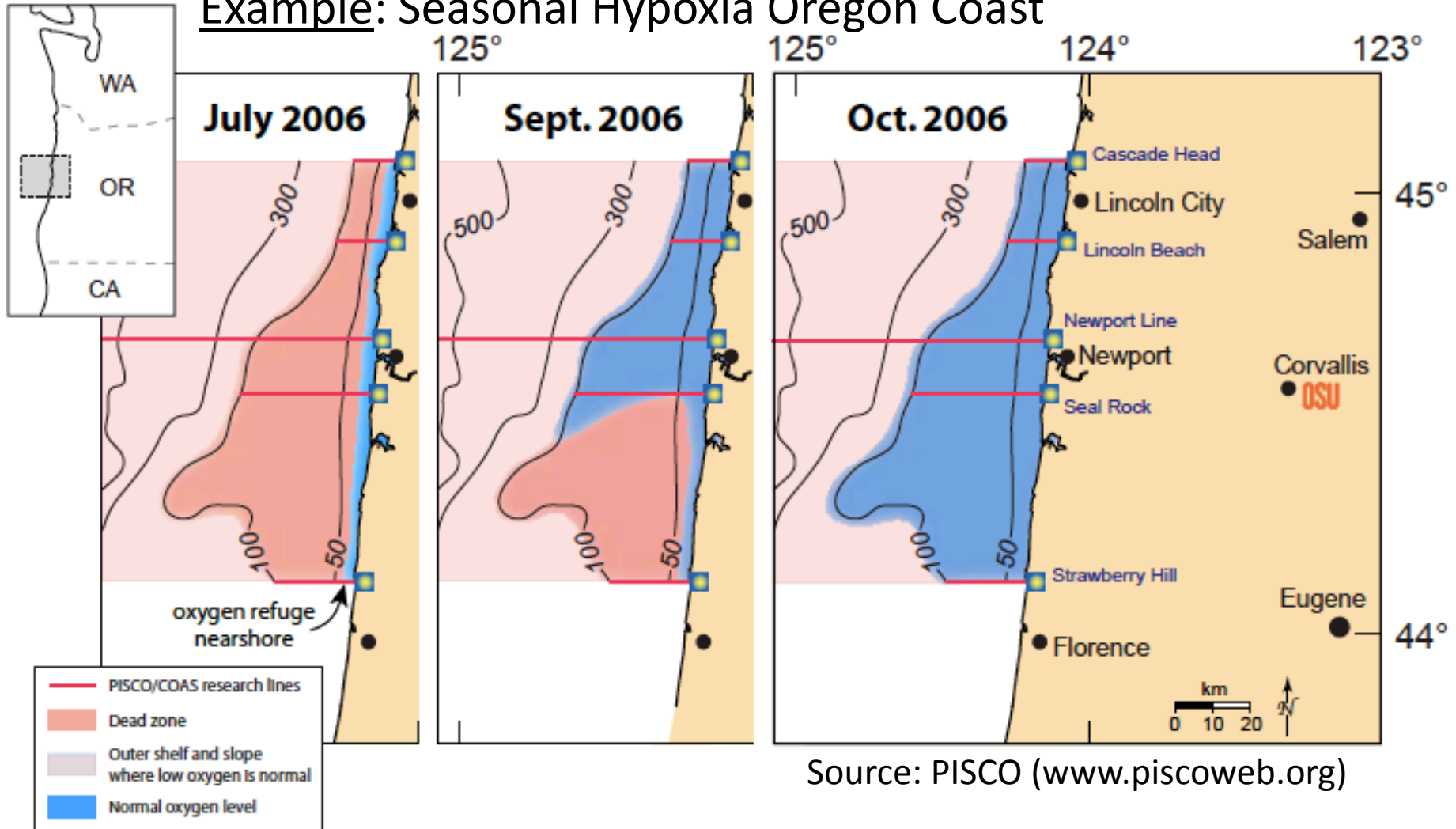
Environmental Changes Have Spatial Dimension that can be addressed via MSP

Example:
seasonal upwelling
of corrosive water
onto continental shelf

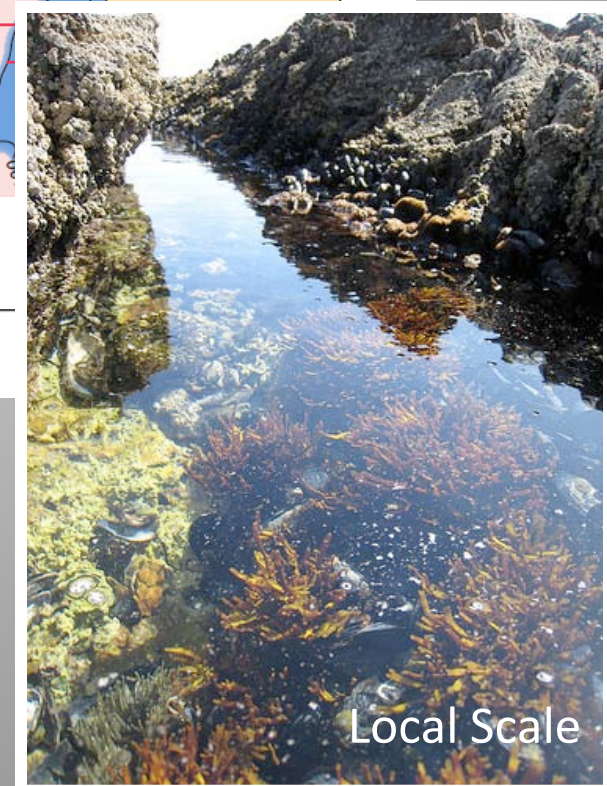
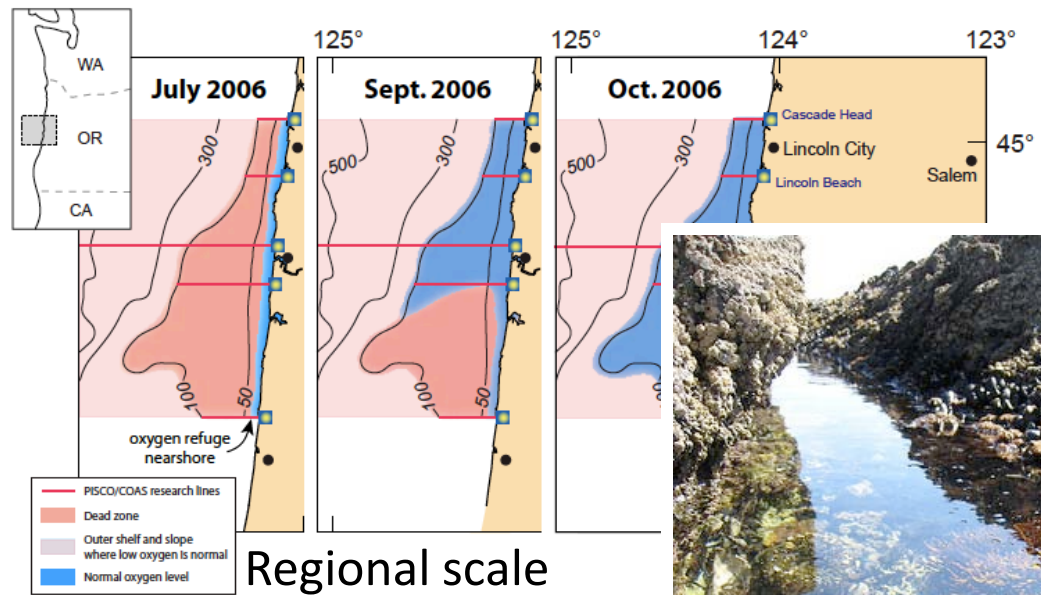
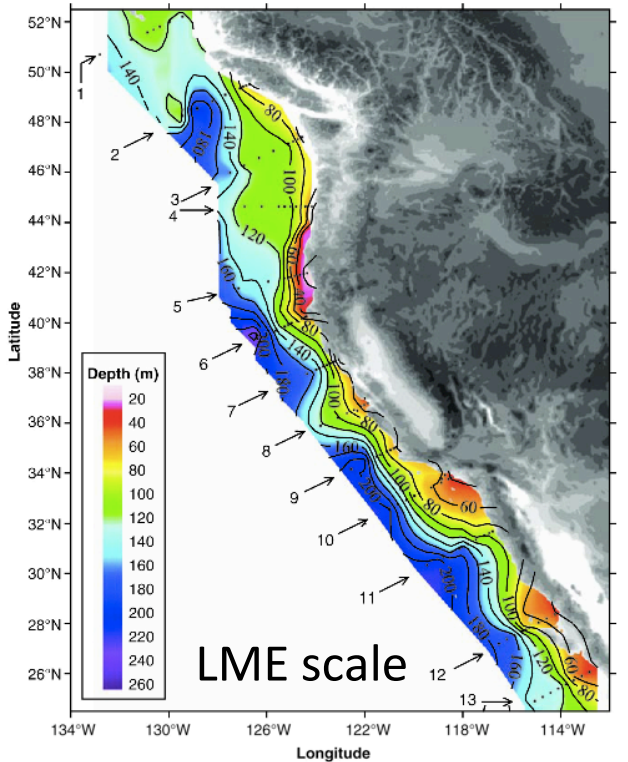


Environmental Changes Have Spatial Dimension that can be addressed via MSP

Example: Seasonal Hypoxia Oregon Coast



Nested Scales of Management Required



Maintain Response Diversity through MSP

- Goals and objectives must explicitly include capacity for social-ecological response to environmental change
- Human uses cannot be so intense that they constrain response diversity or foreclose options for ecosystem recovery
- Management scales should match or approach ecological scales in space and time

Maintain Response Diversity through MSP

- Larger management areas will allow greater response diversity
 - Use nested spatial scales
 - Use modules, or discrete scalable entities
- Explicitly consider both fast and slow variables
 - fast variables: HABs, hypoxia, etc.
 - slow variables: OA, sea level rise, etc.
- Maintain social-ecological processes, not end-points

Acknowledgements

Washington Sea Grant College Program

UW School of Marine Affairs

