

Adaptation Science: Where to from Here?

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Fuenfgeld, Lauren Rickards



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Climate Change Science Institute

Advancing the Knowledge of Climate Change and Understanding its Consequences

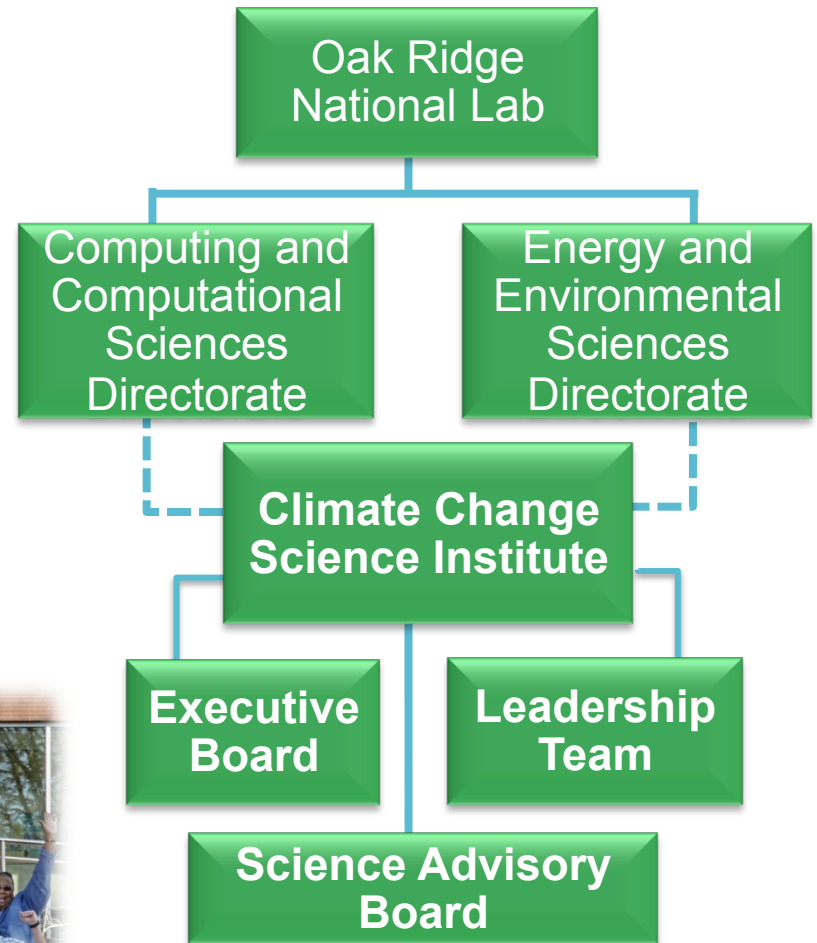
History

- Formed in 2009 to integrate ORNL's climate research programs
- 130 collocated computational scientists, modelers, ecosystem field researchers, and data specialists

Mission

- Advance understanding of the Earth system
- Describe the consequences of climate change
- Evaluate and inform policy on climate change responses

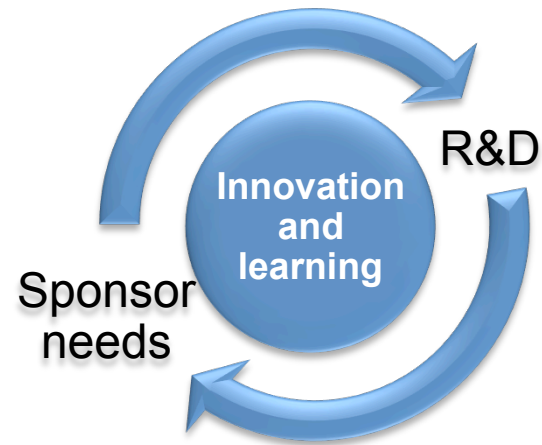
Virtual Organization Spanning Laboratory Directorates



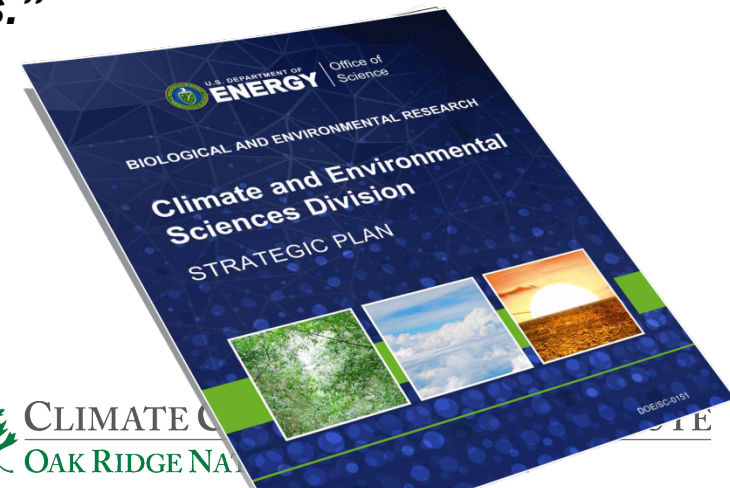
CCSI: Science for society

Mission-oriented research

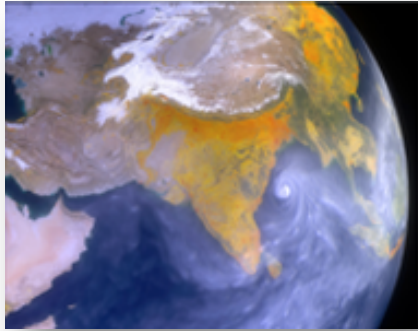
- U.S. Department of Energy
- U.S. Department of Homeland Security
- U.S. Department of Agriculture
- U.S. Geologic Survey
- National Aeronautics and Space Administration
- National Geospatial Intelligence Agency
- National Oceanographic and Atmospheric Administration
- National Science Foundation



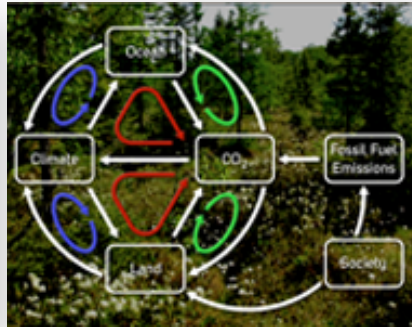
“To advance a robust predictive understanding of Earth’s climate and environmental systems and to inform the development of sustainable solutions to the Nation’s energy and environmental challenges.”



CCSI's scientific themes



Earth System Modeling



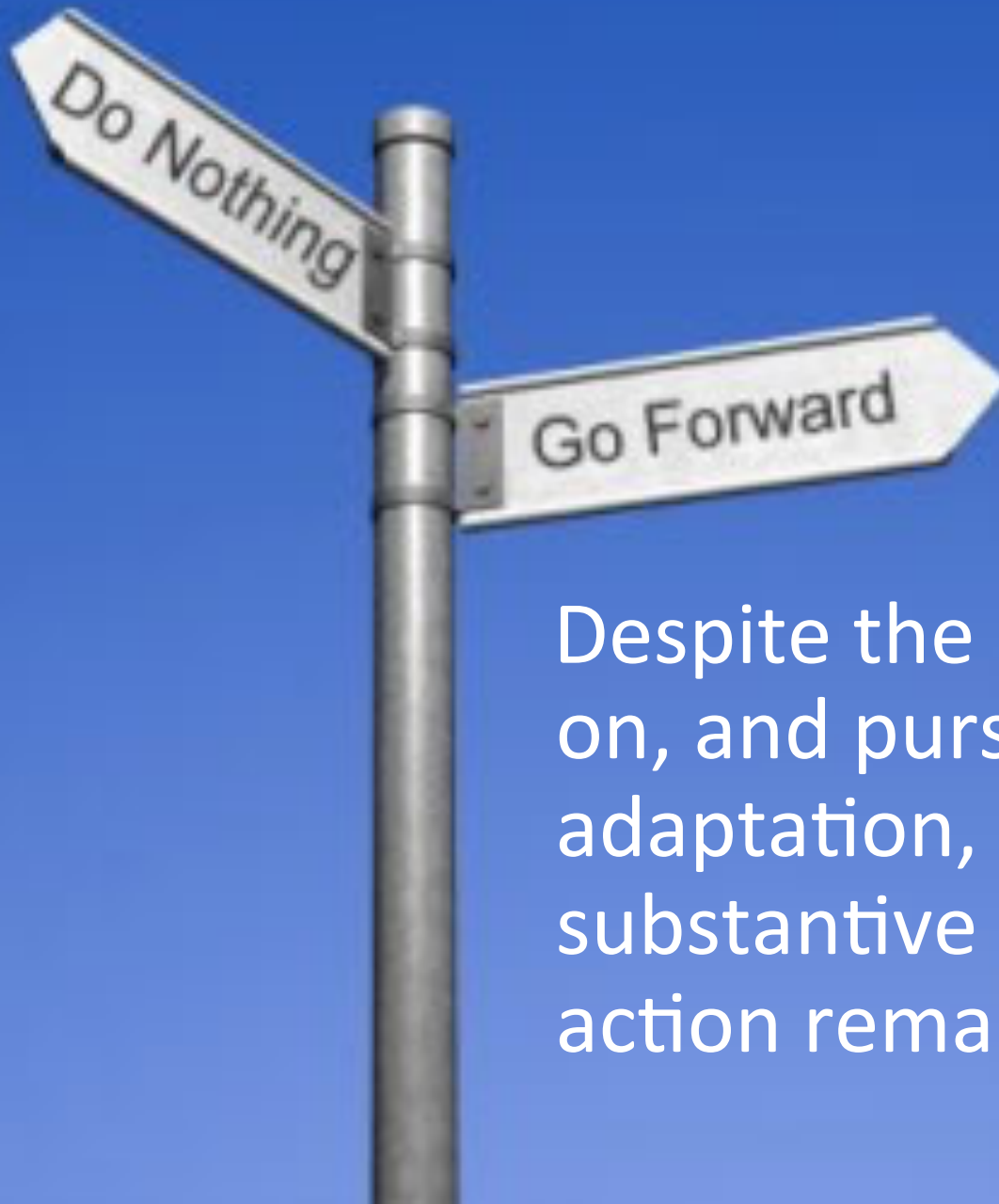
Terrestrial Ecosystem and Carbon Cycle Science



Data Integration, Dissemination and Informatics



Impacts, Adaptation, and Vulnerability Science



Despite the increased focus on, and pursuit of, adaptation, evidence for substantive adaptation action remains weak

Once upon a time. . .

- Climate adaptation was considered the “easy way out”

“[Adaptation is a] kind of laziness, an arrogant faith in our ability to react in time to save our skins”

Al Gore (1992)

“Should we try to prevent the one possible risk of global warming? Or should we try to become smarter and wealthier so that we can adapt ourselves to whatever risks occur, whether it be warming or cooling, or drier or hotter, or maybe an asteroid or a disease, or many other risks that the world will certainly face in the 21st Century?”

Fred Smith, President, Competitive Enterprise Institute (1997)

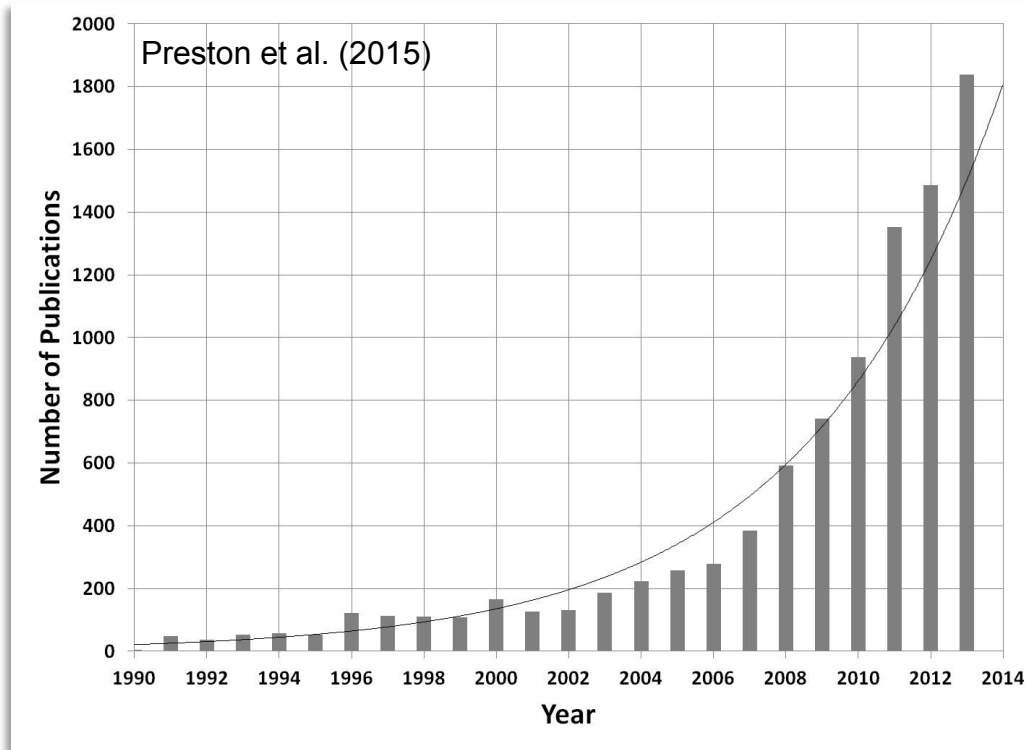
“I think that adaptation, except in the more trivial ways, is a very dangerous route to go down ... I see adaptation, if we take it too far, as really a form of genocide. We’ll be all right, but there’s a lot of people who won’t be all right.”

Tim Flannery (2006)

Adaptation has rapidly evolved into an active research domain

- Adaptation Science is *“research that generates knowledge that can inform adaptation and its implementation”* (Preston et al., 2014)

Climate Adaptation in the Peer-Reviewed Literature



Annual number of peer-reviewed publications with the topical words “climate” and “adaptation”. Source: Web of Science

What is adaptation science?

- Earth system modeling
- Hydrology
- Ag/forestry sciences
- Coastal management
- Economics
- Public Health
- Psychology
- Governance
- Monitoring & evaluation
- Decision analysis
- Transition science
- Action research
- Communications

Australian institutions for adaptation science



Australian Government

The Pacific
climate change
Science Program



IOCI

Indian Ocean Climate Initiative



South Eastern Australian
Climate initiative



Victoria
The Place To Be



Australian Government
Bureau of Meteorology

National Research
FLAGSHIPS
Climate Adaptation



CSIRO

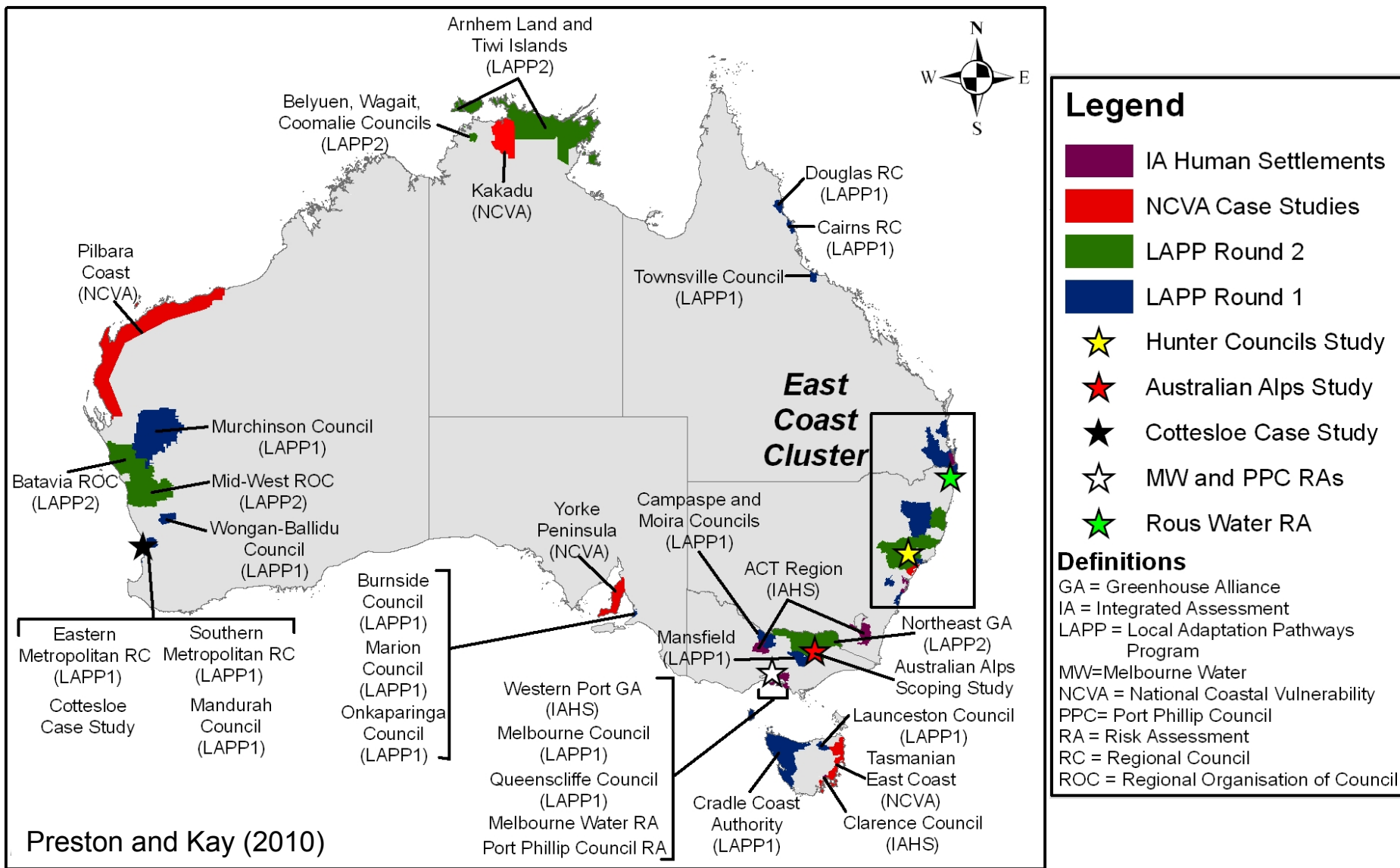


NCCARF
National
Climate Change Adaptation
Research Facility



The Australian
climate change
Science Program

Adaptation assessment activity (2005-2009)



Adaptation research orientations

See Preston et al. (2013,2015), Swart and Biesbroek (2014)



Climate adaptation research is expanding rapidly within an increasingly reflexive society where the relationship between academia and other social institutions is in a state of flux. Tensions exist between the two dominant research orientations of research about and research for adaptation. In particular, the research community is challenged to develop processes for successfully executing transdisciplinary research for adaptation when academic institutions and researchers are largely structured around traditional, disciplinary expertise and funding models. One tool for helping to manage this tension is a third, more reflexive, orientation toward adaptation research that is emerging in the literature. This new 'research on adaptation research' promises to help enhance understanding of the research enterprise itself and how it can become more adaptive.

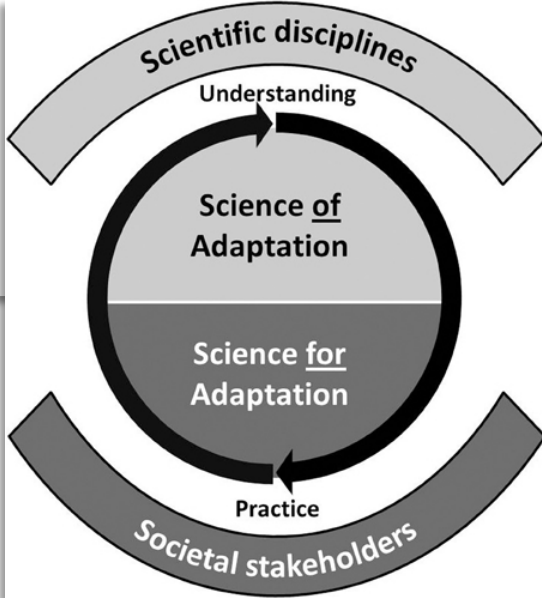
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Current Opinion in Environmental Sustainability 2015, 14:127-135
This article reviews Swart and Biesbroek's research on *Praxis*.

legal systems [3]. This contributes to a range of epistemological, methodological and practical challenges and tensions for adaptation researcher and researchers. Such tensions arise from the multiple orientations of adaptation research, at least two of which are now well-documented in the literature [1,2,4]. The first is research about adaptation, which emphasizes fundamental understanding of adaptation processes in human and natural systems, without necessarily seeking to inform or facilitate a particular adaptation response. The second is research for adaptation, which is more applied in nature as it attempts to generate knowledge that identifies adaptation options, supports adaptation planning, and guides implementation processes. These two different orientations reflect fundamentally different perspectives with respect to the function of adaptation research within society [4-6].

Left to co-exist as parallel endeavors, these two orientations lead to tensions that adaptation researchers must negotiate. These can be explored in the context of Cash *et al.*'s three oft-cited knowledge criteria for linking science to policy: salience, credibility, and legitimacy [7]. Researchers must select their preference for research about versus for adaptation, which ultimately is a preference regarding the balance between credibility (directing effort toward the development of fundamental knowledge and academic indicators of merit) and relevance (directing effort at generating observable societal bene-



Swart and Biesbroek (2014)

1) Research for adaptation

“attempts to generate knowledge that identifies adaptation options, supports adaptation planning, and guides implementation processes”

2) Research on adaptation

“fundamental understanding of adaptation processes in human and natural systems, without necessarily seeking to inform or facilitate a particular adaptation response”

3) Reflexive research

“development of a research enterprise that is responsive to learning and critically reflective of not only what a researcher is doing, but, . . . why, how, and to what effect”

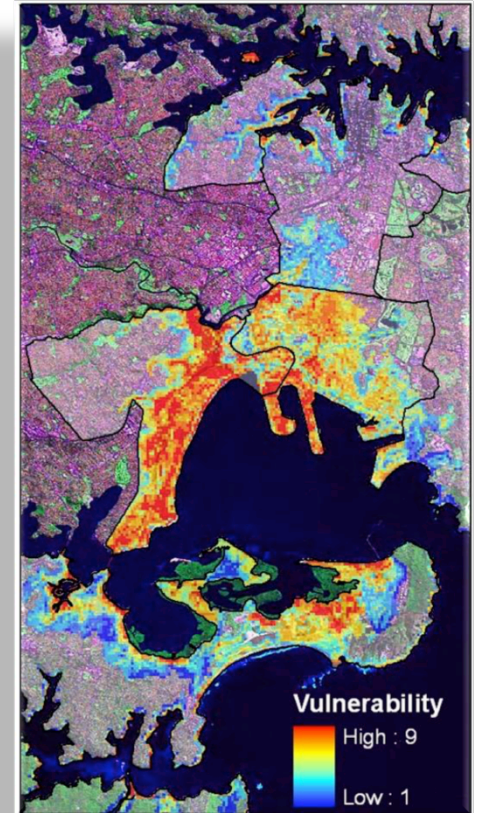
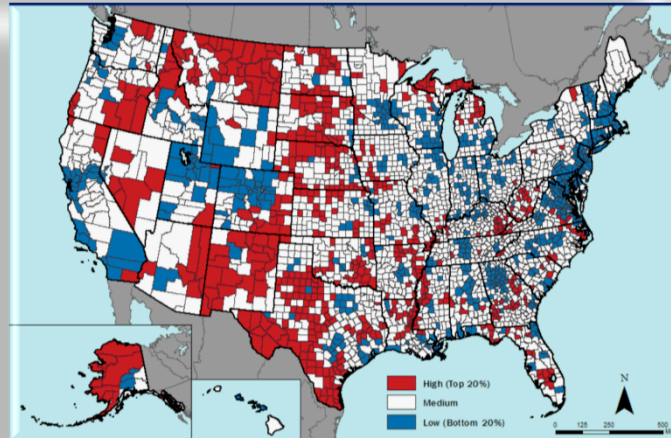
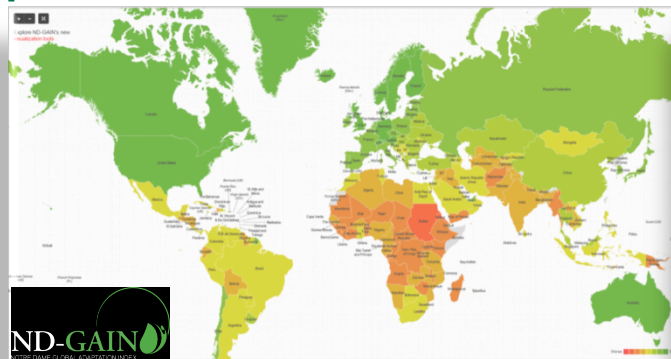
Research for adaptation

- Research for adaptation is based on the worthy goal of enhancing societal awareness and helping society make challenging decisions
 - Practice-oriented
 - Results-oriented
 - Interdisciplinary to transdisciplinary

Specificity, Data Availability, Validation?

“the mapping of climate change vulnerability is a popular analysis approach that enables the representation of local context within vulnerability assessment”

Preston et al. (2011)

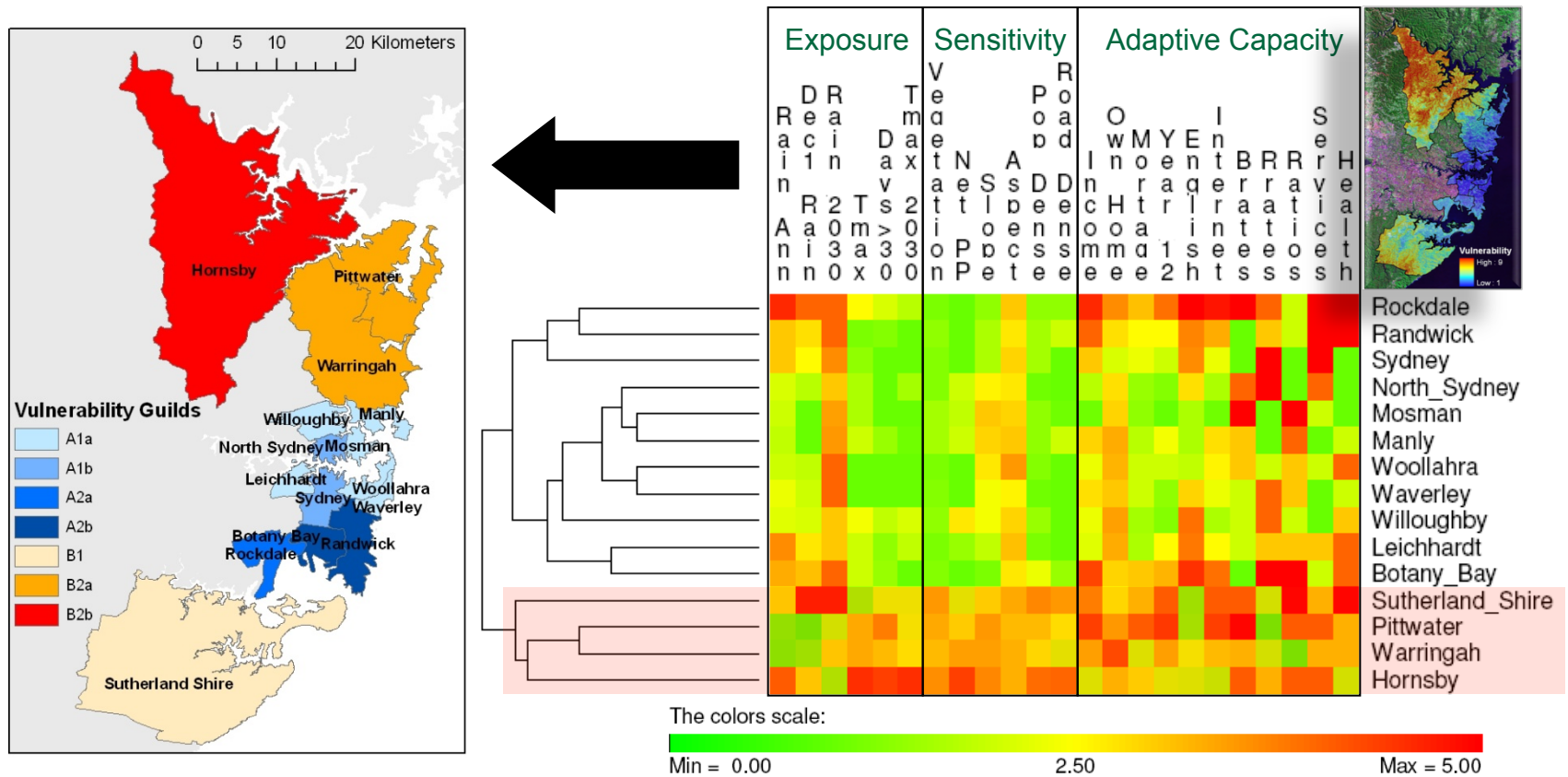


So why map vulnerability?

- **Although somewhat of a ‘dark art’, we should not discount the value of visualization or the need to understand harm**
- **Vulnerability maps can play a valuable role in engaging with adaptation actors** (Preston et al., 2009; 2011)
 - Enhancing relevance of vulnerability assessment
 - Serving as ‘boundary objects’ for discussion and social learning (Lynch et al., 2008; Yuen et al., 2012)
 - Revealing potential barriers to adaptation
- **But, as a basis for decision-support, there is a need for more robust practice** (Preston et al., 2011)
 - Greater specificity of ‘vulnerability of what’ and ‘vulnerability to what’ at scale
 - Greater emphasis on validation, uncertainty characterization
 - Expanded role for participatory assessment and mapping
 - Exploration of new methods

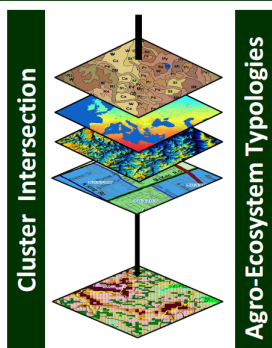
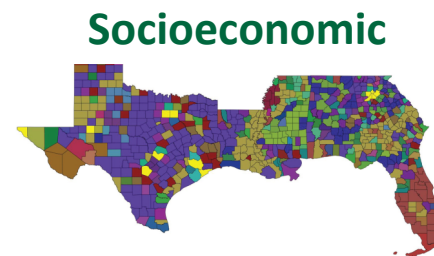
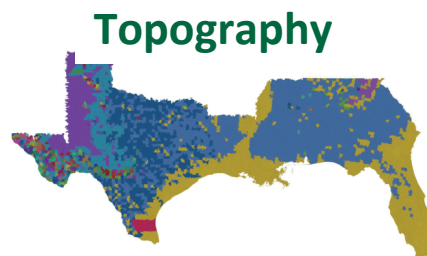
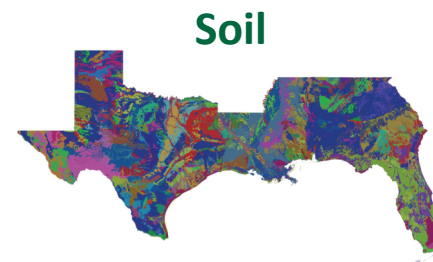
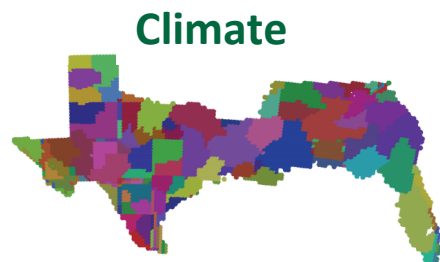
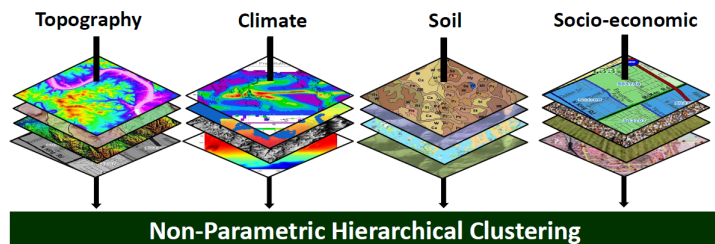
Using spatial typologies in assessment

- The label of 'vulnerable' may be less useful than understanding shared climatic and development challenges
- Other tools may be more useful for generating that understanding

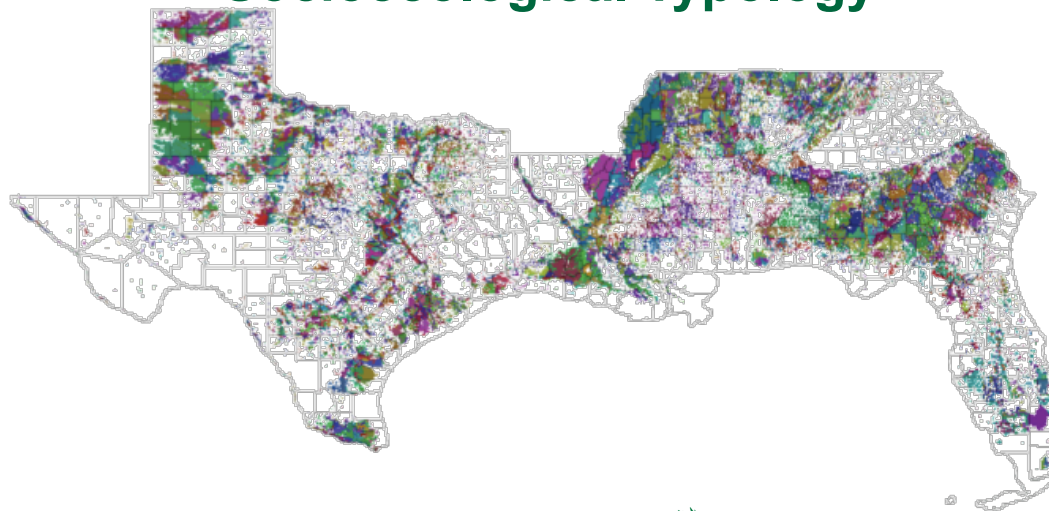


Based on Preston et al. (2008, 2009)

Constructing landscape typologies

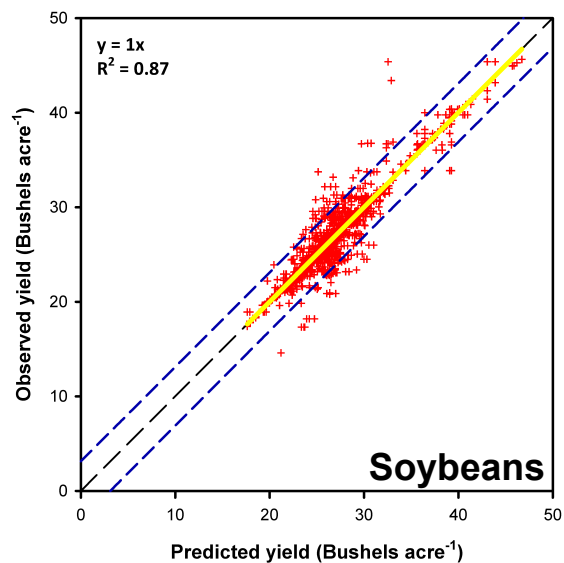
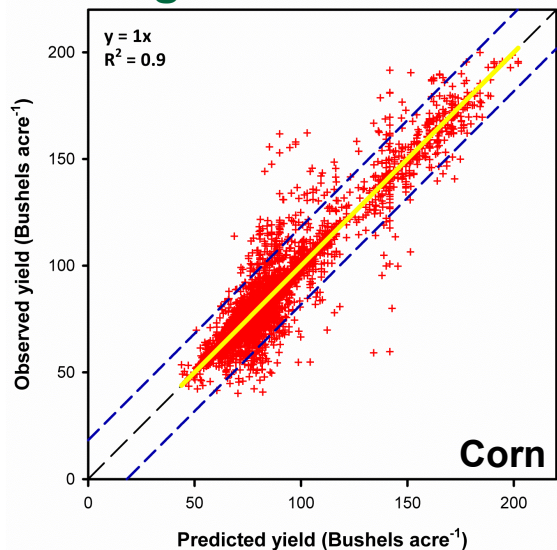


Socioecological Typology

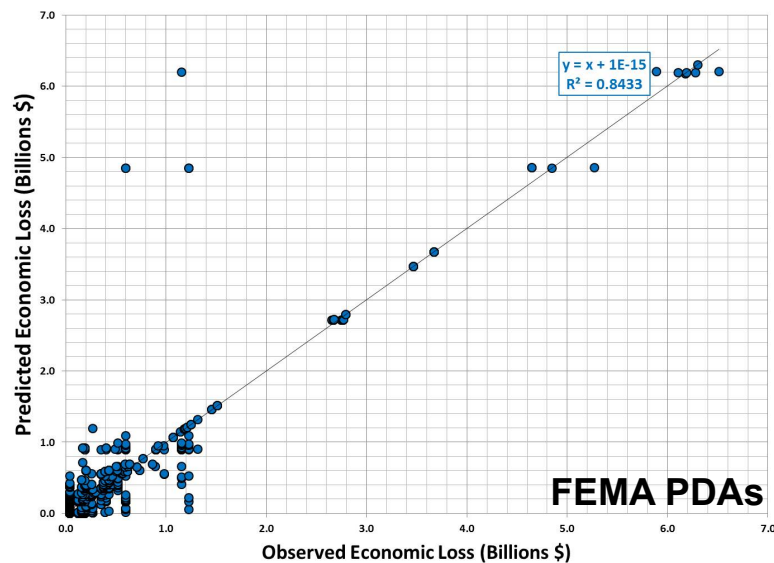
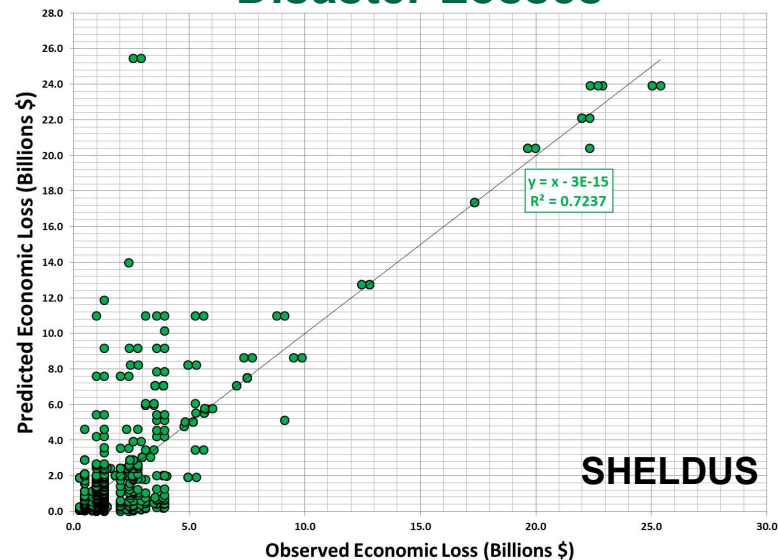


Typologies predict environmental outcomes

Agricultural Yields



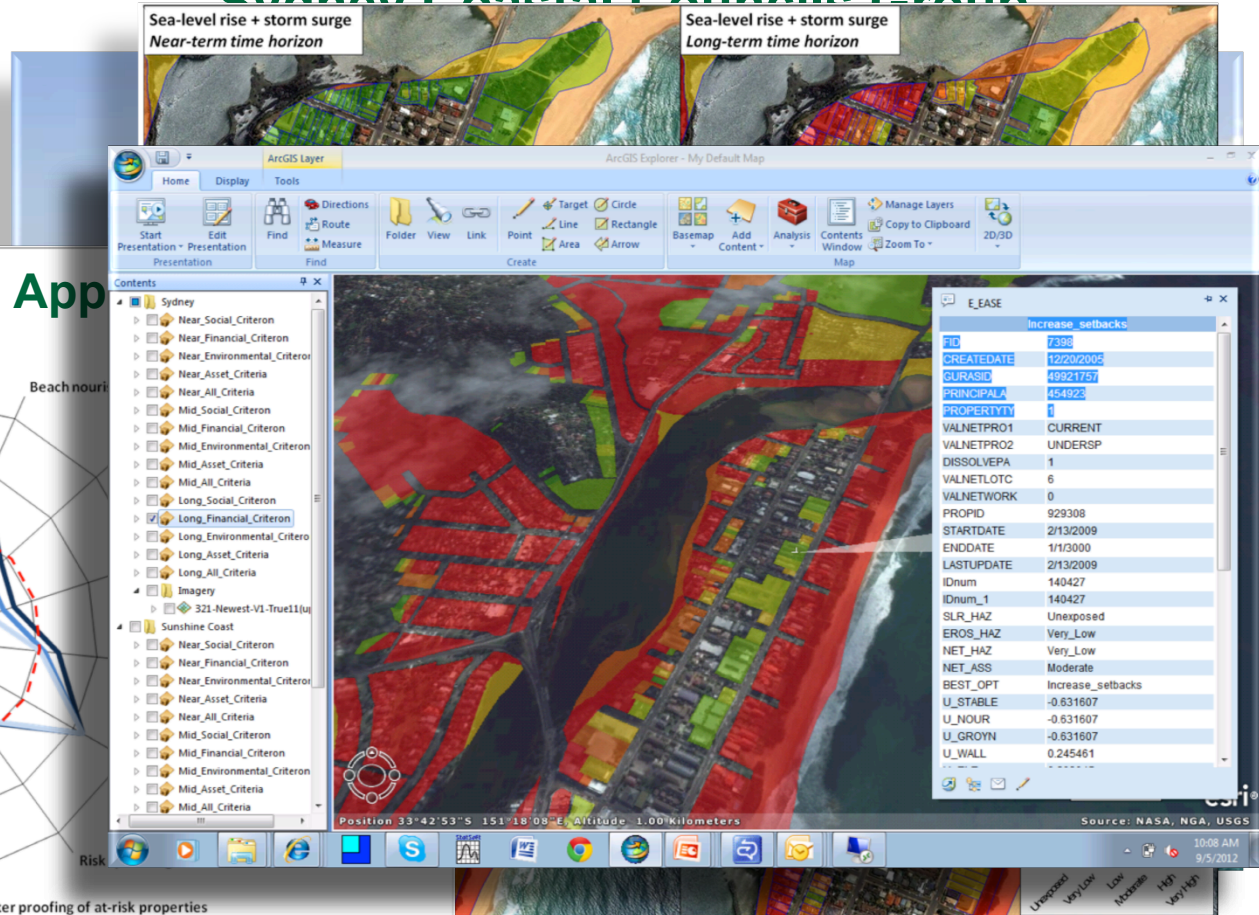
Disaster Losses



Participatory adaptation assessment

- Transdisciplinary approaches to adaptation assessment and planning are often argued to be more relevant and legitimate
 - Local knowledge
 - Local priorities
 - Direct engagement of decision-makers

Coastal Hazard Assessment, Narrabeen Beach

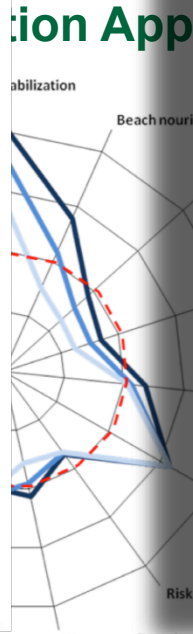


Prioritising Coastal Adaptation Development Options for Local Government

2013

A Multi-Criteria Analysis of Coastal Adaptation Options for Local Government

Coastal Adaptation Decision Pathways Project (CAP)



— Near Term (1-10 Years) — Medium Term (10-25 Years) — Long Term (>25 Years)

Is transdisciplinary research the solution?

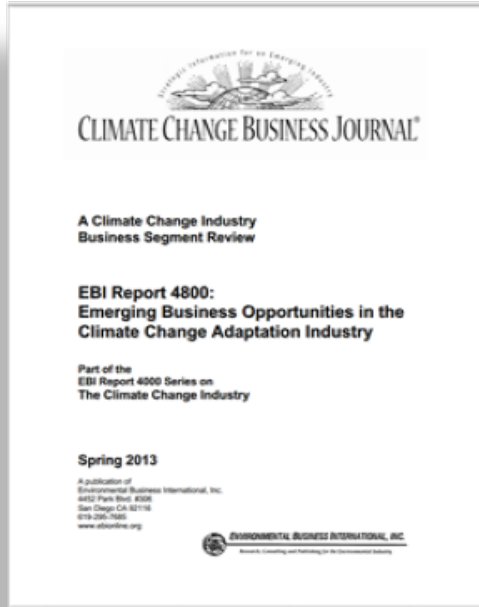
“More co-produced knowledge is often assumed to lead to more and better adaptation because of tangible connections between the research and social needs and interests. But is this really true?”

Swart and Biesbroek (2014)

- **Often, transdisciplinary research is interdisciplinary research with aspirations of utility and/or that is pushed onto stakeholders**
 - Challenges – Researcher Level
 - Researchers aren’t always great in front of an audience
 - Limited understanding of policy contexts
 - Few incentives to deliver outcomes
 - Challenges – Project Level
 - Stakeholders are often missing from the research
 - Engaging with stakeholders doesn’t necessarily lead to policy outcomes
 - Outputs have little utility in a policy environment
 - Challenges – Institutional Level
 - Academic institutions are slow to adjust to a practice-oriented world



Is research *for* adaptation really research?



- Research *for* adaptation is rapidly transitioning from a science requiring research involvement to a practice pursued by professionals
 - Private consultancies
 - Internal expertise

“adaptation will grow to a billion-dollar industry in the United States by 2015.”

EBI (2013)



ACCO defines, develops and supports the functions, resources and communities necessary for effective organizational leadership in addressing climate-related risks and opportunities.

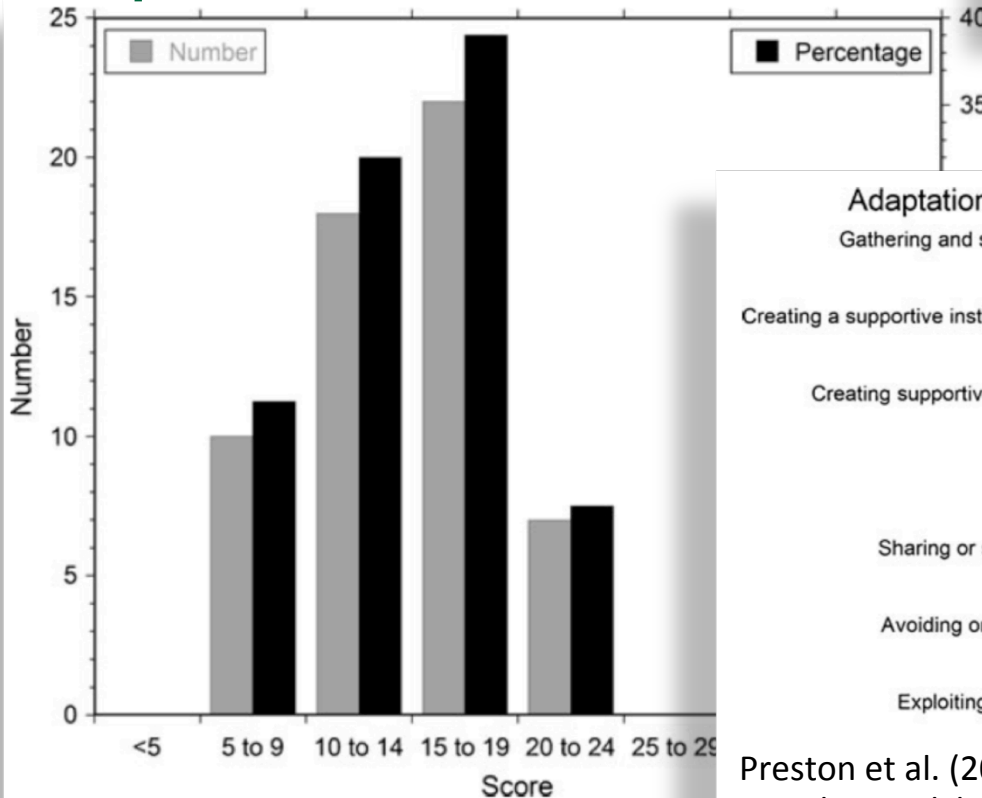
Research on adaptation

- Research on adaptation addresses questions regarding who adapts, enabling factors and constraints, and evaluation
 - Research-oriented
 - Process-oriented
 - Disciplinary to interdisciplinary

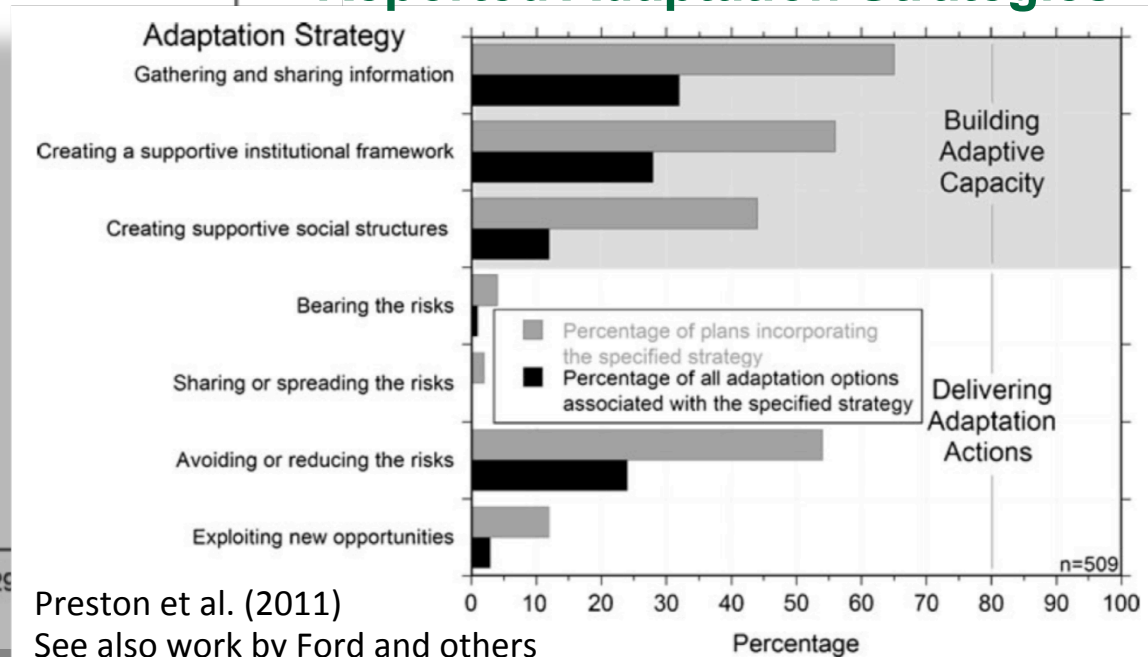
“. . .more emphasis on a science of adaptation can provide better and more informed interventions in practice.”

Swart and Biesbroek (2014)

Adaptation Plan Performance Scores



Reported Adaptation Strategies



Preston et al. (2011)

See also work by Ford and others

Constraints influence the rate and effectiveness of adaptation processes

- There is now a healthy literature on what enables or constraints adaptation action
 - Based on case studies
 - Descriptive rather than causal



16 **Adaptation Opportunities, Constraints, and Limits**

Smith et al. (2008)

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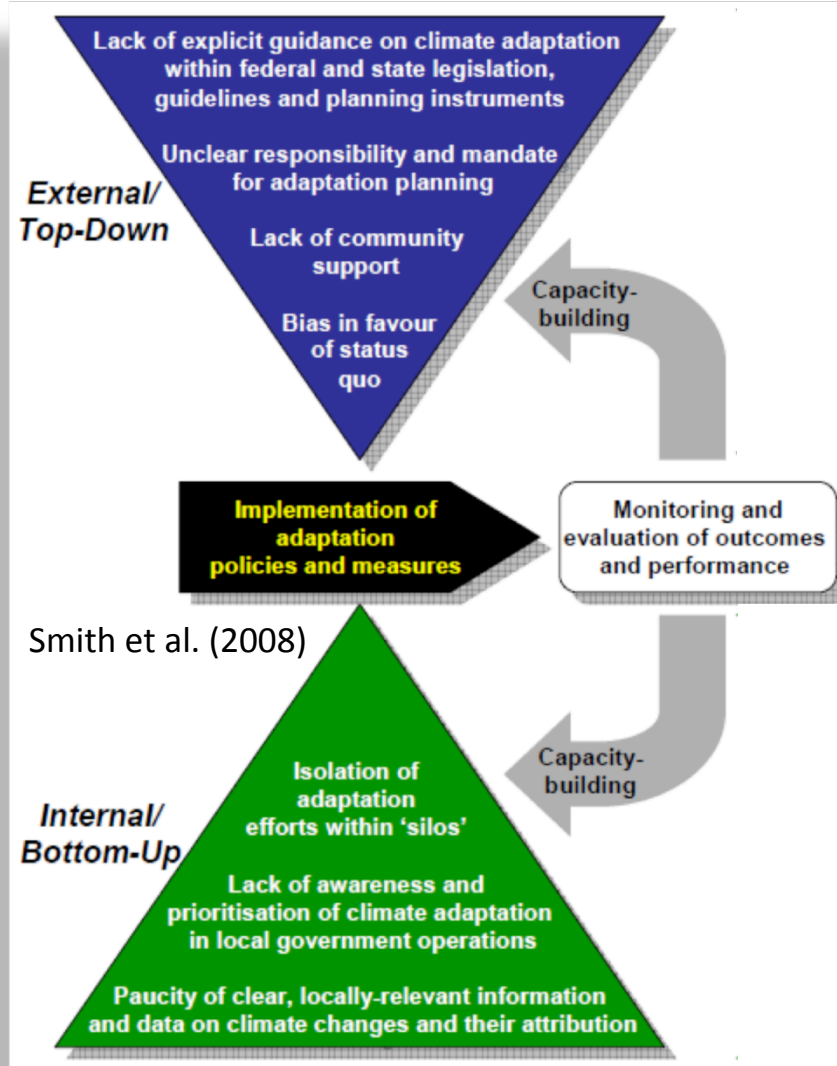
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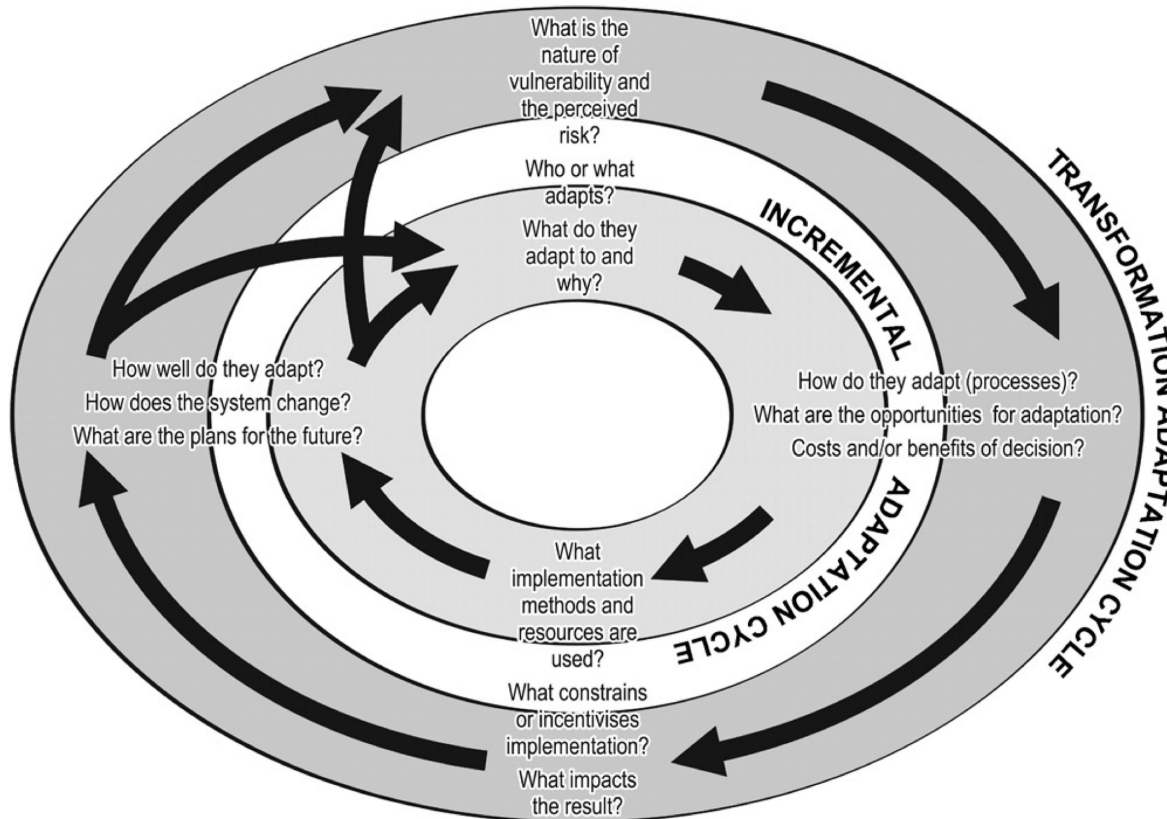
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We need a more nuanced view of how adaptation evolves over time

- Adaptation processes cycle between incremental and transformational modes (e.g., Park et al. 2012)



“whilst there may be the need for a transition from incremental adaptation to transformative adaptation, transition does not always occur, or if it does occur, does not do so in a timely manner”

Park et al. (2012)

Integrating theories of transformation into adaptation

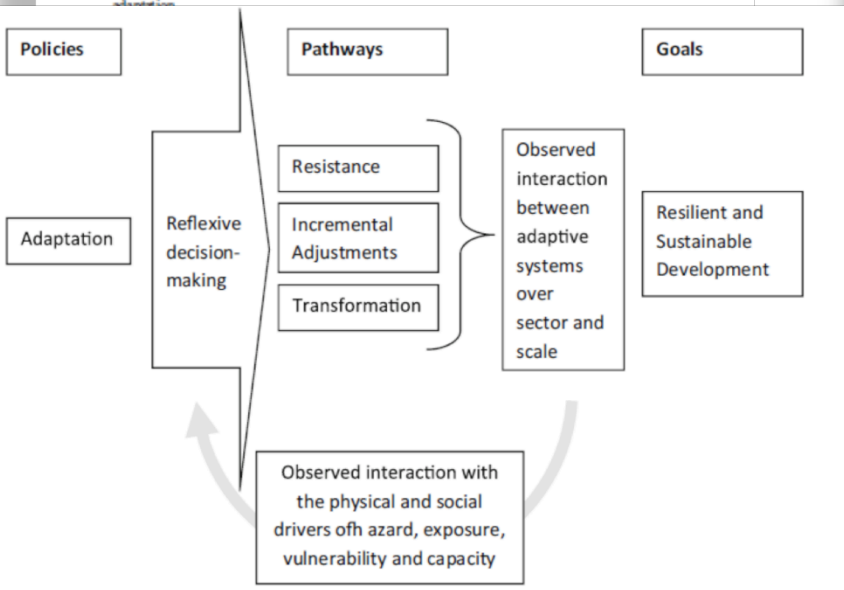
Climate Change (2015) 133:113–127
DOI 10.1007/s10584-014-1303-0

Adaptation and transformation

Mark Pelling · Karen O'Brien · David Matyas

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© Springer Science+Business Media Dordrecht 2014

Abstract Transformation as an adaptive response to climate change opens a range of novel policy options. Used to describe responses that produce non-linear changes in systems or their host social and ecological environments, transformation also raises distinct ethical and procedural questions for decision-makers. Expanding adaptation to include transformation foregrounds questions of power and preference that have so far been underdeveloped in adaptation theory and practice. We build on David Harvey's notion of activity space to derive a framework and research agenda for climate change adaptation seen as a political decision-point and as an opportunity for transformation, incremental adjustment or resistance to change in development pathway. Decision-making is unpacked through the notion of the activity space into seven coevolving sites: the individual, technology, livelihoods, discourse, behaviour, the environment and institutions. The framework is tested against practitioner priorities to define an agenda that can make coherent advances in research and practice on climate change adaptation.



“Within the academic community transformative adaptation has gained visibility through the Intergovernmental Panel on Climate Change (IPCC)”

“There is considerable intellectual engagement with the concept of transformation across the social sciences, and only a part of this has yet been applied to CCA. . . transformation demands this be added to the conceptual landscape of adaptation to climate change

“many new and important questions are emerging about . . . capacities to deliberately transform systems and structures in a manner that is both ethical and sustainable.”

O'Brien (2012), Pelling et al. (2015)



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Are we ready for transformation?



“clear operational definitions of what constitutes transformational adaptation remain elusive.”

“the extent to which transformational adaptation can be operationalized within adaptation policy remains unclear.”

“the factors that constrain incremental adaptation (e.g., 16.3.2) also can constrain transformation, but the greater level of investment and/or shift in fundamental values and expectations required . . .may create greater resistance”

Klein et al. (2014)



“evaluating any need for and scale of change is highly subjective and determined by a range of factors. . . If transformation takes place across multiple scales, through multiple actors at multiple times (O’Brien, 2012), on what grounds can we differentiate between appropriate transformative management responses?”

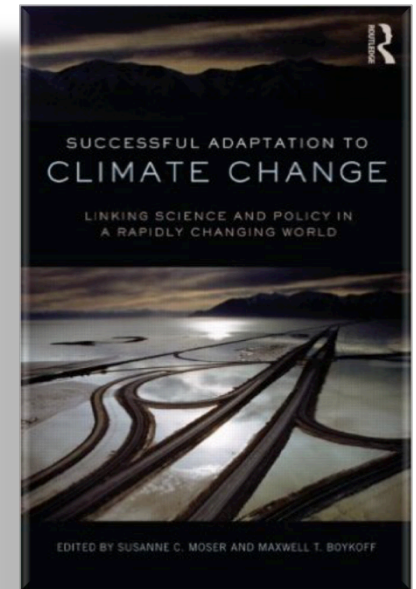
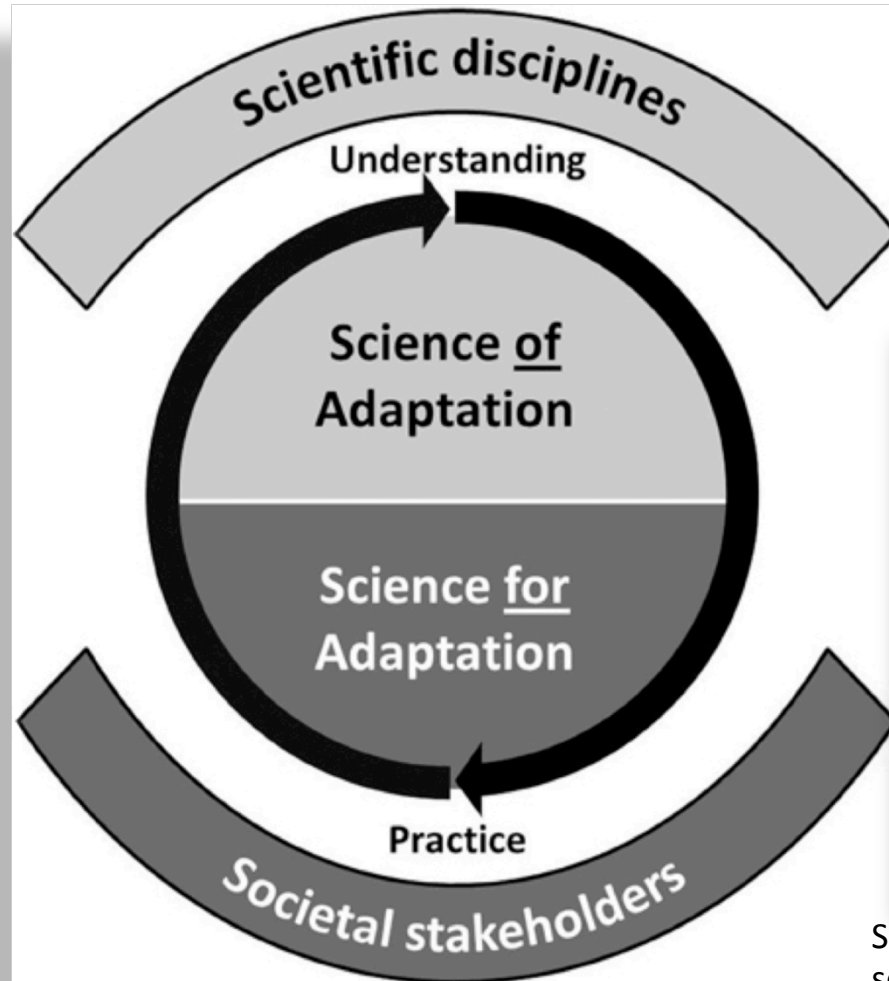
“the probable push factors for transformation will still most likely continue to be event dependent”

“the question is whether management responses will only change when complex Type III problems and approaches become the new norm.”

Nalau and Handmer (2015)

Closing the loop on adaptation science

- If more emphasis on science improves practice, we should also look to practice to help improve adaptation science



Swart and Biesbroek (2014)
see also Preston et al. (2013)

Reflexive adaptation research



**Adaptation
Science**

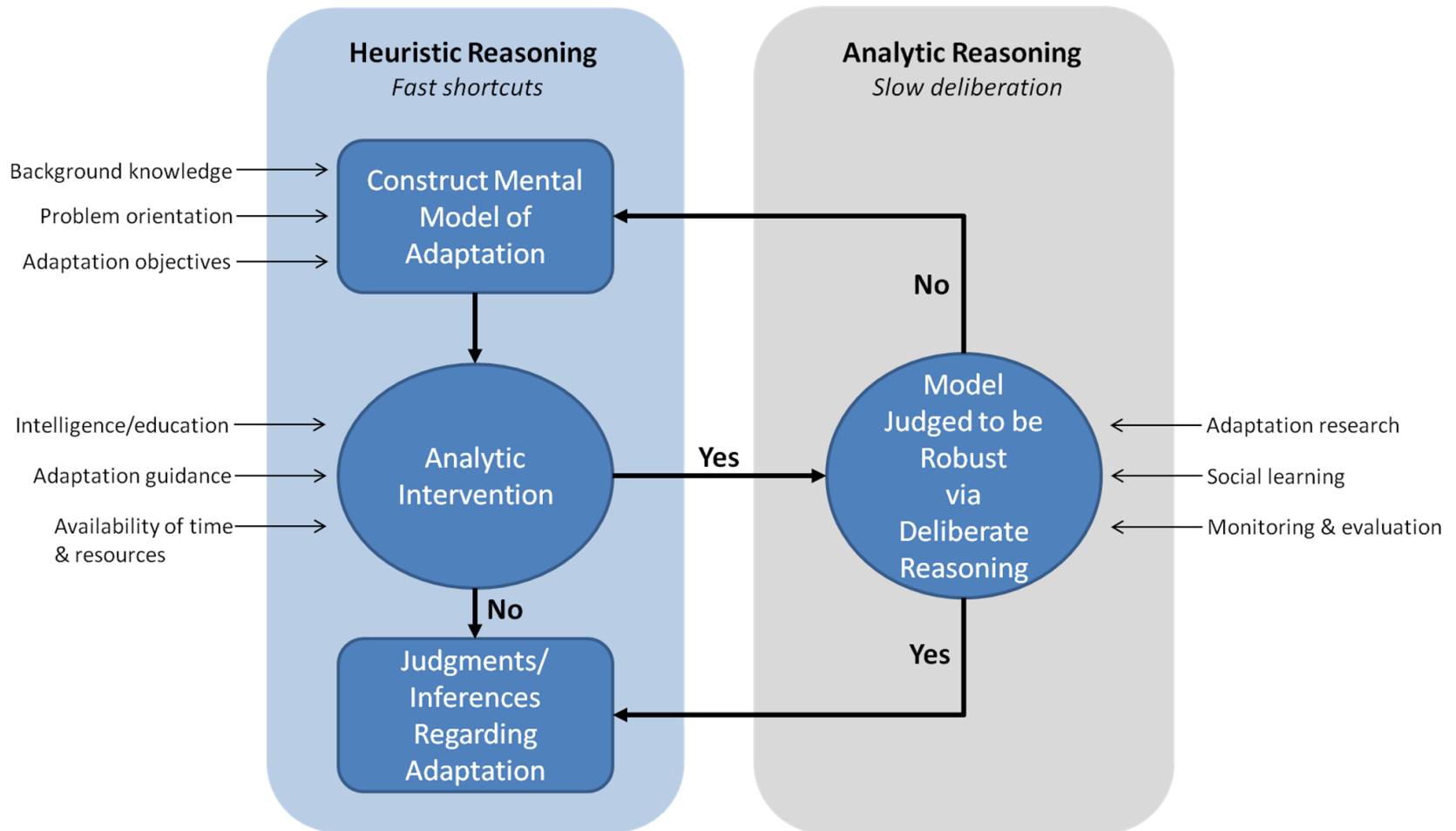
“These examples highlight not only broader challenges associated with how adaptation is attempting to address climate change, but also with how adaptation research and the knowledge generated are being pursued and applied in addressing these challenges “

Preston et al. (2015)



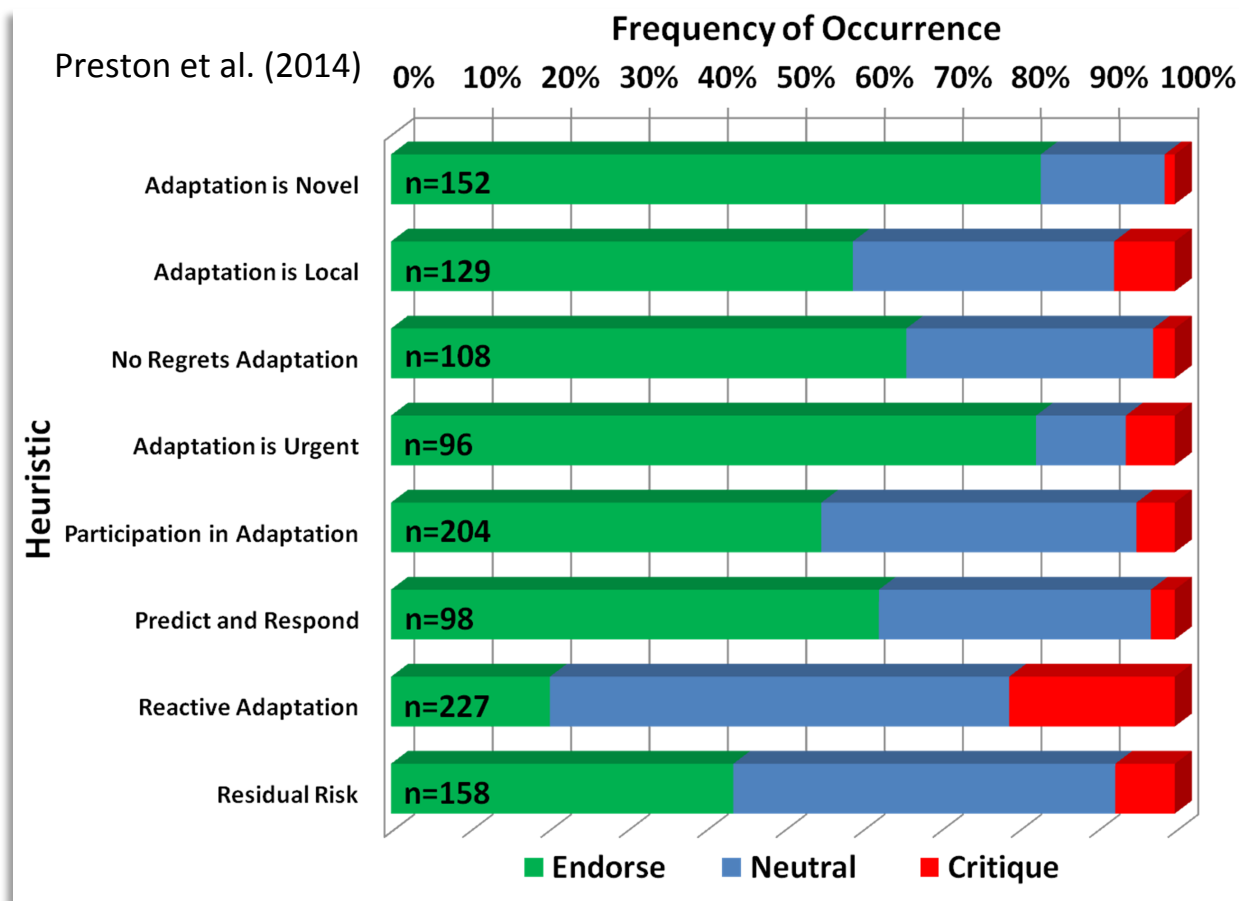
Mental models of risk and adaptation

- The framing of adaptation research and practice is strongly influenced by heuristic reasoning



Preston et al. (2014), based on Kahneman

A critical look at adaptation heuristics



“The use of largely untested heuristic devices. . . may sometimes prove to be barriers rather than providing support in search for optimal solutions.”

Swart and Biesbroek (2014)

Summary

- **Adaptation science continues to expand while building on other research disciplines**
- **Effectively using adaptation science to enhance adaptation practice remains challenging, suggesting a need for further maturation**
- **Research *for* and *on* adaptation should be viewed as mutually informing endeavors**
- **Yet, this necessitates adopting a more reflexive approach to adaptation research that facilitates ongoing introspection and self-criticism**

Thank You

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