Climate Change Vulnerability and Adaptive Capacity: Improving Assessments and Enhancing Resilience of Communities at Risk

2012 National Landscape Conservation Cooperative (LCC) Workshop

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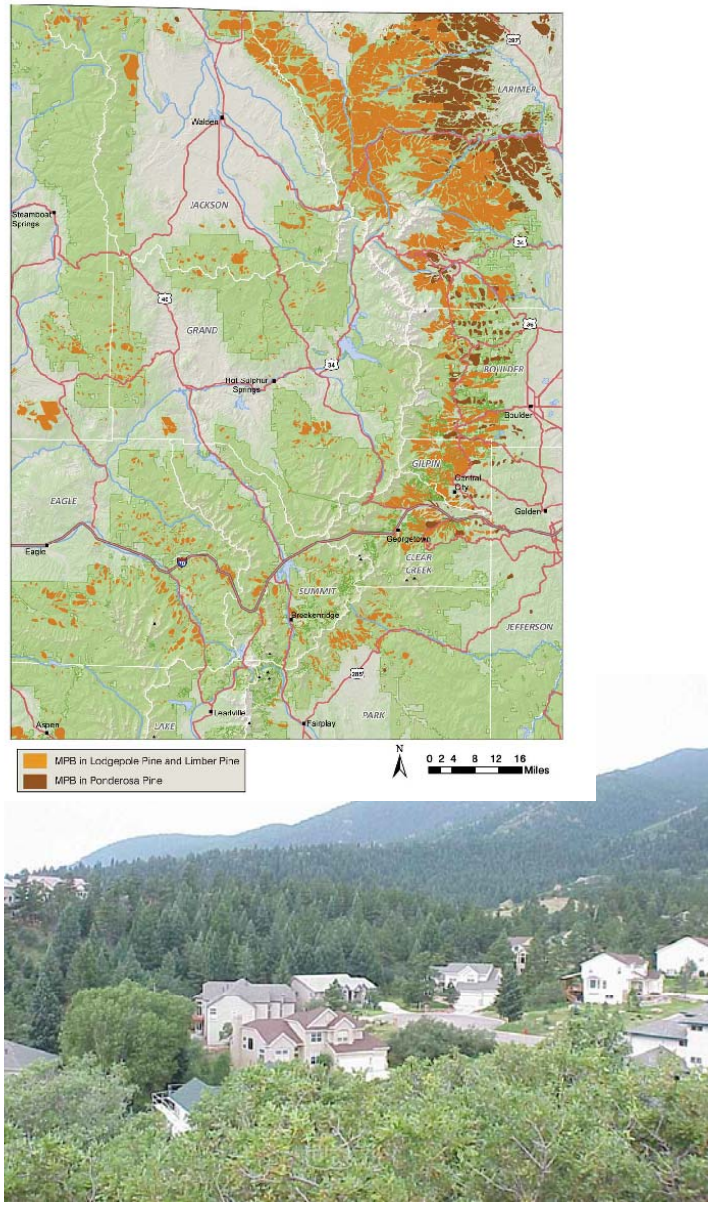
Social Vulnerability Research Initiative



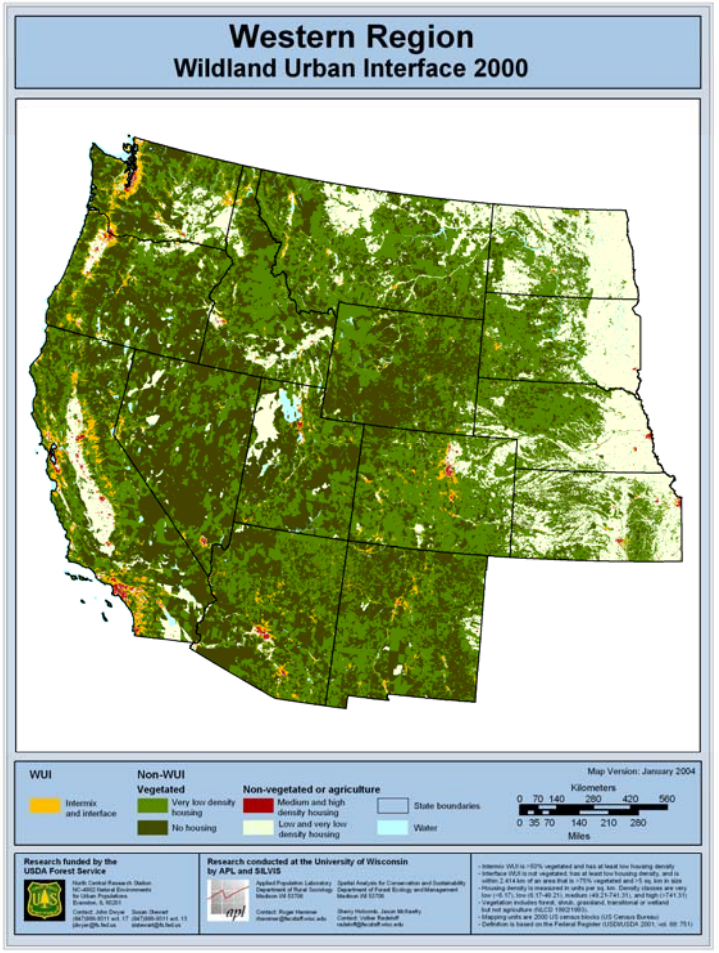
- Forest Service Research Leadership targeted this topic (April 2011)
- Sought coordination across Research stations to:
  - Develop framework to identify populations most vulnerable to climate change impacts
  - Assess social vulnerability indices that can be applied at multiple scales
  - Examine resources, tools, and strategies to improve adaptive capacity of socially vulnerable populations

Presentation Overview

- Problem analysis
  - Research Priority Development
  - Social Vulnerability to Climate Change (FS Research Initiative)
  - Research Workshop on Social Vulnerability (Nov. 2011)
- Vulnerability / Adaptive capacity research effort
  - Feb. 2012
  - Yung & Murphy U. of MT.
- Institutional challenges of landscape-scale governance

Community and Social Vulnerability

- **Early Policy Origins**
  - Managing forests for community stability
- **Research Origins** (Vulnerability to landscape change)
  - Vulnerability to natural hazards
  - WUI Vulnerability/adaptive capacity regarding wildland fire
  - Resilience properties of complex adaptive systems
- **Management Needs** (Responding to landscape change)
  - All-Lands/Landscape Scale Management
  - Forest Service Climate Change Scorecard
    - Vulnerability Assessment & Monitoring Tools
    - Adaptation strategies
    - Organizational capacity, engagement & Partnerships



Lubrecht (MT) Workshop (Nov. 2011)

- **Discussed State of Knowledge /Literature Review** (Murphy & Yung, 2011)
- Identified three tasks going forward:
  - Advance State of Knowledge:
    - improve assessment protocols
    - bring community perspectives into research
    - Integrate social and ecological perspectives
  - Science application: NF Scorecard
    - Vulnerability case studies
  - Communications, Outreach & Coordination

Basic Definitions

- **Vulnerability**: “The degree to which a system is susceptible to, or unable to cope with, adverse effects of climate change, including variability and extremes” (IPCC)
- **Adaptive Capacity**: An element of vulnerability that includes the “characteristics of communities, countries, and regions that influence their propensity or ability to adapt” (IPCC)
- **Resilience:** The capacity of a system to absorb a spectrum of shocks and sustain its fundamental function, structure, identity … (Chapin et al. 2009).
- **Governance**: (Human made) systems consisting of institutions, networks, bureaucracies, and polices in which adaptive agents respond to external and internal impulses (Duit et al. 2010).

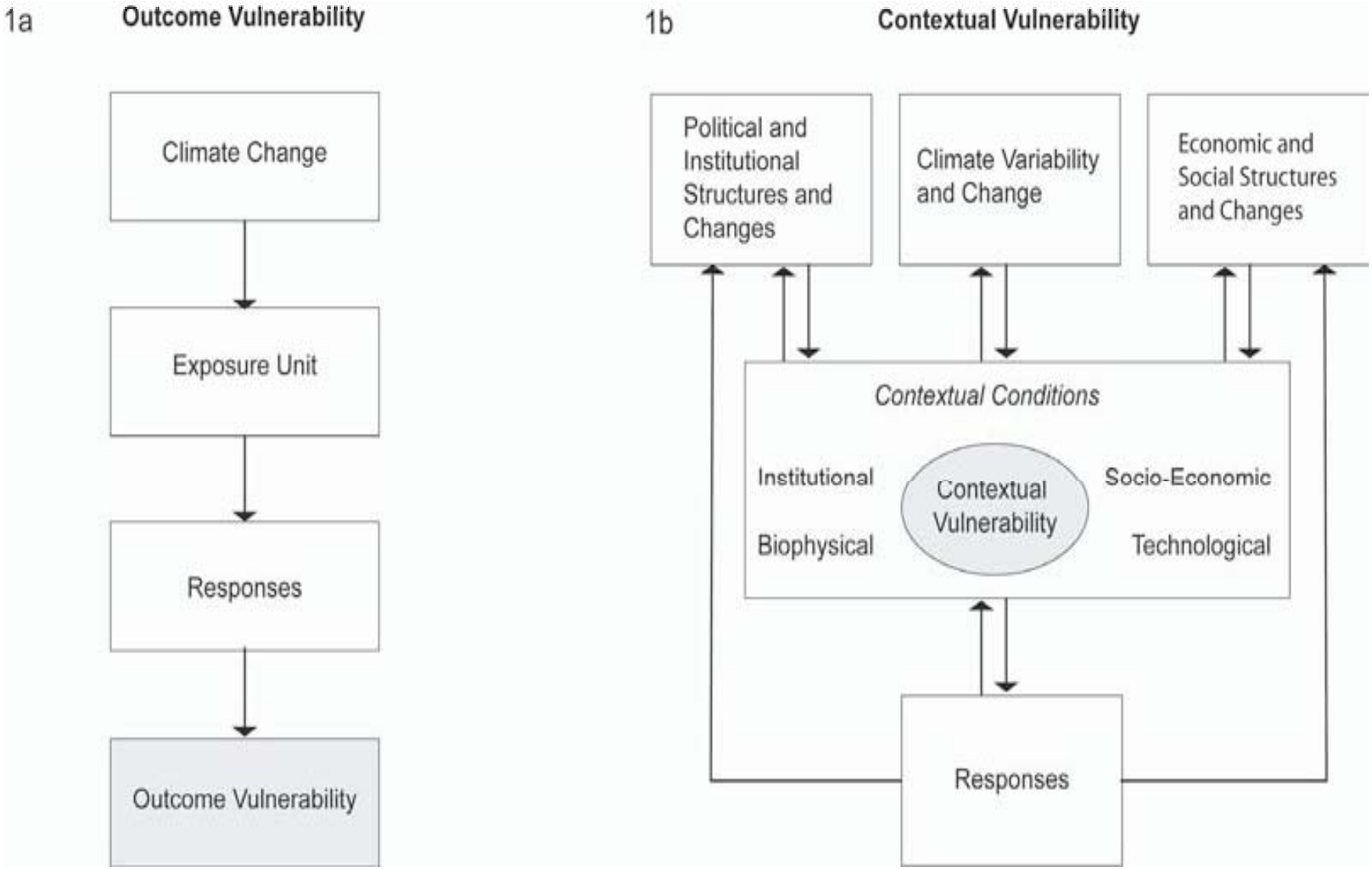
Issues in Social Vulnerability

- *What is meant by social vs. community vulnerability?*
  - *FSRET seemed to be concerned with disproportionate impacts to vulnerable groups*
  - *IPCC definition tends to focus on "communities" or localities*
- *Assumptions about the particular social conditions that make some individuals, households, social groups more or less vulnerable.*
  - *Vulnerability = Exposure + Sensitivity + (lack of) Adaptive Capacity*
- *Moral dimensions of resilience*
- *Emphasis on systems helps to bring social and ecological work together*
- *Focus on governance structures and processes*

Vulnerability Research Frameworks

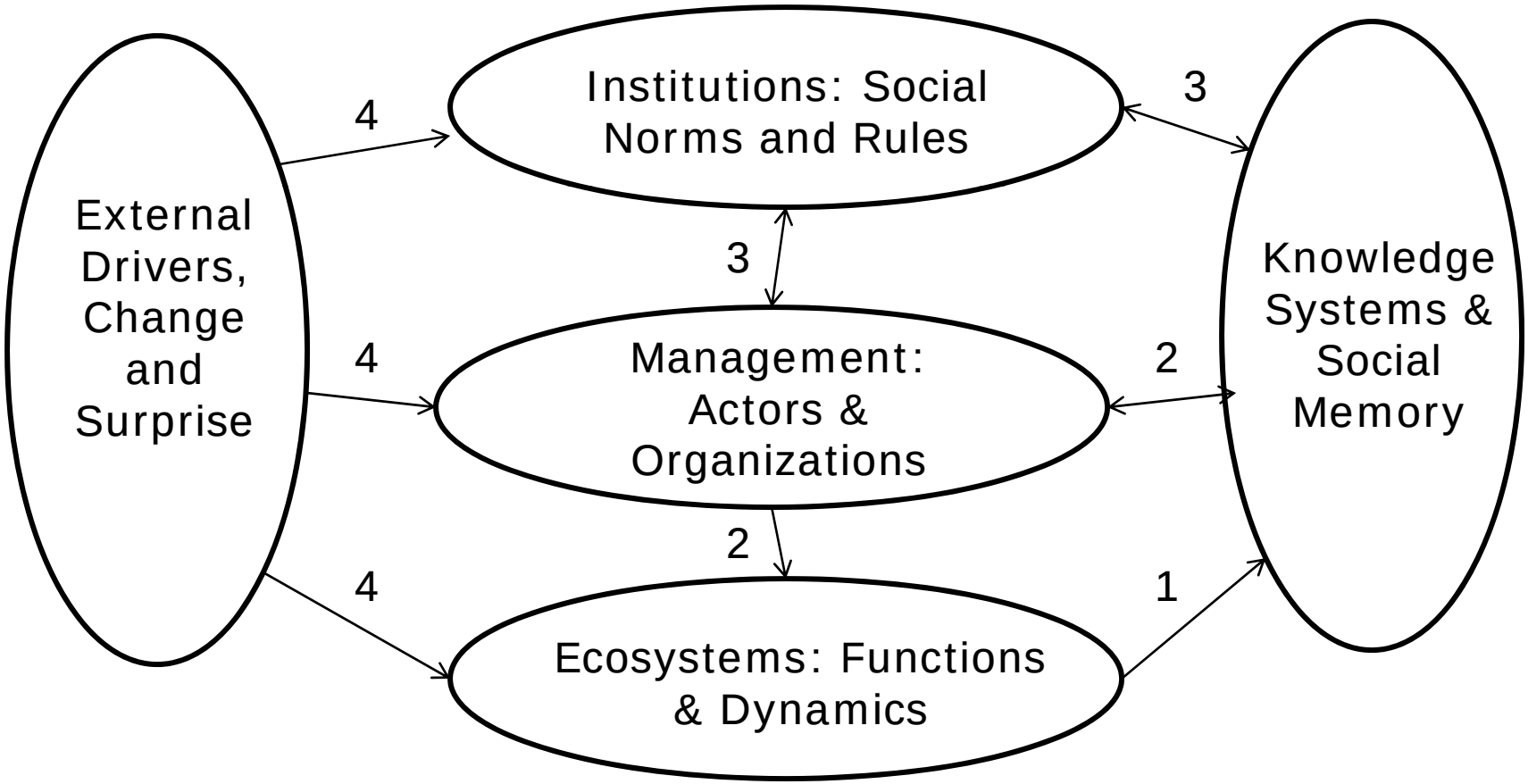
Framework	Focus	Goal	Concepts	Pros	Cons
Outcome Oriented	Impacts of objective threats on discrete exposure units	Demonstrate causal relation between hazard and loss	Not applicable	Targeted, narrow, discrete variables Existing data	Misses social & political dynamics
Context-Oriented	Spatial and temporal scales that produce constraints and opportunities	Demonstrate the complexity of vulnerability and adaptation	Political economy (institutions etc) Moral economy (values etc.)	Better reflects reality Broader vision of drivers of change	Lack of agency Lack of scalability Overly specific
Systems-Oriented	Exposure and resilience of relationships that make up systems	Identify functional relationships and dynamic response to change	Coupled human-natural systems with feedback & links Resilience (averting change) Thresholds (transformative Change)	Focuses on relationships Concerned with transformative change	Too abstract Terms undefined
Actor-Oriented	Exposure Units and courses of action	Identify constraints and opportunities for specific actors & decisions	Rational choice focused on decision making Relational approach focuses on context (see context Oriented)	Combines context and outcome orientation More Scalable, flexible	Overly specific Misses structural dynamics

Outcome vs. Contextual Vulnerability



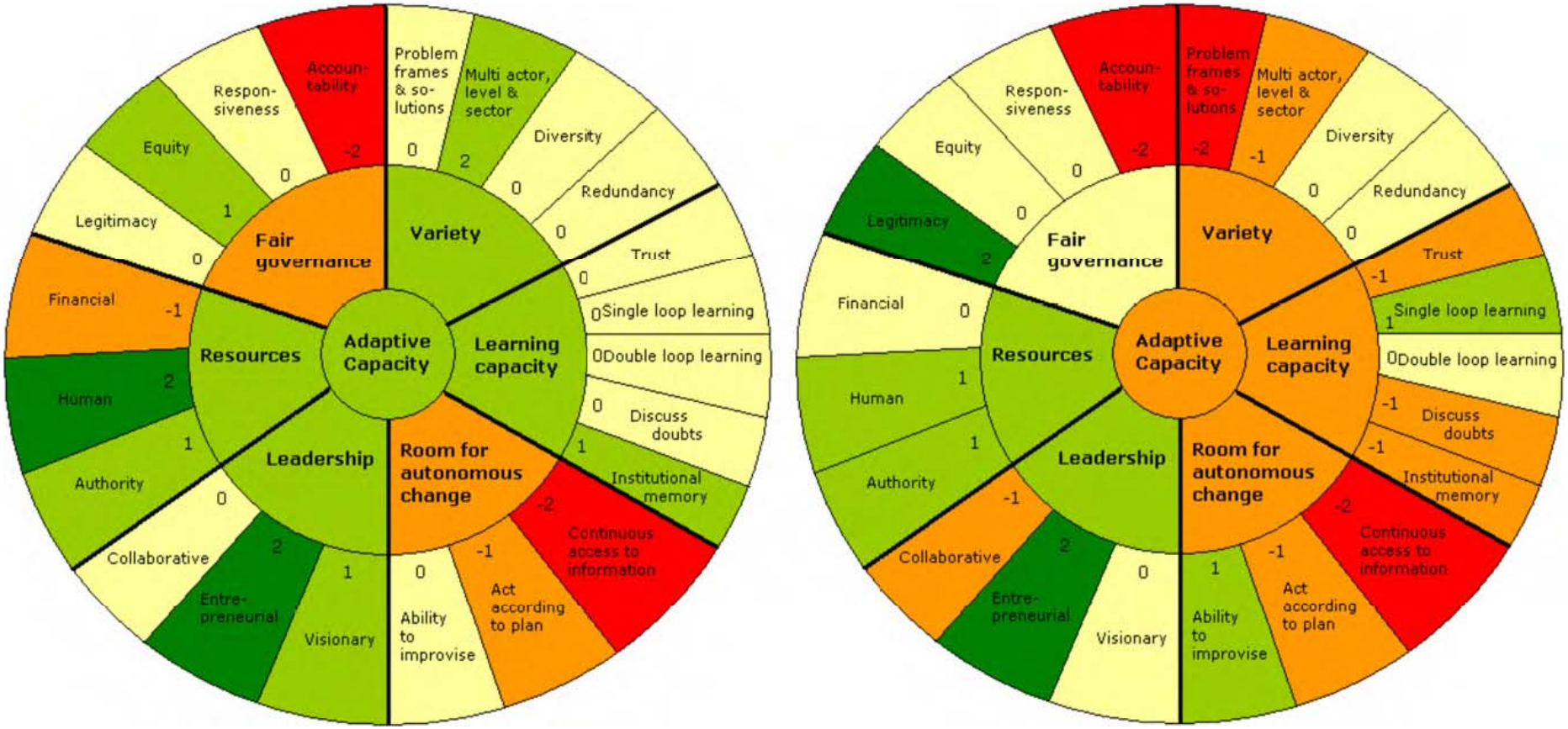
O'Brien et al. 2009

Systems Oriented: Governing Social-Ecological Systems



From: Hahn et al. 2008

Example: The Adaptive Capacity Wheel



The Adaptive Capacity Wheel applied to the communities of Delft (left) and Zaandam (right) The Netherlands. From: Gupta et al. 2010

Research Designs & Methodologies

Research Design and Methods	Dose-Response *(outcome)*	Indices & Indicators *(outcome)*	Mapping *(outcome)*	Agent-Based Modeling *(outcome, actor & systems)*	Scenario Building *(outcome & context)*	Case Study *(actor, context, systems)*
Elements	Vulnerability assessed with quantitatively measured impacts	Create index weighted using expert knowledge	Spatial analysis of quantitative data (e.g. proximity to hazards & distribution of losses)	Simulation of adaptation by exposure units using simple behavioral rules	Climate change models used to generate "what if" scenarios	Empirically trace out drivers and social processes based on field observation
Pros	Targeted, simple, cost effective	Good for targeting efforts. Scalable, data availability, cost effective	Visual, spatial facilitates targeting	Can be predictive, cost effective, and capture complexity	Participatory, helps community work through problems	Highly detailed, complex
Cons	Extrapolation from past events, ignores social dynamics	Serious measurement issues, questionable assumptions	Limited analysis, mostly data presentation technique	Accuracy unknown, scale issues	Highly specific, scenarios may be inaccurate	High cost Site and/or case specific

Interior West Research Project

- **Primary Objectives**
  - *Improve understanding of key contributors to social vulnerability and adaptive capacity*
  - *Evaluate participatory scenario building exercises as a "rapid assessment" approach for agency assessments and climate change planning*
  - *Provide research results to national forest, other federal agencies, and communities to facilitate anticipatory decision making related to climate change adaptation.*

Multiple Case-Study Design

- Apply actor and context oriented framework
- Use scenario building focus group exercises to generate community assessment of vulnerabilities and adaptive capacities.
- Plan Thee Case Studies:
  - Southwest Montana (Big Hole Valley)
  - Central Nevada (Humbolt-Toyabee NF)
  - Central Wyoming or Central Colorado?

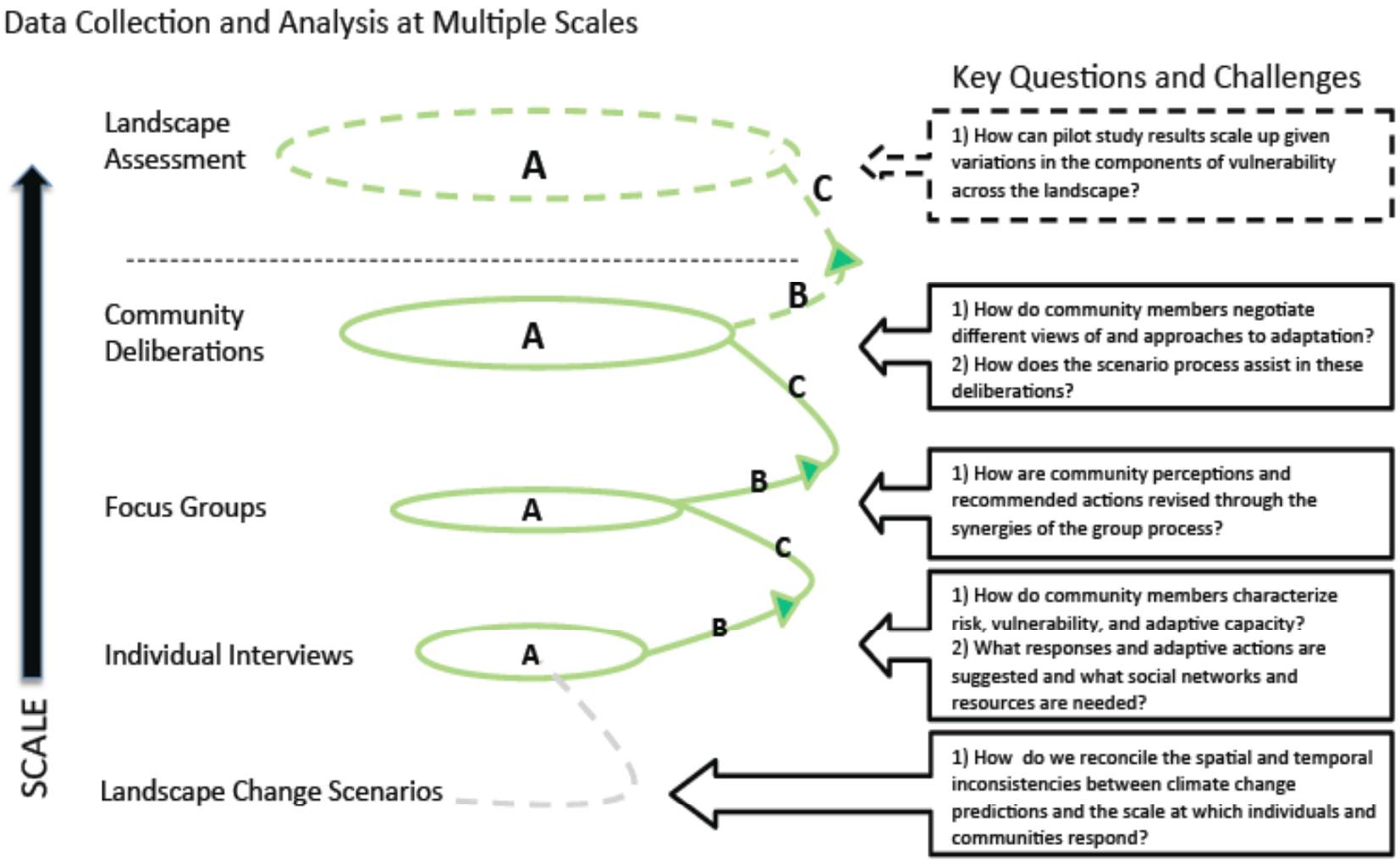
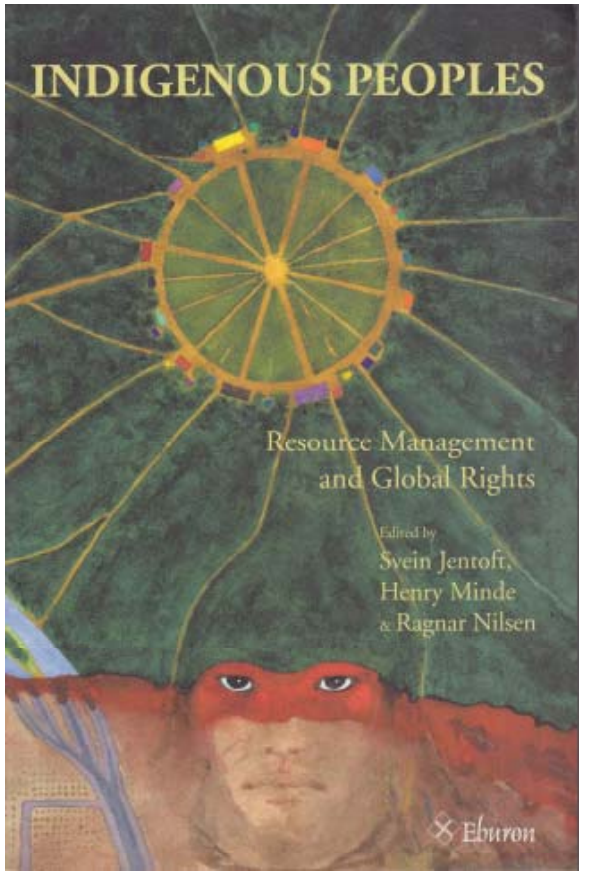


FIGURE 2. Data Collection and Analysis at Multiple Scales. A) Qualitative and quantitative data collection. **B**) Interdisciplinary rapid analysis. **C)** Revision of scenarios based on social data and anticipated ecological impacts of recommended actions. Landscape-level assessments will take place in future stages of the research.

Science Application: Social Vulnerability For Climate Change Scorecard

- Goals
  - Meet FS requirements for each unit to conduct social vulnerability assessments
  - Collaborate with communities to identify was to address impacts of climate change on communities
- Phases
  - Broad scale using secondary data
  - Select in-depth case study NF/communities
  - Develop toolkit, guide, methodologies for multiple locations
- Monitoring over time
  - Model has to be adaptive and incorporate learning



Social Vulnerability Research Goals

- Provide managers a better understanding of local communities
  - Describe institutional and governance constraints and opportunities by focusing on local understandings of vulnerability and adaptive capacity
  - Describe community perceptions of risk and uncertainty
  - Identify future sources of conflict and degree to which agency and community perceptions diverge
  - Identify future avenues for synergy and collective action among various actors
- Assess feasibility of participatory scenario exercises (rapid assessments)
- Provide initial assessments of ecological and social impacts of possible adaptive actions
- Facilitate community engagement
  - Raise community awareness about likely social and ecological impacts
  - Build momentum for collective action within the community

Challenges for Governing Landscape Scale Adaptation

- Management institutions historically organized around “myth of stability” (Stationarity) in natural systems (Budianksy, 1995).
- Top-down knowledge systems are inefficient (insufficient?) for managing complexity and uncertainty (Tainter, 1988).
- Governance as emergent, adaptive actions of a diversity of actors organized in networks (Folke et al. 2005).