Integrating Natural and Social Science for Regional Assessment of Climate Impacts on the Pacific Northwest

Amy Snover

E.L. Miles, A.F. Hamlet, D.P. Lettenmaier, N.J. Mantua
Climate Impacts Group
University of Washington

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The Climate Impacts Group

Areas of study:
- Water resources
- Salmon
- Forests
- Coasts

Motivation:
- Increase regional resilience to climate variability and change
- Produce science useful to the decision making community

→ Requires integration of physical and social science research & incorporation of stakeholders’ perspective
Conceptual approach to assessment

Integrated assessment of regional climate impacts:

The study of how climate, natural resources, and human socio-economic systems affect each other
The climate system

1. Characterize regional climate variations from historical/paleo records
   - spatial consistency
   - cool/wet vs. warm/dry

2. Link to large-scale climate variability
   - ENSO/PDO
   - predictability?
Natural System

Columbia River
- snowmelt dominated
- large response to cool/wet vs. warm/dry winter conditions

VIC hydrology model
Managed System

1. ColSim reservoir operations model

2. Operating system reliability

![Map of the managed system with various objectives and reliability data.](image_url)
The Institutional Context

**Institutions**: formalized actions underlying human social activity, including standards of behavior, formal decision rules and decision-making procedures, and grants of authority to prescribe policy.

The **institutional context** creates the “rules” that shape social practices relevant to the system under examination.
Tools for characterizing the institutional context

Mapping institutional frameworks

- Identify players
- Characterize laws, treaties, rules and constraints
- Determine interactions
- Analyze individual institutions

Methods: interviews, institutional analysis

Pulwarty & Redmond 1997
Tools for characterizing the institutional context

Eliciting decision calendars

- When/how are decisions made?
- Where is climate information relevant to decisions?
Method = interviews, analysis of decision processes

Example: Columbia basin operating periods

1. Fixed period (Aug-Dec)
   Assume the worst about spring inflow
2. Variable period (Jan-Jul)
   Use snowpack measurements to estimate spring inflow
Involving stakeholders

- A salient assessment requires active two-way communication
- Human dimensions research relies on stakeholders’ knowledge
- Provides a means of disseminating results

Putting in Practice:
- water workshops
- interviews
- general outreach
- policy-maker workshops
An End-to-End Assessment of Climate Impacts from CLIMATE..

CIG’s Process of Integrated Assessment:
- Climate dynamics provides the anchor
- Components of the assessment are undertaken in parallel, rather than in series
- Close communication within the assessment team ensures that methods and assumptions are compatible

CLIMATE SCIENCE
- Climate Statistics
- Climate Dynamics

HYDROLOGY
- Hydrologic Models

WATER RESOURCES
- Reservoir Operation Models
- User Interviews, Historical Studies
- Interviews and Surveys

HUMAN DIMENSIONS
- Institutional Mapping, Policy Analysis, Interviews and Surveys

POLICY ANALYSIS
- Policy and Economic Evaluations
- Policy Recommendations

....to USER
1. Understand the **physical** (hydroclimatic) **system** [predictability, uncertainty]

2. Understand the nature and consequences of human choices and activities (the **managed system**) [decision calendars]

3. Understand the **institutional context** of these systems [processes, laws, constraints]
Examples of Integrated Assessment

• Integrated assessment of climate impacts on the Columbia River basin (Miles et al. 2000)

• Value of climate forecasts for Columbia basin hydropower production (Hamlet et al. 2001, Huppert et al. 2001)

• Implications of climate change for PNW urban water resources (Palmer and Hahn 2002)

• Analyses of the institutional context of regional water resources management and potential use of climate forecasts in management (Callahan et al. 1999, Gray 1999)