

Primer: Research Design

Melinda Laituri
Colorado State University



Overview



- What is research?
- Boundaries: Role of the Watershed as an organizing principle
 - Identifying the unit of analysis
- Conceptual models
- Mixed methods and analysis
- Ethics in research

What is research?



- Basic research
 - Fundamental principles, concepts, theories
 - Exploratory, Constructive, Empirical
- Basic research – Applied Research – Practical Applications
- Structural process:
 - Topic
 - Hypothesis or research question
 - Conceptual/operational basis; framework
 - Methods
 - Analysis/Results
 - Conclusions

Creativity in Science



- Choosing a question to investigate
- Where are the intense debates in science?
- What is interesting? What is solve-able?
- Significance/Justification
 - Empirical and theoretical contributions
 - Applied and basic uses of outcomes

Problem Statement



- Develop the **problem statement**
 - Research question/Hypothesis
 - Defines and bounds problem
 - Study site selection
 - Background research: Theoretical framework
 - Variables

Boundaries: Watershed as a unit of analysis



- Basic water planning and management unit
 - Understand existing conditions
 - Historical range of variability (HRV)
 - International water law
 - New Zealand, South Africa
- Nested spatial hierarchy
 - Scale
- Situational backdrop for analysis, cultural meaning, experience, history, future
 - *Place-based*: values and meaning
 - Problemshed
- Defines both physical and social environment
 - Goods, services, sinks, pathways, buffers, sense of place

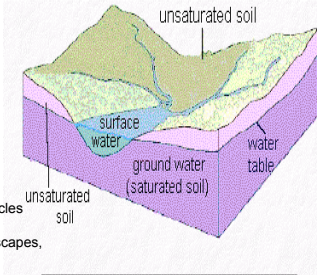
What is a watershed?

- **4 dimensional process**

- Longitudinal: upstream/downstream
- Lateral: floodplain, upland
- Vertical: groundwater zone/stream channel
- Time: seasonality, diurnal fluctuations

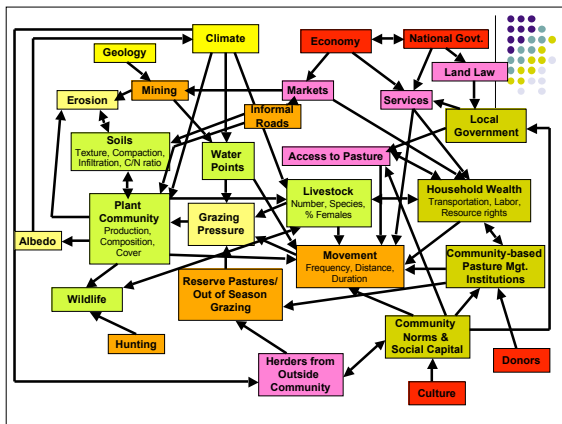
- **System of intergration**

- Network of streams
- Integrated systems and cycles
- Movement of flows
- Mosaic of landcover, landscapes, and habitats

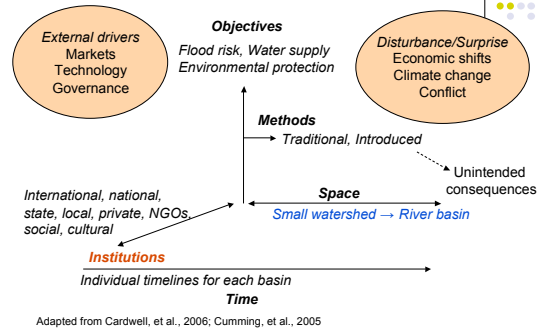


Conceptual models

- Organize our thoughts
 - Define elements of system
 - Understand where people fit in
- Defines dynamic framework for research
 - Focuses on linkages and feedbacks in complex systems
- Refine objectives of research
 - Identifies variables and sub-models of system
 - Clarifies where uncertainty exists



Conceptual Framework



Data issues

- Assessment of existing data
 - Quality and reliability; date
- Identification of data needs
 - Variables to study
 - Independent (explanatory)
 - Dependent (outcome)
- Sampling design
- Spatial and temporal framework

Comparative Matrix for Historical Environmental Management: Water

Social	Context			Water Supply	Economic Development	Irrigated Agriculture	Outcomes/ Unintended Consequences
	Time	Space	Governance (Institutions)				
Ecological							
Changes in stream flow network alteration							
Alteration of stream network							
Natural hazards							
Levels of Biodiversity							
Land Cover							
Feedback loops							
Cascading effects							

To identify relationships continuity, and change

Research Plan, Method, Analysis



- What will you actually do?
- Prototypes/Pilot study
 - Examination of existing data
 - Preliminary results
 - Track record
- Unexpected outcomes
 - Uncertainty

Mixed Methods



- GIS models
 - Integrated database/Overlay analysis
- Time lines
 - Event based
 - Research activity
- Agent-based modeling
 - Prediction
- Establish gradients
 - Rural to urban, River source to river mouth
- Establish common/similar sites
 - Data collection for comparison and identifying interaction

Ethics in research



- Give appropriate credit
- Respect the study site, participants, and colleagues
- Remain objective
- Spend money appropriately
- Communicate