# Complexity, Environmental Change, and Institutional Arrangements for Integrated Water Resources Management:

## Lessons from Watershed Governance in the Unites States

**Mark T. Imperial, Ph.D.**
**Master of Public Administration Program**
**University of North Carolina at Wilmington**
**imperialm@uncw.edu**
**http://people.uncw.edu/imperialm/index.htm**

***Presented at World Water Week – Stockholm, Sweden '05***




# Objectives

- **Explore how uncertainty and complexity influence watershed governance in the United States**
- **Explore how the concept of "resilience" shifts our thinking and practice of integrated water resource management**
- **What are some common collaborative management strategies used to increase resilience in the U.S.?**
- **What are some factors influencing the development of resilient institutional arrangements?**

# Watershed Governance

- **Governance**
  - Achieving direction, control, and coordination of organizations with varying degrees of autonomy in order to advance the objectives to which they jointly contribute
- **Challenge for practitioners is to:**
  - Finding ways to improve governance in a world of shared power where the capacity for solving problems is widely dispersed and few organizations accomplish their missions alone

# Watershed Governance in the U.S.

- **Wide variety of programs operating at different scales over a long periods of time**
  - Interstate Compacts (Lake Tahoe, Delaware River)
  - 1965 Federal River Basin Planning Program
  - Great Lakes Program
  - Chesapeake Bay Program
  - Section 208 of the CWA
  - National Estuary Program (NEP)
  - Special Area Management (SAM) Plans under CZMA
  - State Watershed Programs (e.g., Oregon)
  - Total Maximum Daily Loads (TMDLs)




# How does uncertainty and complexity influence watershed governance in the United States?

# Institutional Evolution

- **Co-evolution/co-adaptation of institutions**
  - Institutions continuously adapt and change to each other as well as changes in society and the environment
  - Most change is incremental but sometimes there are periods marked by profound changes – "punctuated equilibrium"
  - Changes can be symbiotic – one agency implements another's policies
  - Reframing of problems that motivate collective action due to learning and changing societal values – leads to self-organizing (Internal)
  - Cycles of planning & institutional changes introduced from outside the watershed – new government program, law suit, etc. (External)



# Institutional Change

- **Second law of thermodynamics doesn't hold**
  - Institutional systems evolve towards greater complexity and functional specialization
- **Intentional changes**
  - Actions/directions of those inside/outside the network
  - Changes in constitutional level rules can impose changes on collective-choice/operational level rules
- **Emergent changes**
  - Organizations adapt to changing behavior of other organizations in the network and in response to what they learn
- **Path-dependent quality**
  - Important moments of choice that constrain and guide subsequent changes to institutional arrangements

# Complex Behavior is Emergent

- **Complex behavior "emerges" from the interactions of network components**
  - Behavior is not dictated, controlled, engineered, regulated, or coordinated by a central manager
  - Rules that govern behavior of the individual components interact to create complex behavior
- **Important consequences for governance**
  - ***Nonlinear functions***: Whole is greater than the sum of its parts so public value can be generated by working together rather than alone
  - ***Butterfly effect***: Small changes in rules can produce profound unintended consequences that may be unknown until a change is made
  - ***Complexity is hard to grasp***: Often hard to find any local manager that understands how the whole systems is "supposed" to work



# Importance of Learning

- **Information is at a premium**
  - Scientific & time and place information
  - Environmental conditions & institutional performance
  - Few true policy experiments
  - Environmental goals are still value-based
- **Learning occurs at different levels**
  - ***Individual***: managers are smarter and make better "guesses"
  - ***Organizational***: participation in networks leads to innovation adoption, policy change, and collaborative "know how"
  - ***Network***: policy oriented learning, epistemic communities
  - ***Societal***: changes in values and expectations, improved understanding of how ecological systems function, improved understanding of "problems"

# How does the concept of "resilience" shift our thinking and practice of integrated water resource management (IWRM)?

# Resilience & Robustness

- **Resilience**
  - Amount of disturbance a system can absorb before the system is transformed from one set of mutually reinforcing processes and structures to a different set
  - Difficult to apply when components of an institutional system are consciously designed
- **Robustness**
  - Maintenance of some desired system characteristics despite fluctuations in the behavior of its component parts or its environment
  - Need to examine rules at all levels together–operational, collective choice, and constitutional
  - When does the system lose its robustness? When the ecological or institutional system collapses or both? Collapse of one does not imply the other
  - System is in equilibrium when changes follow an *ex ante* plan?

# Resistance

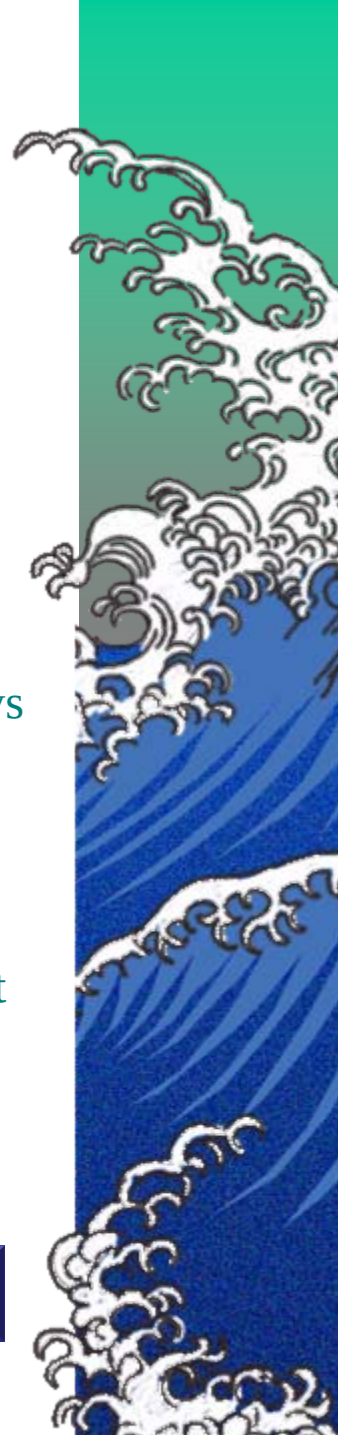
- **Resistance is the complementary aspect of resilience (persistence)**
  - Amount of external pressure needed to bring about a given amount of disturbance in system
  - Some systems can absorb great amounts of external pressure and still persist – resist change
  - External actors want to encourage "self-organization" and to design/map new features into existing arrangements
- **Transaction costs provide a cushion for suboptimal arrangements and create stability (resistance)**
  - Internal actors do not want to waste valuable resources changing what may be difficult or impossible to change
  - Prospective gains of a change are weighed against the costs of change
  - Uncertainty, imperfect information, and a bit of risk aversion can make this a big cushion

# What are some common collaborative management strategies used to increase resilience in the U.S.?

# Self-Organization & Collaborative Management

- **Watersheds differ in their capacity to self-organize and enhance governance**
  - Collaborative management is synonymous with self-organization
  - Outside entities often create constraints on what organizations can do that limit their ability to truly "self-organize"
- **Self-organization can be intentional or emergent**
  - ***Intentional***: organizations get together and consciously try to find ways to improve governance
  - ***Emergent***: organizations are forced to adapt to changing behavior of other organizations or changes in the political, social, or economic environment
  - ***Polycentric network structure***: Behavior is typically voluntary and not legislated top-down. It isn't purely bottom-up because organizations have power differentials and are at different levels of government outside the cooperative relationship





# Why Organizations Participate in Collaborative Management?

- **Participants are autonomous and retain independent decision-making powers**
  - Often they cannot be forced to participate in IGM
  - Social mechanisms such as communication, relationships (trust), mutual interests, and reputation govern activities rather than formal authorities
- **Reasons why organizations participate include:**
  - ***Rational***: Self-interest, acquire resources, exchange resources, respond to political pressure, reduce transaction costs
  - ***Institutional***: participants come to view as collaboration as being a preferred course of action for solving joint problems

# Collaborative Strategies

- **Building, managing, and reconfiguring networks**
  - Interorganizational planning
  - Developing shared priorities and policies
  - Creating collaborative/network organizations
  - Performance management systems
- **Collaborating to get things done (action sets)**
  - Coping and adjusting arrangements
  - Direct Action
  - Leveraging resources & capacity building

# What are some factors influencing the development of resilient institutional arrangements?

# Crafting Design Principles for Robust Institutional Arrangements?

- **Ostrom's (1990) 8 design principles might be a useful starting point**
  - Applied in a wide range of institutional settings – particularly CPRs
  - Would need to be modified for more complex social-ecological systems
- **Principles 1, 2, & 3 help solve core problems with free-riding and resource use**
  - *Clearly defined boundaries*
  - *Congruence Between Appropriation and Provision Rules and Local Conditions*
  - *Collective-choice arrangements*

# Crafting Design Principles for Robust Institutional Arrangements?

- **Rules are not self enforcing so Principles 4, 5, 6 provide continuous mechanisms for interpreting rules and imposing sanctions that increase shared knowledge and agreement**
  - *Monitoring*
  - *Graduated sanctions*
  - *Conflict resolution mechanisms*
- **Principle 7 recognizes and legitimizes the rights of those who self-organize some component that adds to the "designed" portion of the network**
  - *Minimal recognition of rights to organize*
- **Principle 8 recognizes importance of overlapping networks and embedding self-organization in the larger network system that participants cannot change**
  - *Nested enterprises*

# Other Possible Design Principles?

- **Establishing Trust Across Organizations**
  - Recognizes the need to craft network relationships and maintain routine interactions needed to produce the trust required for self-organization (collective action)
- **Developing a Shared Definition of the Problem(s)**
  - Complex commons produce a variety of interests who frame problems in different ways.
  - Institutional arrangements that provide opportunities for network members to develop a shared definition of problems may have greater capacity for self-organization
- **Defining Mutual Interests**
  - Sometimes participants fail to recognize or frame issues in ways that highlight mutual interests
  - Institutional choices need to be viewed as non-zero sum games to encourage cooperation and self-organization

# Other Potential Design Principles?

- **Establishing a Balance of Power**
  - Collaboration is a voluntary activity
  - Participants may be reluctant to participate if they think they can achieve their goals by other means
  - When there is no satisfactory BATNA, cooperation may be more likely
- **Increasing Policy Instrument Diversity**
  - Enlarging the range of policy instruments used to address problems increases range of options and expands potential opportunities for collaboration
  - Increases range of possible institutional changes
- **Others?**

# External Constraints Beyond the Control of Watershed Actors

- **Intergovernmental grant system**
  - ***Lack of local control***: The one who controls resources sets priorities – this occurs at the federal/state level rather than the watershed
  - ***Need to be systematic***: Hard to systematically solve problems when priorities change frequently and there is no budgetary stability over long time periods
  - ***Distributional problems***: implementation funding is often treated as "green pork"
  - ***Administrative Costs***: Grants management can be complicated for collaborative projects
  - ***Flexibility in using grants***: need slack resources to participate in collaborative activities but legislatures/agencies provide limited discretion in how resources are used




# Context Matters

- **Watershed governance is influenced by:**
  - ***Physical environment*:** size, location, relative isolation, visible boundaries, proximity of organizations
  - ***Political environment*:** trends include performance measures, reinvention, resource shortages, shifting local politics, etc.
  - ***Socioeconomic environment*:** are there local resources to support implementation?
  - ***Institutional environment*:** institutional ecosystem creates opportunities and constraints on joint action
  - ***Local culture*:** rural vs. urban, nature of the problems, local preference for specific policy solutions
  - ***Situational histories*:** particularly previous governance efforts, history of organizational conflicts

# Accountability

- **Accountability is a fundamental principle of public administration**
  - For what? To whom?
  - Internal vs. external, formal vs. informal mechanisms
  - Important source of “resistance”
- **Accountability can be a “two-edged” sword**
  - There is a constant tension between autonomy and accountability
  - Collaborative management can generate peer pressure at the political, professional, and individual level that encourages self-organization
  - Too much accountability can create disincentives for organizations to participate in joint action

# Human Dimensions of Collaborative Management

- **Disposition and skills of implementors**
  - Staff/organizations may not like working together
  - Staff/organizations may lack skills to participate effectively or manage network processes
- **Turf guarding as a result of perceived**
  - Threats to job security/career enhancement
  - Challenges to professional expertise
  - Loss of policy direction or undermining agency priorities
  - Anxiety over accountability
  - Conversely, IGM can create and expand turf

# Human Dimensions of Collaborative Management

- **Leadership is critical to initiate, maintain, and expand IGM processes**
  - ***Entrepreneurs*:** View programs as a way to attract new resources or elevate problems on federal/state agendas
  - ***Coordinators*:** Someone has to call meetings, provide a central point of contact, and keep the effort going as interest ebbs and flows
  - ***Facilitators*:** Unclear if outside facilitators are necessary but someone has to help resolve disputes
  - ***Fixer, broker, or devil's advocate*:** find opportunities for joint action, keeps participant's "eye on the ball", keeps the group grounded in practical and political realities
  - ***Champions*:** Strong advocate for particular courses of action who gets others to follow

# Summary

- **Watershed governance is not rocket science . . . It's a lot harder**
  - Governance challenges are as formidable as the scientific
  - Paradoxically it may work best in watersheds which already have strong institutional systems
- **Conceptual work is needed to move beyond the use of generalized metaphors**
  - Agree on operational definitions, find ways to measure concepts, and do comparative institutional analyses
- **Are we properly training tomorrow's managers to govern complex institutional systems and practice adaptive co-management?**

# Questions?