Challenges in Water Management: Engineering, Science, and Policy

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Overview of Talk

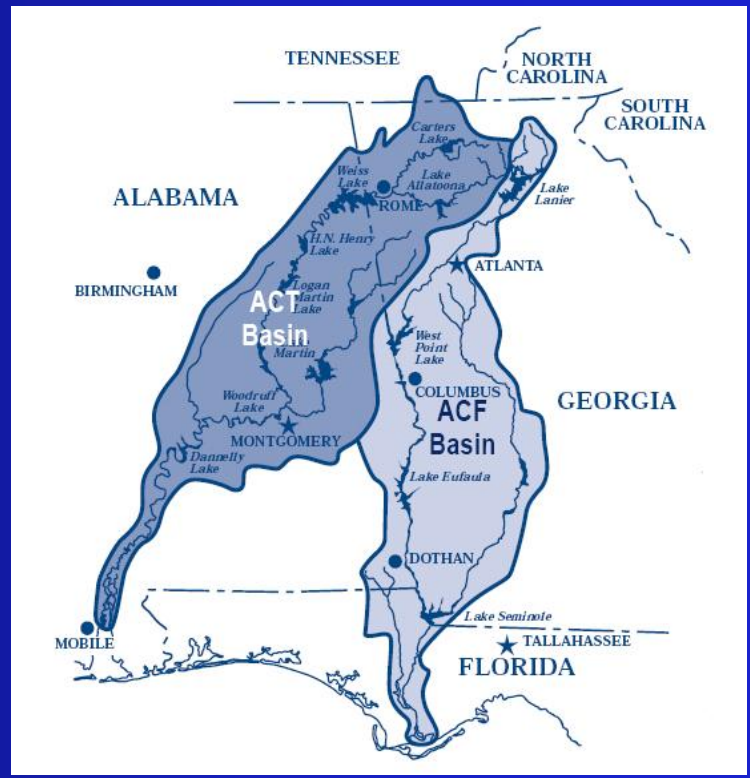
- Challenges of Water Management
- Four Case Studies (each in three parts: problem, project, lessons)
  - Interstate/State (ACT-ACF "Tri-State" Water Wars)
  - State/Regional (Georgia Drought Plan)
  - Regional/Local (Lake Lanier Watershed Management)
  - Classroom/Community (Water Resources/Sustainability)
- Opportunities and Visions for the Center

Challenges for Water Management

- Water problems often require interdisciplinary and integrated solutions
- Water responsibilities (and funding) are fragmented among agencies
- Water expertise is scattered throughout academia
- Students lack hands-on experience with real-world water problems
- Water problems often develop slowly; lack of visibility
- Gaps develop between water research and application
- Benefits and costs are often difficult to quantify (and often neglected)
- Water issues are not confined to hydrologic, meteorologic, political, or socio-economic boundaries
- Prescriptions can be general but local context matters
- A crisis is often needed to catalyze interest in water problems

Tri-State Water Wars: Problem

- Water controversy among Georgia, Alabama, and Florida
- Lawsuit in early 1990s; Georgia proposed reallocation of more water from Lake Lanier (from hydropower to water supply)
- Determine allocation formulas (for the next 50 years in ACF)
- Main participants: Three Governors, Seven Commissioners, Federal Agencies (COE, EPA, FWS, NOAA, USGS,…), Southern Company, Atlanta Regional Commission, Lake Lanier Association, NGOs, academics, and a team of lawyers
- ACT-ACF Comprehensive Study



Tri-State Water Wars: Project

- Determine when and how allocations could be modified
- Downstream versus upstream users
  - Metro Atlanta: urban growth
  - Southern Georgia: agriculture
  - Alabama: future growth
  - Florida: flow regime / shellfish
- Concern: Atlanta growth and unconstrained water use
- "Share the pain" -- raised equity concerns
- Water quality not explicitly addressed
- Study: 15 years, hundreds of millions of $

Tri-State Water Wars: Lessons

- Stakeholders faithfully attended meetings, but concerns often not addressed
- Debate on which years to use as “normal”
- Need adaptive management -- not locked in for 50 years
- New representation brought in new issues:
  - FL: demand caps and minimum flows
  - GA: one or the other, but not both
- States telling other states what to do
- Technical-Policy issues (e.g., flow regime not flow rate)
- Kept extending deadlines
- Then fell apart -- going to Supreme Court

Georgia Drought Planning: Problem

- Drought most costly natural disaster in U.S.
- Georgia lacked state drought plan
- Local level plans had limited effectiveness
- Responsibility-shifting, complacency
- 1998-2002 worst drought on record
- Impacts > $1 billion/year
- Potential costs mitigated ~ $400 - $600 million/year

Georgia Drought Planning: Project

- Development of First State Drought Plan (funded by NSF, Ga Dept. Of Natural Resources), 2000-2003
- Worked directly with > 150 stakeholders, >30 agencies
- Main sectors: municipal, industrial, fish and wildlife, health, environmental, agricultural, hydropower, tourism
- Indicators: streamflows, groundwater levels, reservoir storage, precipitation (3, 6, 9, and 12 month anomalies)
- Triggers: implemented by climate division, linked with management actions; focus on outdoor water use restrictions

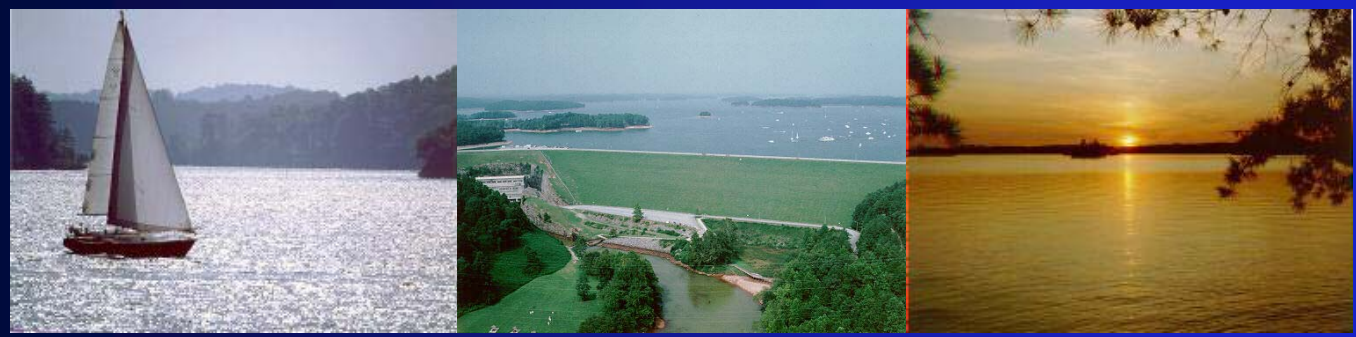
Category		Percentile
	Normal/Wet	0.50-1.00
0	Near-normal/dry	0.35-0.50
1	Level 1	0.20-0.35
2	Level 2	0.10-0.20
3	Level 3	0.05-0.10
4	Level 4	0.00-0.05

Georgia Drought Plan: Lessons

- Surprisingly high level of stakeholder and agency participation
- Lack of funding, lack of mandate; didn't really matter
- Preparing for drought while in a drought
- Coordination among agencies; clarified roles and responsibilities
- Vehicle for addressing water quality concerns
- Restrictions addressing relatively easy targets
- GA plan: sign to Florida and Alabama
- Drought plan prompted other activities (e.g., use of climate forecasts, development of statewide comprehensive water plan)

Lake Lanier Watershed Management: Problem

- Lake Lanier, Georgia. Major water supply source for Metro Atlanta
- Concerns about lake water quantity and quality
- Rapidly urbanizing area (Atlanta MSA 2000 pop. ~ 4 million; 40% increase since 1990; 60% increase expected by 2010)
- Multiple and often conflicting goals (navigation, hydropower, environmental, water supply, flood control, and recreation , fish and wildlife management)
- How best to manage the lake and watershed for the future?



Lake Lanier Watershed Management: Project

- Community Values and the Long-Term Ecological Integrity of Rapidly Urbanizing Watersheds: EPA Water and Watersheds Grant
  - Identify stakeholder concerns
  - Model lake ecological process
  - Develop ecological indicators for stakeholder concerns
  - Generate scenarios; Design policies
- Worked with Lake Lanier Association (~2,000 members); Upper Chattahoochee River Basin Group (~200 members); Water and ecology scientists
- Conducted presentations, workshops, focus groups, surveys
- How science can inform decision-making
- How stakeholder concerns can guide scientific inquiry

Lake Lanier Watershed Management: Lessons

- Different assessments of problem
  - Stakeholders -- wastewater treatment plant discharges
  - Decision-Makers -- development along lake
  - Scientists -- non-point source pollution
- Political framing of scientific issues
- Stakeholder concerns about research
- Trust, communication essential
- Support needed for watershed programs
- Interdisciplinary work just doesn’t “happen”

Water Resources Education: Problem

Educational needs for students of water resources:

- Real-world, hands-on experience
- Interdisciplinary problem solving
- Applying classroom knowledge to practice
- Learning “how to learn” (not just “what to learn”)
- Working with the public and decision-makers
- Communication skills -- writing, public speaking, interactions
- Understanding water from data collection to analysis to results
- Understanding water as part of water/ecological cycle
- Understanding societal context of science and engineering

Water Resources Education: Projects

- Problem-Based Learning: Sustainable Development Course
  - Students developed campus sustainability projects

    e.g., water conservation, pollution prevention, xeriscaping, stormwater management, integrated pest management, …
  - Students worked with decision-makers, implemented projects
  - Sustainability became central principle of campus master plan

- Service Learning: Water Resources Course
  - Students worked with water agencies, industries, and community organizations to address current water problems
  - Linked with K-12/minority educational outreach program

Water Resources Education: Lessons

- Students gained real-world experience and professional skills
- Students also acquired interdisciplinary problem-solving knowledge
- Community and agencies benefited from students' work
- Students motivated; felt they could "make a difference"
- Students learned that implementation is not automatic
- Institutional inertia can be strong; adoption and change take time
- Need to work with decision-makers; develop trust and credibility
- Need to demonstrate benefits and cost savings; precedents

Opportunities and Visions for the Center

- Strengths and Comparative Advantages of the Center
- Sustaining and Building upon Strengths of the Center
- Goals, Activities, and Future Directions

Strengths and Comparative Advantages of the Center

- Involvement with Agencies, Industries, Organizations, and the Public
- Research Addressing Current Problems
- Outreach and Education
- Strong Links Between Science and Application
- Interdisciplinary and Collaborative Work
- Comprehensive Resource for Water Information
- Training Students; Feeder to Professional Community
- Social Capital
- History of Accomplishments

Sustaining and Building Upon the Strengths of the Center

- Scientific Focus
- Relevance to PNW Problems and Issues
- Education, Outreach, and Partnerships
- Funding Opportunities

Scientific Focus

- Ecological function of urban streams
- Effects of urbanization
- Forest resources management
- Fish habitat protection and restoration
- Land use/land cover change
- Stormwater management
- Water resources and water quality assessments
- Biological, physical, and chemical processes in aquatic systems

Relevance to PNW Problems and Issues

- Urban Growth
- Environmental Management and Sustainability
- Fisheries
- Forests
- Endangered Species
- Water and Natural Resources Management
- Climate Change and Climate Variability

Education, Outreach, and Partnerships

- Research Applications to Current Problems
- Graduate Student Assistantships and Traineeships
- Graduate Student Theses and Dissertations
- Undergraduate Involvement
- Summer Projects
- Publications, Information, and Resources
- Training, Internships, Service Activities
- Innovative, Interdisciplinary Courses
- Partnerships (within and outside UW):
  - Prism, Earth Initiative, Program on Climate Change, …
  - Agencies, Industries, Foundations, Academia, Organizations, the Public ..

Funding Opportunities

Obtain Federal Funding (large multi-year grants)

- NSF - NEON (National Ecological Observatory Network)
- NSF - STC (Science and Technology Centers)
- NOAA - Coastal Zone Management
- NOAA - Water Resources Program (new)
- Other agencies

Continue Local Funding/Support

Use Funding for Ongoing and Expanded Activities in Research, Education, Outreach, and Problem-Solving

Goals, Activities, and Future Directions

- Generate International Recognition and Reputation
- Support Research and Application to Problem-Solving
- Bring Visibility to Departments, Schools, UW, and State
- Foster Interdisciplinary, Practice-Based Research and Education
- Promote Educational Outreach and Technology Transfer
- Enhance Student Recruitment, Financial Support, and Training
- Provide Greater Resources to Faculty
- Obtain Long-Term Sustained Funding Sources