Opportunities and Challenges of Transboundary Water Cooperation

Daene C. Mckinney
University of Texas at Austin

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Quantifying the Benefits of Transboundary Water Cooperation
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Outline
263 Transboundary Basins

- Africa: 59
- Asia: 58
- Europe: 73
- Latin America: 61
- North America: 17
- Oceania: 1
- ~ 1/3 shared by more than 2 countries
- 19 basins involve 5 or more countries:
  - 5 basins - 9 and 11 countries
  - Danube River - 18 riparian nations
  - 13 basins - 5 and 8 riparian nations

Problem: Water resources are becoming depleted, almost to the crisis level.
Transboundary Water Cooperation

• Nationally
  – Water rights and institutions are devised to rationally and equitably develop and use the resource

• Internationally
  – Water rights don’t exist between countries
  – Laws are enforced by international agreements between countries, not by an overarching authority
International Water Law

- Guidelines for sharing transboundary water
- Sharing Information
- Notifying and consulting with neighbors
- Utilizing water in equitable and reasonable manner
- Cooperating in use, development and protection
- Preventing significant harm
- UNECE Convention
  - “Convention on the Protection and Use of Transboundary Watercourses and International Lakes” (1992)
- UN Convention
Legal and Institutional Frameworks

- Member States (who are they?)
- Geographical Scope (what is covered)
- Functions (what does it do?)
- Organizational Structure
- Data Sharing, Exchange, and Harmonization
- Decision Making (how are decisions made)
- Benefit Sharing
- Participation (civil society, youth, private sector)
Some Examples

Syr Darya Basin

Rio Grande Basin

Water Stress ($m^3$/person/year)
Treaties on the Rio Grande

- **International Treaties**
  - 1906 Convention (US and Mexico)
    - Divided water above El Paso
  - 1944 Treaty (US and Mexico)
    - Divided water below El Paso

- **Inter-state Compacts**
  - 1938 Rio Grande Compact (Colorado, New Mexico, Texas)
  - 1948 Pecos River Compact (New Mexico, Texas)

- **National Law**
  - Mexican Water Law

- **State Law**
  - Texas Watermaster Rules

Delivery MX → US not less than 431.7 MCM/yr
Average flow = 486 MCM
Drought flow = 224 MCM
Opportunities in the Rio Grande Basin

• Equitability
  – Yes
  – Remember Colorado River (MX wants water)
  – MX Delivery over 5-yr cycle

• Reasonableness
  – Yes, but
  – Must recall 66% expected delivery reliability

• Avoid harm
  – Yes, but
  – Water deficits are damaging to farmers
Opportunities in the Rio Grande Basin

- Share information
  - Separate monitoring
  - Data is shared
  - Notification and Consultation, but new infrastructure is limited

- Joint projects
  - Two major international dams
  - Flood control system
  - Irrigation system improvements
  - Water quality improvements

- > 7 decades of cooperation
Challenges in the Rio Grande Basin

• No basin management plan
  – Simply fulfill the demands of users
  – No IWRM

• Over-allocation of water rights
  – Both countries issued excess water permits – none for past 20 years

• Major droughts
  – “Extreme drought” undefined
  – Allocation not based on % of flow
  – Last > 10 years
  – Not possible to satisfy treaty
  – MCM versus % of flow
Challenges in the Rio Grande Basin

• Participation and transparency
  – Slowly developing in the basin

• Poor water quality
  – Inadequate monitoring
  – Inadequate treatment

• Environmental flows
  – Not yet developed for the basin
  – Many protected areas

• Climate change
  – Some analysis, little planning

• Groundwater
  – Mostly unknown
River Basin Management

Shared Basin Data

Monitoring Point Description

Shared Basin Model

Scenario Simulations

Cooperative Allocation

Available Water in Groundwater Storage (Mln)
1992 Almaty Agreement

• Established Interstate Commission for Water Coordination (ICWC)
  – Includes all 5 Aral Sea basin countries
  – Covers 2 main rivers – Amu and Syr Darya
  – Determines regional water management policy
  – Regulates use and protection of transboundary water
  – Administers Basin Management Organizations

• Approved prior water allocations (% of flow)
• No harm clause
• Provision for “extremely dry years”
• Required information sharing
• Promotes joint research and efforts to resolve Aral Sea “problem”

ICWC founders (from left to right): M. Zulpuyev, N. Kipshakbayev, A. Ilamanov, A. Nurov, R. Giniyatullin, April 6, 1992, Ashkhaba
1998 Syr Darya Agreement

- Established management of Syr Darya cascade of reservoirs
  - Annual negotiation
  - Reservoir releases for irrigation
  - Surplus electricity delivered to Kazakhstan and Uzbekistan
  - Fuel compensation to Kyrgyz
- River Basin Organizations and Regional Electricity Grid Operator implement water releases and energy transfers
Opportunities and Challenges in the Syr Darya Basin

• *Despite 2 decades of cooperation, problems exist*

• No joint basin management plan
  – Short-term planning
  – Reservoir release schedules only
  – No comprehensive IWRM

• Water allocation based on previous regime
  – Prior allocations favor downstream countries
  – No analysis of adequacy, efficiency, or fairness of allocation
Opportunities and Challenges in the Syr Darya Basin

• 1998 Agreement
  – Deficient fuel deliveries to Kyrgyz
    • resulting in winter releases for heating
    • cause flooding in Kazakhstan
  – Hydrologic fluctuations not considered
    • Wet year – downstream demand decreased, store water in reservoir
    • Dry year – downstream demand increased, release water from reservoir
    • Storage services not valued

• Upstream development
  – New infrastructure not envisioned in agreements
  – Little analysis done
  – Little consultation or information sharing
Cooperation in Transboundary Basins

- **Non-cooperative** – countries maximize benefits through independent actions
  - Kyrgyzstan could (try to) generate all of its energy from hydropower
  - Downstream countries left to react to this

- **Cooperative** – countries maximize benefits through cooperation
  - 1998 Agreement and proposed revisions
    - Share water (releases and storage)
    - Compensated compromise (energy transfers) between summer irrigation and winter hydropower water uses
1998 Agreement - Implementation

- **Kyrgyzstan (KG):**
  - + Fuel to cover energy deficit
- **Uzbekistan (UZ):**
  - + Agricultural production
  - + Electricity from KG
  - - Gas for KG energy deficit
- **Kazakhstan (KZ):**
  - + Agricultural production
  - + Electricity from KG
  - - Coal for KG energy deficit

**Issues:**
- Different valuation for electricity
- Different costs for gas and coal
- Different net margins for agricultural production
Quantifying Benefits of Cooperation

- Model: Operations & Cooperation
- GAMS Optimization model of basin operation
- 10 years of flows
- Calculate benefits to various coalitions
- Game theory model of cooperation
Non-Cooperative Behavior

- Kyrgyzstan acts independently
  - Releases water to generate electricity to cover own energy demands
  - Does not release water for downstream use

- Why should Kyrgyzstan cooperate?
- Why should Uzbekistan or Kazakhstan cooperate? What would they gain?
Cooperative Behavior

How should countries share the increased benefits from cooperation?
Some Common Themes and Conclusions

• Multi-decade cooperation
• Performing monitoring
• Sharing (some) information
• Climate change planning
• Lack IWRM and basin plans
• Allocations need revision
• Treaty compliance difficult under hydrologic extremes
• Participation and transparency lacking
Some Common Themes and Conclusions

• Treaty terms undefined
  – “Extreme drought”
• Harm - not always avoided
  – Flooding
  – Deficit
• Environment neglected
  – Water quality
  – Environmental flows
• Groundwater under-utilized