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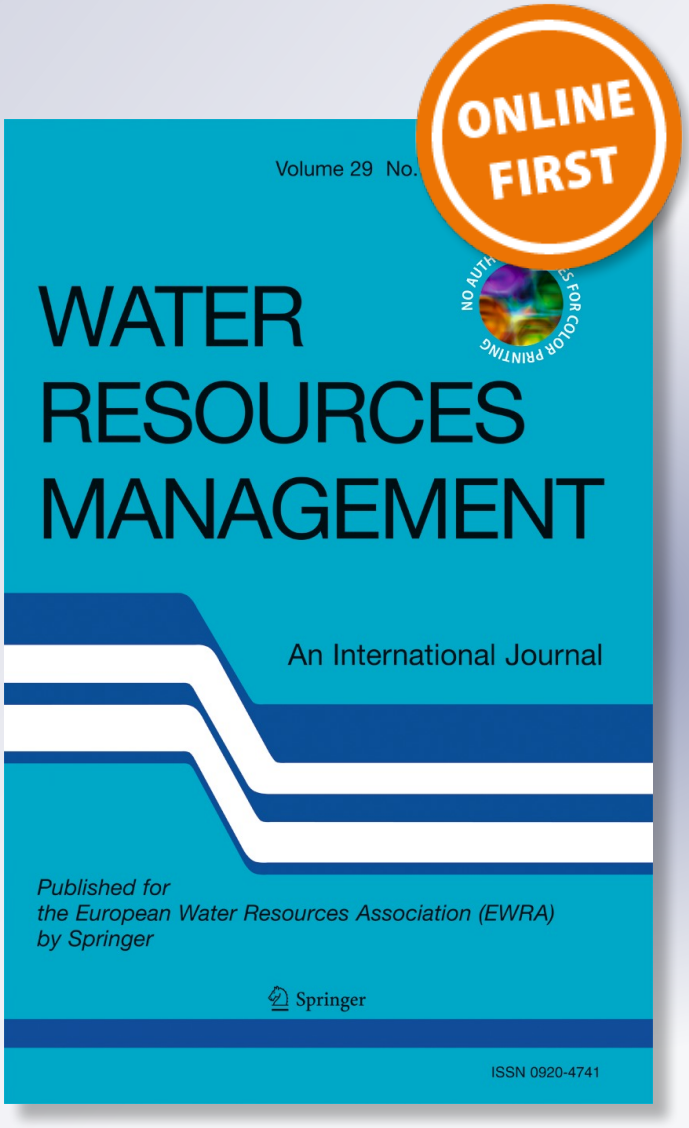

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Abstract This article examines governance, policy, and economic complexities of intergovernmental river basin management. The watershed or river basin approach is examined within the context of integrated water resources management as a means to efficiently manage interstate river systems. Organizational, institutional, and budget structures of watershed management models are explored and benchmarked with economic performance measures of prototypical river basin commissions in the United States. River basin organizations such as the Delaware River Basin Commission have the requisite authority under Federal/state compact to manage a river as a single entity provided financial structures are in place to sustainably fund water resources programs in interstate basins. To sustainably finance watershed programs, river basin governance organizations would benefit from revisiting the economic user pays principles long practiced in Europe, Latin America, and Oceania and advocated by the continental-scale European Union Water Framework Directive.

Keywords Watershed · River Basin · Water Policy

1 Introduction

Water is a renewable resource that is the most essential chemical in society and one of the few substances in nature without an economic substitute (Delli Priscolli and Wolf 2009). The waters of the United States provide over 260 billion gallons per day of water supplies (Kenny et al. 2009) with annual value of $21.4 billion. The Gallup Poll (2009) revealed the top four environmental problems among Americans concerned water quality including 80 % who cared a great deal/fair amount about drinking water pollution, river pollution, water contamination, and freshwater.

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Water may be the most pressing environmental concern of the 21st century as government institutions are being transformed by society's changes that call for sound principles of transboundary watershed management (Delli Priscolli and Wolf 2009). In 1962, the Harvard Water Program recommended an economic approach that would balance the benefits and costs of improved water quality under the authority of a river basin organization (Maass et al. 1962). The watershed approach later evolved to balance institutional objectives at the Federal, State and local levels and to provide consensus building among multiple stakeholders to address the water resources challenges of society (National Academy of Sciences 1999). Since watershed boundaries often do not align with political divisions, intergovernmental river compacts have been signed to share the flow of water and control water pollution (Cech 2005). In 1961, President John F. Kennedy and the governors of Delaware, New Jersey, New York, and Pennsylvania signed the Delaware River Basin Compact as one of the first models of Federalism or shared power in watershed management between the Federal government and states (Mandarano et al. 2008).

2 Objectives

The objectives of this research are to review the governance, policy, and economic complexities of the river basin approach to water resources planning and management and: (1) trace the evolution of watershed and river basin management, (2) examine various institutional models of intergovernmental water management such as interstate compact commissions, watershed councils, and international models, and (3) compare and contrast the various types of river basin commissions along with their respective institutional, organizational and budget structures.

3 River Basin Management

Water governance is a major ingredient in the effort to resolve water conflicts in nations and states throughout the world (Araral and Wang 2013). Water governance is defined as the "the range of political, social, economic and administrative systems that are in place to develop and manage water resources, and the delivery of water services, at different levels of society." The river basin management (RBM) approach has evolved to address "hydropolitics", a dynamic that Schmeier (2013) has defined as "the systematic study of conflict and cooperation between states over water resources that transcend international borders."

River basin management borrows from the principles of integrated water resources management (IWRM) as a multidisciplinary way to balance social, economic, and environmental river interests in a sustainable way (Hooper 2006; Delli Priscolli and Wolf 2009; GWP and INBO 2009). IWRM "promotes the coordinated development and management of water, land, and related resources within a basin to maximize the resultant economic and social welfare in an equitable manner without compromising the sustainability of vital ecosystems." IWRM emerged from the 1992 U.N. Conference on Environment and Development in Rio de Janeiro, 1997 UN Convention on Non-Navigational Uses of International Watercourses, 2000 with the UN General Assembly Millennium Goals Declaration (DeStefano 2010).

Transboundary river basin management is most successful when: (1) political commitment is directed from the highest levels in government, (2) basin management is governed by

national water policies/legislation, and (3) institutional roles/responsibilities are specifically defined. RBM has emerged as an efficient paradigm because the economies of scale provide benefits through compulsory water management (Wolf 2004). RBM is based on the principles of sound water law where water as a public good is essential to human survival and must be managed based on economic incentives (Dellapenna 2010a, b). River basin organizations can offer efficient river basin governance based on political, environmental, and socioeconomic parameters provided there is sufficient financial support and budgets to support operations and water policy coordination (Schmeier 2013).

In 2000, the river basin approach was unveiled on a continental scale with the European Union (2000) Water Framework Directive. The EU requires all 28 countries to prepare river basin plans to manage drinking water supplies for 500 million people or 7 % of the world's population (Heinz et al. 2007). By 2015, EU state must implement basin plans based on IWRM that employ economic principles such as polluter pays and benefit-cost analysis (de Kok et al. 2009). In June 2013, the 8th International Conference of the European Water Resources Association (EWRA) in Porto, Portugal renewed the call for an interdisciplinary river basin planning (Maia and Pereira 2015).

4 International River Basin Management

While practiced in only a dozen or so river basins in the United States, river basin management has longed been practiced internationally (Delli Priscolli and Wolf 2009). Over 400 international treaties and organizations (Schmeier 2013) govern 263 river basins (GWP and INBO 2009) that drain 45 % of the earth in 145 countries on five continents (Table 1). The United Nations Environment Programme (2008) has mapped the world's 23 major river basins that range from the Amazon in South America to the Zambezi in Africa (Fig. 1). Nations have established over 30 river basin management programs on the five continents from Africa, Asia, and Europe to the Western Hemisphere and the Americas (Table 2).

The more extensive forms of river basin management (Table 3) have long been practiced in Europe, Oceania, and Latin America (GWP and INBO 2009; Delli Priscolli and Wolf 2009). Since 1964, France has managed water through a network of six *Comites de Bassin* (Basin Committees) and *Agences de l'Eau* (Water Agencies) that collect user fees from polluters and dischargers and reinvest these revenues in watershed pollution control programs. The German Ruhr water associations (Genossenschaften) are authorized by Federal law and financed by user charges. The Dutch water boards (Polders) are among the oldest democratic institutions in Europe and are composed of landowners (farmers) who vote and pay taxes to the board. In the 1980s, Portugal created 15 river basin authorities to regulate water use and collect funds based

Table 1 International river basins (Schmeier 2013; GWP and INBO 2009)

Continent	Basins	% of Area
Africa	59	62
Asia	57	39
Europe	69	54
North America	40	35
South America	38	60
	263	45

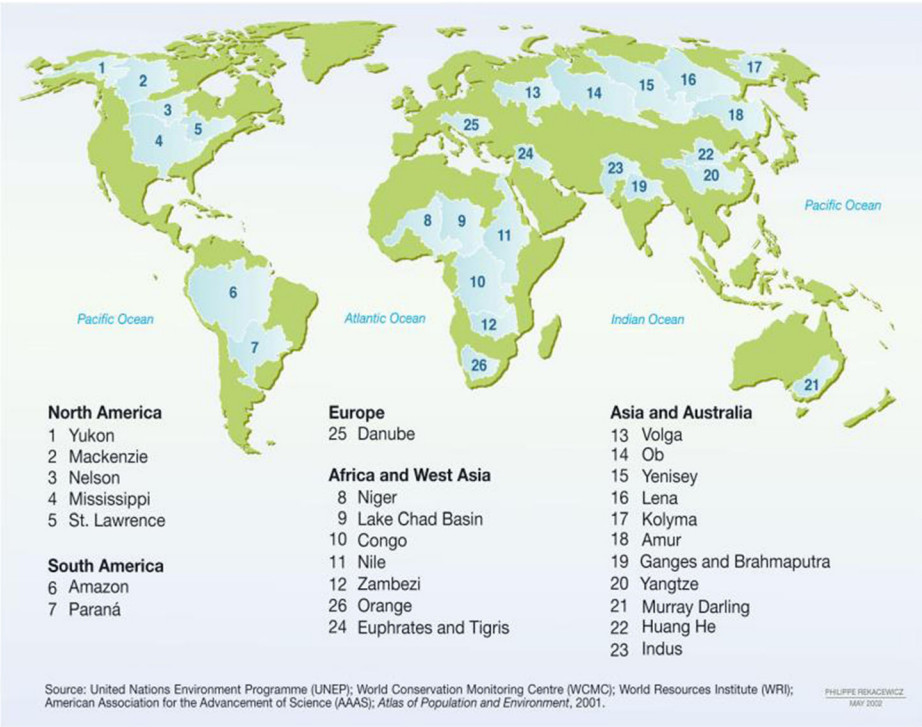

Fig. 1 Major river basins around the world (UNEP 2008)

on water user and polluter (discharger) pays principles. During the 1980s, the British National River Authority was formed to regulate catchment management by a 15 member board responsible for eight river basin regions. The Spanish Ministry of Public Works oversees nine *Confederaciones Hidrograficas* each with a secretariat of a water commissioner, technical staff, and Secretary General funded by water use charges and discharge fees. The Russian Ministry of Natural Resources coordinates five Volga River Basin agencies with funding by a user/polluter pays approach. Mexico has 25 river basin councils, 6 basin commissions, and 2 basin committees including the Lerma Chapla River Basin Council created in 1993 from the National Water Law. In 1985, the Murray Darling Basin Ministerial Council in the provinces of New South Wales, Queensland, South Australia, and Victoria organized along the lines of the DRBC and is governed by two commissioners, 40 technical staff, and a 26 member Community Advisory Council (Wolf 2005). In 1991, New Zealand replaced more than 800 governmental units with 12 regional water catchment councils to coordinate three central agencies and 74 district or city authorities.

5 The Watershed Approach

Water and federalism are a complicated mix as water flows through the hydrologic cycle without regard to political boundaries (Mandarano et al. 2008). Except for a few states such as Virginia and West Virginia and Idaho and Montana (Fig. 2), watershed and political boundaries often do not coincide (Kauffman 2002). Where political jurisdictions do not follow hydrologic

Table 2 River basin programs in continents throughout the world (GWP and INBO 2009)

Country	River Basin Program	Year
Asia/Oceania		
Australia	Murray-Darling Basin Authority	2008
China	Changjiang (Yangtze) Water Resources Commission	
India	Sabarmati River Basin (Narmada Water Disputes Tribunal)	1979
Laos, Thailand, Cambodia, Viet Nam	Mekong River Basin Commission	1995
Sri Lanka	Kala Oya Basin Mahaweli Authority Organization	2001
Africa		1999
Algeria	Algerian Hydrographical Basin Agencies	1990s
Burkina Faso, Ivory Coast, Ghana, Togo	Volta Basin Technical Committee	2004
Chad, Egypt	Lake Chad Basin Commission	1960s
Ghana	Ghana River Water Resources Commission	1998
Kenya, Malawi, Mali, Senegal, Zambia	International Commission for Congo-Oubangui-Sangha Basin	
Lesotho, South Africa, Bitswana, Namibia	Orange-Senqu River Commission	2000
Mali, Senegal, Mauritania, Guinea	Organisation for Development of the Senegal River	1972
Morocco	Er Rbia River Basin Agency	1995
Senegal, Gambia	Organisation for Development of the Gambia River	1978
Europe		
Belgium	Walloon Region Water Pricing Framework	2010
France	Six Agencies de L'eau (River Basin Committees)	1964
Germany	Ruhr Association	
Hungary, Ukraine, Serbia, Bulgaria	International Commission for Protection of the Danube River	1986
Romania	Romanian National Waters Administration (Apele Romane)	1996
Russia, Kazakhstan	Irtysh River Basin Information System	2000
Spain	Jucar River Basin Organisation	2006
North America		
Canada	Quebec Water Policy (33 rivers)	2002
Canada and USA	International Joint Commission	1909
Mexico	Yucatan Peninsula Basin (National Water Commission)	2004
South America		
Argentina	Mantanza Riachuelo River Basin Authority	2006
Bolivia, Brazil, Colombia,Ecuador	Amazon Co-operation Treaty Organisation	
Brazil	Committee for Hydrographical Basin of River Paraiba do Sul	1997
Costa Rica	Costa Rica Environmental Waste Canon	2005
Ecuador	Mancomunidad de la uenca del Rio Jubones	
Guatemala	Authority for Management of Lake Izabal/River Dulce Basin	1998

lines, water managers face complex institutional and governance challenges and competition for water supplies (Sharpe 1999; Cody and Carter 2009). Watersheds include many state, provincial, and local governments and this often results in inefficient and contentious use of the water resource.

Table 3 River basin management organizations around the world (GWP and INBO 2009; Delli Priscoli and Wolf 2009)

Country	Description	Funding
France	Six water basin agencies (*Agencies de L'eau*)	Users fees from polluters/dischargers
Germany	Ruhr water associations (*Genossenschaften*)	User charges
Great Britain	National River Authority, 15 member board	Privatized w/collection of user fees.
Netherlands	Dutch water boards (Polders)	Water board tax
Portugal	15 river basin authorities	Water use, polluter (discharger) pays fees
Russia	Ministry of Natural Resources, 17 river basin agencies	User and polluter pays approach.
Spain	Nine basin authorities (*Confederaciones Hidrograficas*)	Water charges, discharge fees
Australia	Murray Darling Commission (Basin Ministerial Council)	
New Zealand	12 regional catchment councils	
Mexico	National Water Commission, 25 river basin councils	User fees

For instance, the 13,000 mi^2 (33,700 km^2) Delaware River Basin in Delaware, New Jersey, New York, and Pennsylvania presents unique challenges because each of the four states and dozens of counties and hundreds of cities and towns administers their own set of disparate water quality regulations, stormwater ordinances, and policies. Because the governments have different agendas, it can put them in dispute with upstream or downstream neighbors leading to conflicts that may be resolved by public managers through the principles of watershed management.

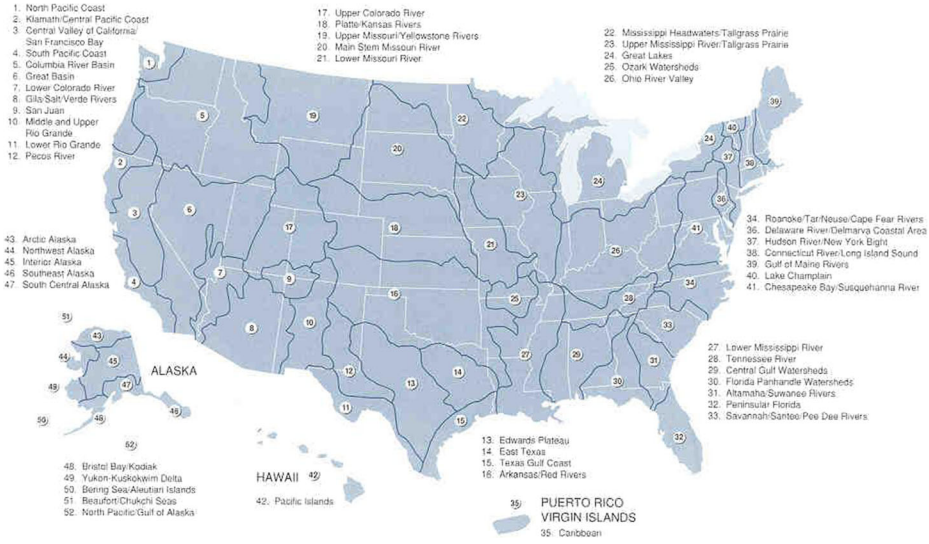

Fig. 2 Watershed and political boundaries in the United States (Kauffman 2002)

At "Drinking Water 2001", a public policy forum sponsored by the University of Delaware, keynote speaker and environmental journalist McKay Jenkins (2002) described this dilemma:

> … What I would like to do today is try and expand our notion of the importance of watersheds to talk about borders and flow in a larger context. Ecologists and drinking water experts have long acknowledged the silliness—not to say utterly counter-productive, and potentially destabilizing notion—of political boundaries when it comes to the flow and distribution of water. What does a county line mean to an aquifer? What does a state line mean to a raincloud? What does a national border mean to a river? … The point I want to make here is that any effort to reject the permeability and flow of boundaries, be they natural or psychological, runs against the natural way of things. Water wants to flow—it's in the nature of water. People want to flow—it's in the nature of people. … Finally, … in some places in the country, we are beginning to think in terms not of boundaries, but in terms of watersheds, and flow.

The word for watershed was derived from the 14th century German *wasser-scheide* or "water parting" (Reimold 1998). Also defined as a crucially important event, the watershed is the region draining into a river or water body. The English word for watershed did not become common until about 1800 (Oxford English Dictionary 1978). The U.S. Environmental Protection Agency (1999) described the watershed approach as "a coordinating framework for environmental management that focuses public and private sector efforts … within hydrologically defined geographic areas taking into consideration both ground and surface water flow." A basin or watershed in the United States or catchment in the British Commonwealth is the surface water or groundwater that flows into a common terminus (Delli Priscolli and Wolf 2009).

The watershed approach is a beneficial and efficient form of governance because it: (1) moderates competing uses between upstream and downstream stakeholders, (2) balances institutional objectives at the Federal, State, and local levels, (3) involves a consensus decision-making approach among stakeholders and citizens, (4) incorporates multidisciplinary thinking from the fields of science and policy, (5) provides for cost sharing among watershed stakeholders for cost-effective solutions, and (6) relies on voluntary and mutual partnerships, not mandatory command and control regulations (National Academy of Sciences 1999; Sherk 2005).

On the other hand, watershed planning and management is challenging and complex because: (1) diverse interest groups often cannot agree on a unified watershed master plan, (2) hydrologic and political boundaries often do not coincide leading to political conflicts, (3) the process can be slow and complex as stakeholders often withdraw waiting for action, and (4) fragmented authority leads to conflicts between insular Federal, State, and local entities.

River management based on watersheds reaches back over two centuries (Table 4) to the formative years of the United States (Hooper 2010; Cech 2005; Delli Priscoli 1976). In 1783 just after the American Revolution, New Jersey and Pennsylvania signed the first interstate compact to resolve a conflict about navigation rights along the Delaware River. Colorado River explorer John Wesley Powell (1878) recommended delineating new states based on watershed boundaries and for this belief he lost his job as the second director of the USGS. In 1889, Powell spoke to an unsupportive audience at the Montana Constitutional Convention in Helena about mapping the new state's county boundaries "…which would be convenient with drainage basins" (Kemmis 2001).

Table 4 River basin initiatives in the United States

Date	Action	Description
1783	Delaware River Compact	After Revolutionary War, NJ and PA signed first interstate compact for navigation.
1879	Mississippi R. Commission	Congress passed law to address flooding concerns during westward migration.
1899	Rivers and Harbors Act	Corps of Engineers regulate dumping/dredging along navigable rivers in the U.S.
1902	Reclamation Act	Pres. Roosevelt created Bureau of Reclamation to construct irrigation projects in west.
1909	Boundary Waters Treaty	U.S. and Great Britain establish International Joint Commission in Great Lakes.
1922	Colorado River Compact	Pres. Harding and governors sign interstate accord in CO, NM,UT, WY, AZ, CA, NV.
1925	River Basin Study (308) Act	Corps of Engineers completes comprehensive "308" river basin studies in the U.S.
1933	Tennessee Valley Authority	Generates hydropower in Appalachia as first river based regional development agency.
1940	Potomac River Commission	Congress, DC, MD, PA, VA, and WV form first river basin compact in mid-Atlantic.
1946	Brandywine Valley Assn.	30 people from PA and DE form first small watershed association in America.
1947	NEIWPCC	CT, ME, MA, NH, NY, RI, and VT control water pollution in New England.
1948	Water Pollution Control Act	First water quality law in 50 years. Funded states to reduce water pollution.
1948	ORSANCO	IL, IN, KY, NY, OH, PA, VA, WV address water pollution in Ohio River basin.
1961	DRBC Compact	Signed by JFK, governors of DE, NJ, NY, PA as first Federal-state water accord.
1965	Water Resources Planning Act	Creates White House Water Resources Council, Title II interstate river commissions
1969	Nebraska Natural Res. Districts	Unicameral legislature consolidated 500 drainage offices to 24 watershed-districts.
1970	EPA	Nixon issued EO combining environmental protection under one cabinet office.
1972	Florida Water Resources Act	Florida legislature created 5 water management districts along hydrologic basins.
1972	Clean Water Act amendments	Required fishable/ swimmable waters by 1983, eliminate discharges by 1985.
1983	Chesapeake Bay Agreement	EPA, DC, MD, VA, PA sign voluntary pact to clean up Nation's largest estuary.
1987	National Estuary Program	Congress authorized EPA to establish 28 NEP programs i.e. Del. Estuary Program
2008	Great Lakes–St. Lawrence	Compact signed by IL, IN, MI, MN, NY, OH, PA, WI, and Ontario and Quebec.
2010	Apalachiola-Chaatahootchee	AL, FL, and GA negotiating compact to address the drought conflicts of 2010.

At the turn of the 20th century, Congress passed the Rivers and Harbors Act of 1899 that authorized the U.S. Army Corps of Engineers to regulate dumping, dredging, and construction

along navigable rivers. The Reclamation Act of 1902 authorized Theodore Roosevelt to create the Bureau of Reclamation under the Secretary of Interior to construct irrigation and reservoir projects in the arid lands west of the100th Meridian. To control water diversion along the U.S./Canada border in the Great Lakes, the U.S. and Great Britain signed the Boundary Waters Treaty of 1909 that established the International Joint Commission (Galloway and Clamen 2001).

After the First World War, the U.S. turned to domestic concerns during the "Roaring Twenties". President Warren G. Harding, Secretary of Commerce Herbert Hoover, and seven governors signed the Colorado River Compact of 1922 that appointed the Secretary of Interior as the supreme Federal authority to apportion water between upper basin (Colorado, New Mexico, Utah, and Wyoming) and lower basin (Arizona, California, and Nevada) states (Gelt 2001). Congress passed the River Basin Study Act of 1925 authorizing the Corps to complete Section 308 studies that later led to the creation of river basin commissions such as the DRBC.

FDR's New Deal was designed to lift the nation from the Great Depression and it led to vigorous public works programs in many river basins. In 1933, Congress created the Tennessee Valley Authority to address poverty in Appalachia and produce hydroelectric power as the first river basin regional development organization in the U.S. (Feldman 2001). The economic success of TVA led to proposals after World War II to create 10 more river authorities but Congress never acted as Federal and state interests feared losing power to this "huge government bureaucracy". After the Dust Bowl, the Flood Control Act of 1936 for the first time required cost-benefit analysis and consideration of social benefits for federal river basin projects. In 1936, Congress approved a compact by New York, New Jersey, and Connecticut to form the Interstate Sanitary (now Environmental) Commission (IEC) to enforce water quality regulations in the Hudson River, East River, and Long Island Sound. In 1940, Maryland, Pennsylvania, Virginia, and West Virginia formed the Interstate Commission on the Potomac River Basin (ICPRB).

The nation returned to water resources management after World War II as populated rivers like the Delaware and Columbia were heavily polluted by industrial wastes discharges during the war effort. In 1946, 30 people from West Chester, Pennsylvania and Wilmington, Delaware got together to form the Brandywine Valley Association as America's first small watershed organization (Kauffman 2002). In 1947, Congress consented to a compact between the six New England states plus New York State to create the New England Interstate Water Pollution Control Commission. With the first water quality legislation in 50 years, Congress passed the Federal Water Pollution Control Act of 1948 (amended in 1956) that funded states to improve water quality, prepare pollution control studies, and construct wastewater treatment plants. In 1948, Illinois, Indiana, Kentucky, New York, Ohio, Pennsylvania, Virginia, and West Virginia formed the Ohio River Valley Water Sanitation Commission to reduce water pollution in the largest river basin in the East.

With the turbulent '60s came the environmental movement. JFK was persuaded by Pennsylvania Governor David Lawrence to overrule Secretary of Interior Stewart Udall's concerns about unconstitutionality of treaties between the states and signed the 1961 Delaware River Basin Compact on the basis of comity between Delaware, New Jersey, Pennsylvania, and New York as the first shared Federal-state water accord (Albert 1988; Albert 2009). In 1965 after years of consideration by JFK, Lyndon Baines Johnson signed the Water Resources Planning Act (WRPA) which formed the Water Resources Council in the White House to advise the President on water resources matters. In 1967, Congress amended the WRPA to establish Federal/state Title II interstate river basin commissions in the New England, Great Lakes, Ohio, Upper Mississippi, Missouri, and Pacific Northwest basins. In

1968, LBJ signed the Wild and Scenic Rivers Act to protect "outstandingly remarkable" free flowing rivers as wild, scenic, and recreational. In 1969, Richard Milhous Nixon assumed office and signed the National Environmental Policy Act (NEPA) that created the Council on Environmental Quality (CEQ), designated the Federal government as "Protector" of environmental resources, and required Environmental Impact Statements (EIS) for federal projects.

Earth Day was first observed in April 1970 and later that year Richard Nixon issued an Executive Order that created EPA while the states formed parallel agencies such as DNREC, NJDEP, PADNR, and NYSDEC. Based on the early success of the DRBC, the United States, Maryland, New York, and Pennsylvania formed the Susquehanna River Basin Commission in 1970. Congress overrode Nixon's veto and passed the Federal Water Pollution Control Amendments (Clean Water Act) of 1972 that established water quality standards and pollution discharge permits. The 1977 CWA amendments required states to meet fishable and swimmable uses by 1983 and eliminate pollutant discharges by 1985. Section 208 of the CWA required that states form area-wide water pollution planning agencies, one of which became the Water Resources Agency for New Castle County, Delaware.

During the Reagan era (1980–1988), political power decentralized from the Federal government to the states and a new "flexible federalism" ensued where the federal and state governments shared more responsibilities through the watershed approach (National Academy of Sciences 1999). In 1981 Ronald Reagan terminated the Water Resources Council and defunded the Title II river basin commissions. In 1983, EPA and the District of Columbia, Maryland, Virginia, and Pennsylvania signed the voluntary Chesapeake Bay Agreement to clean up the nation's largest estuary and reduce water pollution in the vast 64,000 mi^2 (166,000 km^2) watershed. The Safe Drinking Water Act of 1986 and amendments in 1996 set enforceable drinking water standards including a wellhead protection program and source water protection program. The Water Quality Act of 1987 was the first Federal law to control urban stormwater pollution and required states to submit a biannual Section 303d list of impaired streams to EPA and develop watershed Total Maximum Daily Loads (TMDLs) as a "pollution diet" to clean up polluted streams which do not meet water quality standards. The 1987 CWA amendments authorized EPA to establish the National Estuary Program where 28 partnerships such as the Delaware Estuary Program coordinate Federal, state, and estuary restoration activities on a watershed basis.

During the 1990s, the EPA (1995) unveiled the Watershed Protection Approach as a way for the states to meet the goals of the Clean Water Act. Congress commissioned a National Academy of Sciences (1999) study that concluded hydrologic basins provide a logical framework for regional water management by integrating water science (physical sciences) and policy (social sciences). With the rise of the EPA watershed approach in the 1990s, hundreds of informal, grass roots watershed councils and associations (built on the 1946 BVA model) formed to provide a basin focus to water resources management. In 1997, New York City negotiated an agreement with EPA under the Safe Drinking Water Act to eventually spend $1.5 billion to reforest and restore farms on 105,000 acres of watershed land in eight counties above the Catskill Reservoirs in the upper Delaware Basin instead of spending $10 billion on a microfiltration plant near the Bronx (Meehan 2010). Alabama, Florida, and Georgia signed the 1999 Alabama-Coosa accord as one of the last interstate river basin compacts in the U.S.

The watershed approach became more widespread at the turn of the 21st century when EPA (2002) released a "Renewed Commitment to Watershed Management" as an environmental guiding principle. The U.S. Army Corps of Engineers developed a Civil Works Program

Strategic Plan (FY2003-2008) that urged a comprehensive watershed approach to manage the nation's water resources. In 2003, the Christina Basin Clean Water Partnership between the DRBC, EPA, and Delaware and Pennsylvania was awarded a $1 million EPA Watershed Initiative Grant as the No. 1 ranked grant among over 200 applications received throughout the United States (Ernst 2005). The U.S. Commission on Ocean Policy (2004) recommended a regional watershed approach to manage the nation's coastal, estuary, and ocean resources. A National Water Policy Dialogue sponsored by the American Water Resources Association in 2005 reinforced the need to embrace interstate watershed management.

The Interstate Council on Water Policy (2006) announced a "rediscovery" of watershed planning and "renewed interest" in multistate river basin institutions to manage transboundary water resources. In 2009, the Congressional Research Service (CRS) called for reconsideration of a proposal to form a nation-wide network of river basin commissions to resolve the 21st century challenges of watershed management (Cody and Carter 2009). The CRS concluded that water resource projects are authorized in a piecemeal fashion and recommended reinvigorating the river basin approach as originally envisioned by the now disbanded 1965 U.S. Water Resources Council.

Watershed management has been assumed by the sharp rise in local environmental groups, at last count there were 132 of these organizations on the Delmarva Peninsula and over 16,000 local environmental groups in the U.S. (Kempton et al. 2009). By 2010, the Milwaukee Metropolitan Sewerage District and Conservation Fund spent $13.4 million to create a Milwaukee Sweetwater Trust that promotes green watershed BMPs such as rain barrels, vegetated swales, cisterns, and green roofs to reduce stormwater flows (Meehan 2010). Alabama, Florida, and Georgia negotiated a compact for the Apalachicola-Chattahoochee-Flint (ACF) river basin to address the after effects of the drought of 2010.

Tracy Meehan (2010), former EPA Administrator for Water, wrote that the problems of complying with the Clean Water Act are not those of science and technology but rather of governance and maintained that a new watershed approach was needed to address water resources problems in the United States. Meehan saw collaboration as a central theme of "symphonic watershed governance" to balance the interests of governments and stakeholders and concluded that river basin commissions are ideally suited to manage watersheds because they were formed by Congress and state legislatures as "sovereign entities unto themselves".

In 2010, a bill was introduced to Congress to establish an Office of Sustainable Watershed Management in the White House to fund 10 regional watershed boards to cover the United States and coordinate public/private interests in water resources planning and management. The watershed boards would be co-chaired by federal and state representatives with membership from interstate agencies, tribes, local governments, and industries. The bill was tabled by the House of Representatives due to concerns about the Federal budget.

6 River Basin Governance

Under Federalism and the Constitution, the United States has a federal government that shares power with the sovereign states. The Federal government has long possessed central power over interstate waters and the states have maintained power over intrastate waters (Delli Priscolli and Wolf 2009; National Water Commission 1973). Since watersheds often do not coincide with political boundaries, river basin organizations have evolved for Federal and state governments to share power over interstate waters. The challenge of interstate water

management comes from lack of a national water resources policy, fragmented Federal/state regulation, squabbles over federal/state sovereignty, population growth, and extreme weather events (Mandarano et al. 2008). For a century, the Federal government has experimented with many forms of interstate river basin organizations such as single federal administrators, regional authorities, interstate watershed councils, Title II interstate basin commissions, and interstate compact commissions (Table 5).

Single Federal Administrator Under the Colorado River Compact, Congress designated the Secretary of Interior as the sole Federal authority to allocate the waters of the six states in this vast western basin. This is a strict top-down, command and control approach to basin governance as the lines of authority are clear and definitive, decision-making is responsive, and a single leader provides the focal point for all planning, policymaking and implementation. However, the single administrator is usually focused on a single issue that leads to shortcomings in "intergovernmental collaboration and shared stewardship/ decision-making authority".

Regional Authority To address crippling poverty in Appalachia, in 1933 Franklin Delano Roosevelt signed the law that created the Tennessee Valley Authority as the only true Federal river basin regional development organization in the U.S. The TVA's strengths as a strong centralized authority allow it to minimize intergovernmental coordination needs and allow projects to be implemented efficiently by a single agency. Weaknesses include a "command and control" approach with reluctance to employ checks and balances with little consensus by the public and too much reliance on the federal government.

Table 5 River basin governance organizations in the United States ((ICWP 2006; Wolf 2004; Cody and Carter 2009)

Type	Description	Strength	Weakness	Example
Single Federal Administrator	Sole federal official (Sec. of Interior) has authority over watershed	Line of authority clear More power to Federal government	Single administrator focused on single issue. Less power to states	Colorado River Compact (1922)
RegionalAuthority	Centralized regional governmental agency.	Projects implemented efficiently by single agency	Reluctant to employ checks/balances. Undue reliance on federal govt.	Tennessee Valley Authority (1933)
Watershed Councils	Agreement by states through federal/state legislation or MOA	Good collaboration with public. Consensus driven, businesses friendly.	Lack formal legalpower. States only members (little Federal role).	Chesapeake Bay Partnership (1983)
Title II Interstate-Basin Commissions	Organizations directed by commissions, each member had one vote	Manage water resources in integrated basis. States equal to Federal govt.	Added layer of government. Competes with Federal water funds.	NE, Great Lakes, Ohio, Mississippi, Missouri Basins
Federal-State Basin Compact Commissions	Congress must address Constitutional concerns about interstate treaties	Builds trust. Utilizes comity, collegiality, minimizes disputes.	Surrender sovereignty to third party. Compete for Federal/state funding	Delaware River Basin Commission

Watershed Councils Loosely organized informal groups such as the Christina Basin Clean Water Partnership are composed of elected officials, staff, nonprofit environmental groups, and the public to coordinate water management issues. These grass roots councils are run with "soft management authority" in planning, coordination, and advocacy with less power than a compact authority. With the rise of the EPA watershed approach in the 1990s, hundreds of grass roots watershed councils formed to be less formal than a commission and lack formal legal enforcement power but are able to collaborate with the public, are consensus driven, and are non-threatening to stakeholders and businesses.

Title II Interstate Basin Commissions After years of pushing by JFK, President Lyndon Baines Johnson signed the Water Resources Planning Act of 1965 that recommended forming a network of interstate river basin commissions with the Federal government as chair and each Federal and state member with one vote Mandarano et al. (2008)). WRPA amendments in 1967 funded new Federal/state Title II commissions for the New England, Great Lakes, Ohio, Upper Mississippi, Missouri, Pacific Northwest river basins. In 1981, Ronald Reagan cut Federal funding for the Water Resources Council and then terminated funding for the Title II river basin organizations which led to their demise. Water policy scientists have called for resurrecting the Water Resources Planning Act and reestablishing river basin commissions throughout the U.S. to address 21st century water problems (Reuss 2003).

7 Interstate River Basin Commissions

Since large rivers tend to flow between the states and watersheds do not usually align with political boundaries, interstate compacts have been signed to share the flow of water and control water pollution (Cech 2005). Established by treaties between the Federal and state government, basin commissions often possess the most authority of the river governance models as they are compulsory, established by formal government legislation, and have a permanent office staff (secretariat) who manage the river system as a single entity (Global Water Partnership and International Network of Basin Organizations 2009).

Interstate compacts are legal agreements between the states that provide a joint federal-state response to water resources problem to manage water resources (GAO 2007; Dellapenna 2010a, b). Successful Federal-state compacts offer complimentary approaches to solving interstate water management issues and are based on comity or collegiality that builds equal trust between state partners and minimizes disputes (Mandarano et al. 2008). Commissioners have one state-one vote authorities, with members from each state and federal representatives appointed by the President. River basin commissions employ independent technical staff and are decentralized institutions that balance state autonomy with Federal supremacy in water resources management (Hooper 2006). Section 106 of the Clean Water Act provides EPA funding to river basin commissions for interstate water management (Meehan 2010). These compact commissions are neither the federal or state government and are often labeled as a third level of government (Featherstone 1999). The Government Accountability Office (2007) reported to Congress that interstate compacts are effective in the areas of organization, authority, accountability, and conflict resolution.

Compacts are governed by a commission and require consent of Congress because the interstate commerce clause (Article 10) and non-delegation principle of the U.S. Constitution prohibits treaties (compacts) between the states without Federal approval (Sherk 2005).

Congress can delegate authority for the compact to a Federal agency provided there is "an intelligible principle" for the agency's interest.

Over a dozen interstate river basin compacts (Table 6) have been signed in the United States (Cech 2005; U.S. Fish and Wildlife Service 2005; GAO 2007). In 1783, Maryland and Virginia signed an accord to resolve fishing and navigation conflicts along the Potomac River President Warren G. Harding and seven governors signed the Colorado River Compact of 1922 as the first interstate water supply allocation agreement. Between 1923 and 1939, compacts were signed for the South Platte and Rio Grande river basins.

East of the Mississippi, Federal and state governments formed seven congressionally-approved interstate basin compacts with roles in conflict resolution, regulation, water quality, flood mitigation, and water supply regulation. Congress established the Interstate Commission on the Potomac River Basin in 1940 as the Mid-Atlantic's first basin compact to help the District of Columbia, Maryland, Pennsylvania, Virginia, West Virginia and Federal government manage the Potomac through regional and interstate cooperation. The Interstate Environmental Commission (1936), New England Interstate Water Pollution Control Commission (1947), and Ohio River Valley Water Sanitation Commission (1948) are single purpose basin organizations that focus on water pollution. The success of the 1961 DRBC Compact led the President and Governors of Pennsylvania, Maryland, and New York to sign the 1970 Susquehanna River Basin Compact. The DRBC and SRBC compacts "were ahead of their time" in managing a river on a watershed basis without regard to political boundaries (Abdalla et al. 2010). The Council of Great Lakes Governors compact governs the Great Lakes Commission (2008) as a comprehensive multiple purpose agency involved in most areas of water management.

Interstate Environmental Commission The IEC was formed in 1936 as the Interstate Sanitation Commission by a congressional compact between New York, New Jersey, and Connecticut to enforce water quality regulations around New York City with a population of 20 million people. IEC operates with a staff of 12 with a $1 million budget with 56 %

Table 6 Interstate river basin compacts in the United States (ICWP 2002; Cech 2005; USFWS 2005; GAO 2007, and Abdalla et al. 2010)

Adopted	River	States	Purpose
1783	Delaware	NJ, PA.	Navigation
1783	Potomac	MD, VA	Navigation/Fishing
1922	Colorado	WY, CO, UT, NM, AZ, NV, CA	Water Quantity
1923	South Platte	NE, CO	Water Quantity
1939	Rio Grande	CO, NM, TX	Water Quantity
1940	Potomac	MD, PA, VA, DC	Water Quality
1948	Ohio	IL, IN, KY, OH, NY, PA, VA, WV	Water Quality
1949	Connecticut	CN, MA, NH, VT	Flood Control
1961	Delaware	DE, NJ, NY, PA	Water Development
1970	Susquehanna	MD, NY,PA	Water Quantity/Flooding
1999	Alabama-Coosa	AL, FL, GA	Water Quantity
2008	Great Lakes	IL, IN, MI, MN, NY, OH, PA, WI, OT	Water Quality
Negotiating	Apalachicola-Chata	AL, FL, GA	Water Quantity

from Federal sources (EPA) and 44 % from state appropriations. The IEC is governed by 12 commissioners from New Jersey (three seats), New York (four seats), and Connecticut (five seats).

Interstate Commission on the Potomac River Basin The ICPRB was established by Congress in 1940 to protect, and conserve the Potomac River and its tributaries through regional and interstate cooperation. The Commissioners are the District of Columbia and Maryland, Pennsylvania, Virginia, and West Virginia. The United States participates in but never signed the compact. The IPRB annual budget is $2.3 million with 43 % from Federal sources and 57 % from grants and fees. The ICPRB staff of 23 has limited regulatory authority over a 14,760 mi^2 (38,260 km^2) basin with 6.1 million people in the Washington, D.C., metropolitan area.

New England Interstate Water Pollution Control Commission The NEIWPCC was created in 1947 to manage a 14,700 mi^2 (38,100 km^2) area with a population of 6 million in the six New England states plus New York State. The NEIWPPC has 13 staff with an annual budget of $10.8 million with 53 % from Federal sources (mainly EPA), 19 % from grants, and 11 % from state funding. NEIWPCC is governed by 33 commissioners with five from each state except Rhode Island which has three commissioners.

Ohio River Valley Water Sanitation Commission ORSANCO was formed in 1948 by Illinois, Indiana, Kentucky, New York, Ohio, Pennsylvania, Virginia, and West Virginia to control water pollution in the Ohio River basin. ORSANCO enforces water quality standards in a 154,000 mi^2 (399,183 km^2) basin with 21.7 million people. ORSANCO has 24 staff and an operating budget of $3.8 million with 61 % from Federal (mostly EPA) sources and 35 % from state appropriations. ORSANCO is governed by 25 commissioners from Illinois (three commissioners), Indiana (3), Kentucky (3), New York (3), Ohio (2), Pennsylvania (3), Virginia (3), West Virginia (3), and the Federal government (2).

Delaware River Basin Commission DRBC was created by President John F. Kennedy in 1961 with five commissioners representing the President and governors of Delaware, New Jersey, New York, and Pennsylvania. With the DRBC Compact came a shift in managing water resources—the creation of a single collaborative agency where each state shares equal responsibility for managing the river and its watershed without regard for political boundaries (Abdalla et al. 2010). The DRBC was the first Federal/state regional water agency united to manage a river basin without regard to political boundaries (Gore 2012). The DRBC Compact creates opportunities for coordination not available in other basins without a regional compact (Warren 2003). The DRBC governs the basin by equity (one state, one vote) and a majority vote is needed to decide most issues. The commission holds public bimonthly meetings, hearings, and advisory committee meetings to discuss and resolve basin project, regulatory, and budget matters. The DRBC Compact states:

> Whereas, the President and Congress of the United States and Governors of Delaware, New Jersey, New York, and Pennsylvania signed the Delaware River Basin Compact on November 2, 1961. The water resources of the basin are functionally interrelated, and the uses of these resources are interdependent. A single administrative agency is therefore essential for effective and economical direction, supervision, and coordination

of efforts and programs of federal, state, and local governments and of private enterprise. The DRBC shall promote sound practices of watershed management in the basin. Each of the signatory parties to the DRBC reserves the right to levy, assess, and collect fees (i.e. revenue) measured by the withdrawal or diversion of water from the basin for use within the jurisdiction of the respective signatory parties.

With a staff of 45 and budget of $5.7 million, DRBC manages a 13,000 mi^2 (33,700 km^2) basin with a population of 8.2 million. Funding is provided by 46 % state, 35 % permit and fees, and 20 % grants and contracts. DRBC has not received Federal funding since 1997. The Delaware Basin covers just 0.4 % of the continental U.S. (Kauffman et al. 2008) yet supplies drinking water to over 16 million people (5 % of the U.S. population) and the 1st (New York City) and 7th (Philadelphia) largest metropolitan economies in the nation (Fig. 3). The 100-year DRBC Compact oversees water interests of 14 federal, 14 interstate, and 43 state agencies in the watershed (Fig. 4).

Susquehanna River Basin Commission The SRBC was created in 1970 by congressional approval of a compact between Maryland, Pennsylvania, and New York to manage water resources in a 27,510 mi^2 (70,380 km^2) watershed with 4 million people. The SRBC is governed by four commissioners representing the President and governors of the three states. The SRBC has 35 staff and an annual budget of $7.7 million with 19 % from the states and 81 % from permits/fees.

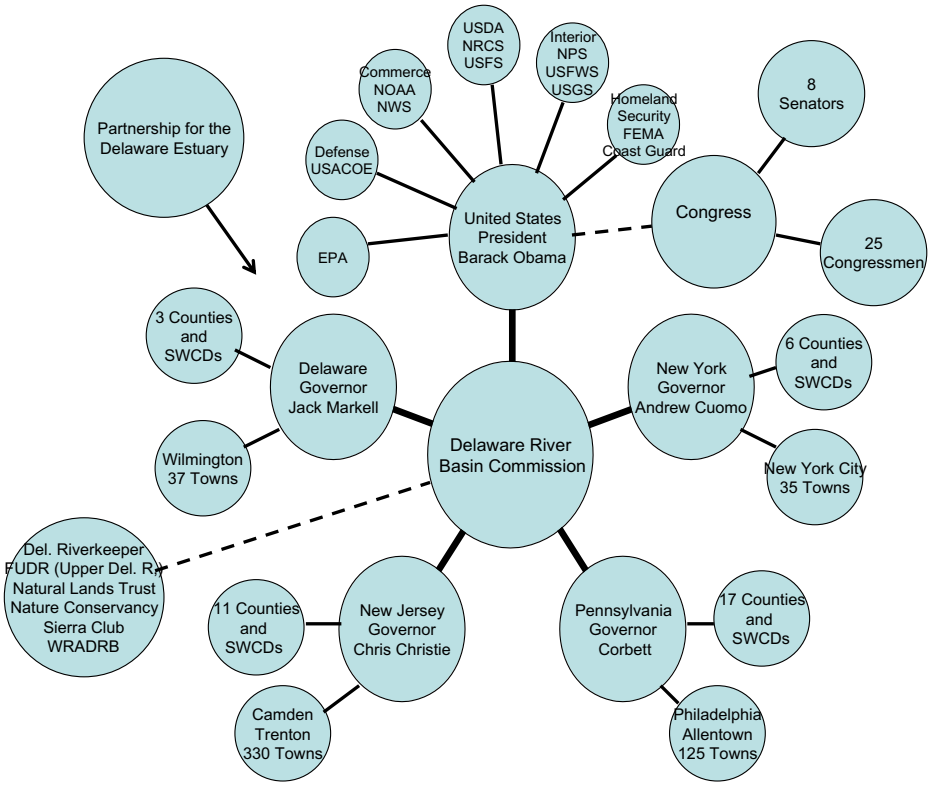

Fig. 3 Water resources governance framework in the Delaware River Basin

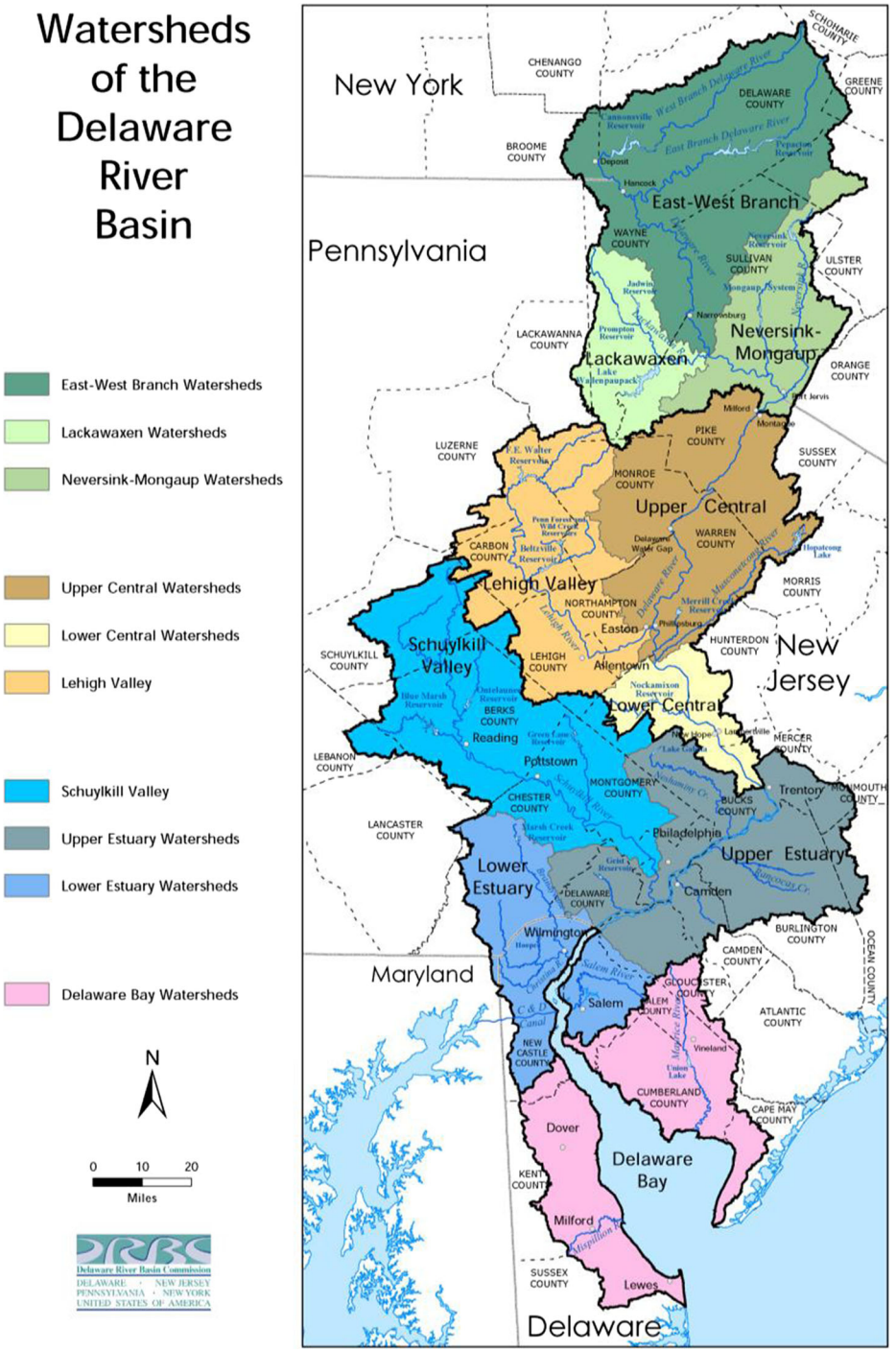

Fig. 4 The Delaware River Basin

Great Lakes–St. Lawrence River Basin Water Resources Council The Great Lakes states and Canada signed the Compact into law in 2008. The Council of Great Lakes Governors oversees economic development, interbasin water diversions, and water quality standards in a 375,000 mi^2 (972,000 km^2) area with 43 million people. The Great Lakes Commission has 31 staff with a $6.4 million budget including 92 % from grants/contracts and 7 % from state appropriations. The GLC is governed by 45 commissioners from Illinois (6), Indiana (5), Michigan (5), Minnesota (5), New York (4), Ohio (5), Pennsylvania (3), Wisconsin (3), Ontario (4), and Quebec (5).

8 Economic and Budget Considerations

Since John F. Kennedy formed the DRBC in 1961; the Harvard Water Program (Maass et al. 1962), National Academy of Sciences (1999), Interstate Council on Water Policy (2006), Congressional Research Service (Cody and Carter 2009), Schmeier (2013) and others have touted the river basin commission as an ideal organization with unique authority by Federal/state compact to manage water resources provided there is sufficient financial support for operations and water policy coordination. This section compares and contrasts the various economic and budget structures of the river basin organizations.

River basin commission funding varies by size and scale with no discernible apportionment formula (Table 7). The seven eastern river basin compacts cover all or parts of 20 states and 605,000 mi^2 (1,570,000 km^2) or 19 % of the continental U.S and manage water resources for 109 million people or 1/3 of the nation's population. The basin commissions range from the relatively small Interstate Environmental Commission around New York City to the vast Great Lakes Basin. The SRBC manages water supplies for 4 million people while the Great Lakes Commission manages a basin with a population ten times as large. Resource allocations for the interstate basin agencies range from 13 staff at the New England Interstate Water Pollution Control Commission with a $10.8 million annual budget, a staff of 35 for the SRBC with a $7.7 million budget, and a staff of 45 for DRBC with a $5.7 million budget. Per capita budgets range from $0.05/person in the IEC to $1.93 in the SRBC (Fig. 5). Proportioned to basin area, the budgets range from $17/$mi^2$ in the Great Lakes Basin to $734/$mi^2$ in New England (Fig. 4).

Annual budgets for the interstate basin commissions range from $1.1 million for the Interstate Environmental Commission to $10.8 million for the New England Commission (Table 8). Over 40 % of the revenue for the IEC, Potomac, New England, and Ohio River commissions are appropriated by the annual EPA budget through the Clean Water Act while

Table 7 Congressionally approved river basin compacts

Compact	Date	Commissioners	Basin (mi^2)	Population	Staff	Budget ($)
IEC	1936	CT, NJ, NY	5,000	20,000,000	12	1,076,236
ICPRB	1940	MD, PA, VA, WV	14,670	6,110,000	23	2,282,000
NEIWPCC	1947	CT, ME, MA, NH, NY, RI, VT	14,700	6,000,000	13	10,786,424
ORSANCO	1948	IL, IN, KY, NY, OH, PA, VA, WV, US	154,185	21,698,691	25	3,855,407
DRBC	1961	U.S., DE, NJ, NY, PA	13,539	8,200,000	45	5,660,000
SRBC	1970	U.S., MD, NY, PA, US	27,510	4,000,000	35	7,737,902
Great Lakes	2008	IL, IN, MI, MN, NY, OH, PA, WI, OT	375,400	43,000,000	31	6,423,308

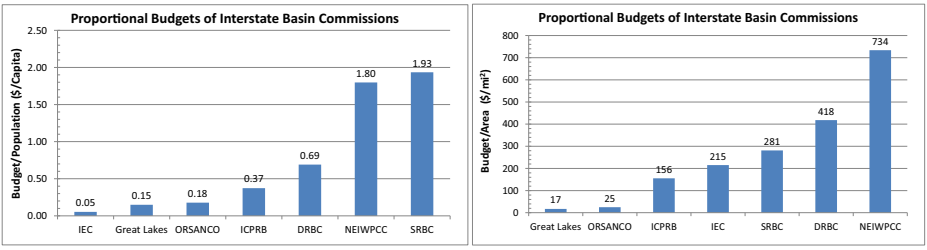

Fig. 5 Proportional budgets of interstate basin commissions

the DRBC, SRBC, and Great Lakes Commission lack these dedicated congressional line items and receive zero revenue from Federal budget appropriations (Fig. 6). Over 55 % of the Potomac River and Great Lakes budgets emanate from grants and contracts that tend to ebb and flow for a few years and then sunset. Less volatile permit and user fees provide 80 % of the SRBC budget. DRBC revenues are composed of 46 % state funding, 35 % permit/fees and 20 % grants/contracts while Federal appropriations have been missing since 1997. Like the DRBC, the Great Lakes Commission and SRBC received no Federal appropriation whereas the Interstate Environmental Commission (ISC), New England, and Ohio River commissions receive over half their funding from Federal sources. The DRBC, ISC, and ORSANCO rely on the states for over a third of their funding while the Great Lakes Commission relies on grants/contracts for 92 % of funding and the SRBC relies on permit fees for 81 % of its funding.

Cost share funding based on equitable apportionment is based on policy decisions by the signatory parties and/or formulas that account for benefits that the river basin commission provides to the governments based on population, land area, property value, personal income, and/or shoreline length (Table 9). The Interstate Commission on the Potomac River Basin budget is set by a base contribution from each state plus a share based on state population in the basin with the Federal contribution equal to the largest state appropriation. The Interstate Sanitation Commission (ISC) budget prorates expenses among New Jersey, New York, and Connecticut on a 45-45-10 basis which is based on the length of shoreline in the ISC jurisdiction. The New England Interstate Water Pollution Control Compact budget is based on 50 % population and 50 % value of real property in each state. The Ohio River Valley Water Sanitation Compact budget is based on 50 % state area and 50 % state population in the basin. Like the DRBC, the SRBC compact specifies the budget should be "apportioned equitably among the signatory parties by unanimous vote of the Commission" which the SRBC interprets that each party should pay an equal share.

Table 8 River basin commission budgets

Compact	Federal ($)	State ($)	Permit/Fees ($)	Grants ($)	Total ($)
IEC	598,989 (56 %)	471,173 (41 %)	0	6,074 (1 %)	1,076,236
ICPRB	983,000 (43 %)			1,299,000 (57 %)	2,282,000
NEIWPCC	5,666,003 (53 %)	1,187,000 (11 %)	577,000 (5 %)	3,356,421 (31 %)	10,786,424
ORSANCO	2,366,352 (61 %)	1,363,500 (35 %)	0	125,555 (3 %)	3,855,407
DRBC	0	2,588,000 (46 %)	1,958,000 (35 %)	1,114,000 (20 %)	5,660,000
SRBC	0	1,489,200 (19 %)	6,244,004 (81 %)	4,698 (0 %)	7,737,902
Great Lakes	0	480,000 (7 %)		5,943,308 (93 %)	6,423,308

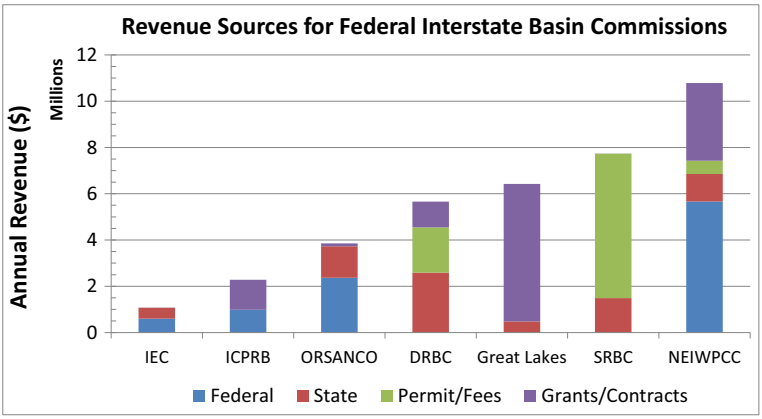

Fig. 6 Revenue sources for interstate river basin commissions

9 Discussion and Conclusions

Water governance based on the principles of river basin management and integrated water resources management has evolved as a key to resolve water conflicts (hydropolitics) in nations and states throughout the world. River basin management borrows from the principles of integrated water resources management as a multidisciplinary way to balance social, economic, and environmental river interests in a sustainable way. This progressive approach to manage water resources based on hydrologic boundaries emerged from the 1992 U.N. Conference on Environment and Development in Rio de Janeiro, 1997 UN Convention on Non-Navigational Uses of International Watercourses, and 2000 UN Millennium Goals Declaration. In 2000, the river basin approach was unveiled on a continental scale with the European Union Water Framework Directive which requires all EU 28 countries to implement basin plans by 2015 to manage water supplies for 500 million people or 7 % of the world population.

While practiced in only a dozen or so river basins in the United States, river basin management has longed been practiced internationally. Over 400 international treaties and organizations govern 263 river basins that drain 45 % of the earth in 145 countries on five continents. Nations have established over 30 river basin management programs on the five continents from Africa, Asia, and Europe to the Western Hemisphere and the Americas (Table 2).

Table 9 River basin commission funding formulas

Commission	Parties	Funding Apportionment
DRBC	US, DE, NJ, NY, PA	Population, Area
ICPRB	PA, WV, VA, MD, DC	Base Rate, Population, Federal = largest state
ISC	NY, MJ, CN	Length of Shoreline
NEIWPCC	ME, NH, VT, MA, RI, CN, NY	50 % Population and 50 % Property Value
ORSANCO	IL, IN, KY, NY, OH, PA, TN, WV	50 % Population and 50 % Area
SRBC	US, MD, NY, PA	Equal share by jurisdiction
GLC	IL, ID, MI, MN,NY, OH, PA, WI	Base Rate, Population, Area, 50 % Federal

River basin authorities financed through economic instruments such as user fees are well established in France, Germany, Great Britain, Netherlands, Portugal, Spain, Russia and Mexico, Australia, and New Zealand.

River management in the United States reaches back over two centuries to the nation's formative years after the American Revolution. To address water pollution and flooding problems after the Second World War, Federal and state governments began to establish Congressionally-approved interstate river basin compacts in populous watersheds east of the Mississippi in the Ohio, Potomac, Delaware, and Susquehanna basins and in New York, New England, and Great Lakes. After years of consideration by JFK, Lyndon Baines Johnson signed the 1965 Water Resources Planning Act (WRPA) which formed the U.S. Water Resources Council in the White House to advise the President on water resources matters. After 1980, the Reagan administration terminated funding and the mission of the Water Resources Council and river basin management in the U.S. ebbed for a decade.

Since the Clean Water Act amendments were approved by Congress during the 1970s and EPA reintroduced the principle during the 1990s, the watershed approach has evolved to balance the economic, environmental, and social interests of the many governments and stakeholders that benefit from a river system. Because watershed and government boundaries often do not coincide, water managers face complex institutional and governance challenges and competition for scarce water supplies. The watershed approach is beneficial because it balances competing uses between upstream and downstream stakeholders, balances institutional objectives at the Federal, State and local levels, utilizes a multidisciplinary science and policy approach, and provides for cost sharing among watershed stakeholders. Watershed management remains challenging because it is difficult for a diverse group of people to agree on a unified course of action, hydrologic boundaries do not usually coincide with political boundaries, and because of the fragmented authority at Federal, state and local levels.

The U.S. Federal government has experimented with many forms of interstate river basin management organizations such as single federal administrators, regional authorities, interstate watershed councils, basin interagency committees, and interstate compact commissions. Established by treaties between the Federal government and states, river basin commissions have the most authority of any of the organizations as they are granted compulsory powers through a compact between Federal and state governments, established by government legislation by law, and have permanent office staff (secretariat) available to oversee the basin in the long term.

East of the Mississippi River, Federal and state governments have formed seven congressionally approved interstate basin compacts. The Interstate Environmental Commission (1936) and New England Interstate Water Pollution Control Commission (1947) are single purpose basin organizations that focus on water pollution while the Interstate Commission for the Potomac River Basin (1940), Susquehanna River Basin Commission (1970), and Great Lakes Commission (2008) are comprehensive multiple purpose agencies with responsibilities in most areas of water management. The Delaware River Basin Commission (1961) is the only Federal-state basin compact with authority in all areas of water supply, water quality, flood mitigation, and watershed management.

The seven river basin compacts touch 20 states, cover 19 % of the contiguous United States and manage water resources for 109 million people or one-third of the nation's population. The Delaware, Susquehanna, and Great Lakes commissions receive no Federal appropriations whereas the Interstate, New England, and Ohio River commissions receive over half their funding from Federal sources. The Delaware, Interstate, and Ohio River commissions rely on the states for over a third of funding while the Great Lakes relies on grants for 90 % of funding and Susquehanna relies on permit fees for 80 % of funding. Delaware River Basin

Commission revenues are spread between 46 % state, 35 % permit/fees and 20 % grants. One of the more successful interstate river basin organizations (DRBC) with the most authority has not received a Federal appropriation since 1997.

By signing the river basin compacts, the Federal government is willing to employ Federalism principles to share interstate water resources management power with the states. Federalism is a system where a central governing authority (Federal government) shares authority with sovereign political units (states). The river basin commissions utilize a shared power structure under the principle of comity or legal reciprocity where the Federal government and states extend certain courtesies to each other without demeaning the sovereign laws of each jurisdiction.

Solutions to the challenges of river basin management may lie in the economic approach to where the users who benefit from the river bear some of the costs of restoring the basin. Since John F. Kennedy formed the Delaware River Basin Commission in 1961; the Harvard Water Program (1971), National Academy of Sciences, Interstate Council on Water Policy, and Congressional Research Service have touted river basin commissions as ideal governance organizations with unique authority by Federal/state compact to reduce water pollution using an economic approach. To sustainably finance watershed programs, river basin organizations could benefit from revisiting the economic user pays principles long practiced in Europe, Latin America, and Oceania and now by the continental-scale European Union Water Framework Directive.

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