The International Water Soft Path: Possibilities and Challenges in a New Era of Global Water Affairs

by

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Abstract

Freshwater is often called a "fundamental" resource, meaning it is central to nearly all social and ecological processes on Earth. Water experts claim that today we are living in a new era of global water scarcity, arguing that current and looming water crises around the world will become more acute without effective management. The good news, however, is that these experts also offer a vision for how these new global water challenges should be addressed. Water experts endorse an umbrella water management concept known as the Water Soft Path (WSP). The WSP is a broad and diverse approach to water and people management that accounts for both supply and demand variables, and it emphasizes increasing the per unit productivity of water use. Most importantly, water soft path management embraces ecological sustainability as a fundamental management principle.

WSP proponents and other natural resource experts widely regard catchment basins, or watersheds, as the best unit of management to implement soft path practices. However, watershed boundaries often do not align with political boundaries, including for the approximately 40% of global population who rely on water resources from basins that cross international borders. Thus the resulting problem is that WSP best management practices would involve international efforts and sophisticated cooperation in order to manage entire international catchment basins using a common approach. In reality, very little of this form of international cooperation is happening today, and scholars have yet to investigate why. Overall, there is a deficiency in academic literature about international

soft path water management, and it is the general lack of analysis and attention to this topic drives the central question of this inquiry: *When will states, as users of common-pool water resources, self-organize to adopt WSP management approaches in individual watersheds or drainage basins in order to effectively address twenty-first century water challenges?*

The purpose of this study is two-fold: first, to demonstrate how any serious consideration of what experts tell us about how to best manage water resources in a new era of global water challenges begs the central question above; and second, to offer a strategy for how to answer it.

This study uses Elinor Ostrom's recently developed social-ecological system framework to diagnose and compare four cases of international transboundary water situations. Ostrom's new tool allows for analysis that provides a better understanding of when states might manage shared water resources using soft path approaches. Qualitative analysis about international water norms is also used in order to provide appropriate context for the analysis conducted using Ostrom's framework.

Conclusions are drawn that the international system is largely not ready for the integrated soft path management of transboundary water resources. However, five variables are identified as affecting the likelihood that states will manage shared waters using soft path approaches, which is itself an indication that Ostrom's new framework is a valid tool for addressing this topic. Finally, this study appeals to a form of ecological political consciousness as a means of working towards sustainable water management at the global level.

To Beth -
your support and patience
deserves at least one page

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Chapter 1: Framing the Problem

"The world's oceans, rivers, lakes, and groundwater systems do not respect political borders. These large water systems cover most of our planet, but they continue to be managed in a national and fragmented way that is endangering the food supply and livelihoods of billions of people. If our nations continue to exploit these shared resources in unsustainable ways, we face a dismal future characterized by the depletion of our water and marine resources, increased poverty, and greater conflict" (Global Environmental Facility 2012, p.1).

1.1 An overview of today's global freshwater scarcity issues

Freshwater is often called a "fundamental" resource, meaning that it is central to nearly all social and ecological processes on Earth. Today's world has a myriad of crises and challenges associated with water. The wide-ranging topics include food production, pollution, armed conflict, industrial development, ecological degradation, species extinction, climate change, and countless others. As a fundamental resource, the nature of freshwater is that it does not stand alone as its own issue or set of issues, rather water is intertwined with many other environmental, economic, and social affairs (Gleick 1993b). As Sandra Postel, director of the Global Water Policy Project, eloquently puts it: "Water, unlike other scarce, consumable resources, is used to fuel all facets of society, from

biology and economy, to aesthetics and spiritual practice. Water is an integral part of ecosystems, interwoven with the soil, air, flora, and fauna. Within watersheds, everything is connected: surface water and groundwater, quantity and quality" (Postel 1999). It is worth keeping this perspective in mind when addressing freshwater affairs in order to appreciate both the importance and complexity of this natural resource that is central to perhaps all aspects of life on Earth.

In today's world we face some stark facts indicative of pressing water problems. Even a short list such as the following should give rise to concern:

- Over one billion people worldwide lack access to clean drinking water.
- More than three billion people lack basic sanitation services.
- Globally, 20% of freshwater fish species are either endangered or extinct, and in the U.S. freshwater fish account for 47% all animals on the federal endangered list.
- Humans have already appropriated more than half of all accessible freshwater runoff globally, prompting some scholars to draw comparisons to the concept of "peak oil" by referring to today as the time of as "peak water." And this century as human population grows faster than increases in the amount of accessible freshwater, per capita availability will decrease.
- Global warming is already causing a general intensification of earth's hydrological cycle, resulting in significant changes to water availability and quality. The upshot is that problems associated with water scarcity and ecological degradation are likely to be exacerbated in the next 100 years (Jackson et al. 2001).

To put matters into perspective, by 2030 even the water-abundant region of southern Ontario, Canada is projected to have water demand that exceeds renewable supply[1] (Kay and Hendriks 2009). Canada is commonly regarded as one of the most environmentally conscious nations in the world, and the country's major agricultural, industrial, and population centers in Ontario are concentrated in the Great Lakes-St. Lawrence River Basin, which is the world's largest freshwater reserve. Even the origin of "Ontario" is derived from an Iroquoi word thought to mean "beautiful, large body of water" (Ontario 2012). All of this would seem to suggest that southern Ontario would be an unlikely candidate of concern regarding water scarcity issues, but the pressing reality is the exact opposite. This underscores the idea that water scarcity issues affect regions of the world far beyond what we might casually believe to be problematic.

These examples are simply an overview of that global water problems we face today, and in a nutshell, they represent the bad news. While the list of specific issues could likely be expanded ad nauseam, for practical purposes it should suffice to generalize that problems associated with water are becoming increasingly acute around the world, and that it would be wise for us to do what we can to address them.

While the bad news is indeed extensive, not everything is all doom and gloom, so to speak. Although the scope and depth of global water problems might seem overwhelming, the good news is that water experts endorse a relatively unified vision for how we might effectively address the challenges we face today. What we need to do at

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[1] This is without even considering the future possibility of pumps and pipelines transporting water to arid regions of North America or around the world, permanently removing water from Great Lakes resources. This practice is currently prohibited by the U.S., Canada, and all states and provinces bordering any of the five Great Lakes.

many levels of human organization, experts tell us, is to adopt a broad-based approach that is commonly referred to as "soft path" for water management, or the Water Soft Path (WSP). This management concept is central to this inquiry, and it is worth explaining in some detail.

1.2 Water Eras: an introduction to Water Soft Path (WSP) logic

Peter Gleick, one of the world's leading water experts, was one of the first people to put forth a new vision of water management strategies in response to twenty-first century problems (Gleick 1998a). His explanations of the soft path for water management, as well as his arguments for why we should adopt WSP practices, are especially powerful due to thorough empirical support.[2] Gleick's relatively famous discussion of historical water eras (Gleick 2009a) is perhaps the most lucid introduction to WSP logic, and thus an appropriate starting point for exploring this concept.

The First Water Era, as Gleick calls it, lasted for millennia, coinciding with times when humans lived hunter-gatherer existences. Earth's natural hydrologic cycle provided water for human use and took away what they didn't want. In other words, rivers and streams brought drinking water and fish, and washed away various waste products. People lived relatively short lives, and water-related problems and illnesses generally

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[2] Gleick's empirical work on global water issues is second to none. For detailed analysis of contemporary water issues and up-to-date data, see *The World's Water*, Gleick's biennial report now in its seventh edition. His Water Eras argument is a common language conclusion he has drawn from the ongoing scientific work and data published in these reports.

took a backseat to the deadly consequences of plagues, malnutrition, childbirth, and other more immediate threats.

As human civilizations evolved, this simplistic approach to water management became insufficient as societies outgrew local water resources. Then emerges what Gleick calls the Second Water Era, which began with basic but intentional manipulations of the water cycle in order to satisfy increasing demand. New technologies, engineering, and institutions delivered mass quantities of water through innovative techniques. Dams, canals, and aqueducts fed the ancient cities of Rome and Greece, as well as the agricultural fields of Mesopotamia and the Indus Valley. Wastewater began to be collected and separated from other functions of everyday living. These advances helped people live longer, healthier lives in closer proximity to one another, ultimately giving rise to cultures that created art, philosophy, and science. Gleick sees the peak of the Second Water Era in nineteenth and twentieth centuries, coinciding with times of rapid industrialization, and scientific and engineering advancement. The waves of cholera, dysentery, and other water-related diseases that had swept around the world were coming to be understood and eliminated through advances in water infrastructure and public health policy. The damaging consequences of floods and droughts were becoming increasingly mitigated. Modern irrigation techniques, along with innovations in pesticide and fertilizer, led to the Green Revolution that prevented mass starvations. The peak of the Second Water Era resulted in a quadrupling of the world's population in the twentieth century alone, increasing from 1.5 to 6 billion people.

There are two key features of the Second Water Era: The first feature is the flourishing of what Gleick calls “hard path” approaches to water management, which means an overwhelming reliance on massive, centralized infrastructure projects. The second feature is a general assumption about endless supply of freshwater. These defining characteristics of the Second Era are clearly interrelated: Large-scale hydro projects were built quite literally on beliefs about exploiting cornucopian supplies, and the mass delivery of water gave many people little reason to worry about or question supplies.

While these Second Era approaches have had tremendous historical payoffs, the problem with them is that are inappropriate for today’s water needs. Hard path projects have had serious and often unanticipated social and ecological costs. Despite their benefits, we continue to find water-related crises around the world that cannot be solved simply by building more dams or pipelines. Additionally, we also know that freshwater is a finite resource, and per capita supply is decreasing as global population increases. While today’s negative consequences of Second Era approaches and thinking are seen most clearly at the regional level in the forms of shortages, pollution and contamination, ecological destruction, and other crises, the core features of Second Era approaches also clash with today’s global water issues. The basic idea here is that given our knowledge that water is not an infinitely abundant resource, we should not expect to solve our water problems only by seeking to exploit more of it. Broad questions about climate change, growth, development, energy, and resource consumption are all interrelated through freshwater issues, and these questions cannot be effectively answered simply by using more water.

The important aspect of Gleick's water eras argument is that the ideas and approaches of the past are largely unable to solve some of our most difficult water problems today. This disconnect signals the beginning of a new historical period that he calls the Third Water Era. He argues that we need a new approach in order to meet today's challenges, and that we cannot solve our water problems simply by seeking to increase supply. As he sees it, this new era requires nothing short of a revolution in how we think about water:

"The world of water is changing -- not just how much water is available, or who controls it, but the whole way we think about and manage this precious commodity. The assumptions we made in the last century about the availability and use of water no longer seem to apply. And for water managers, planners, hydrologists, engineers, economists, policy makers, and concerned citizens, the time has come for new thinking and new solutions. . . Water is taking center stage as the most critical resource facing humanity." (Gleick 2009a, p. 17).

1.3 Soft Path solutions

Water experts echo Gleick's concerns, and they endorse what are known as "soft path" management approaches in response to a new era of water challenges. The water soft path, or the WSP, is the general name given to a comprehensive and integrated approach that stands in contrast to Second Water Era or "hard path" water management practices.

At a an overarching level, the difference between traditional management strategies and the WSP is a matter of two contrasting perspectives. Traditional hard path approaches are based on an *anthropocentric view* that emphasizes increasing supply in order to meet rising demand, focusing on short-term cost effectiveness as a guiding principle. WSP approaches, on the other hand, shift to an *ecosystem perspective*, whereby long-term ecological sustainability is the ultimate goal and fundamental management principle. The WSP also accounts for variables such as supply and demand, but these are integrated into a more long-sighted view that seeks more efficient methods of water management in order to bring human beings into a more balanced relationship with Earth's ecology and water resources (Brandes et al. 2009).

The guiding principle of ecological sustainability, which lies at the center of the WSP, is perhaps the uniting feature of this management approach. Experts describe this as a balancing act, whereby the challenge we face today is to satisfy humanity's water demands while simultaneously protecting Earth's vital freshwater ecosystems (Postel 2000). In the past, issues such as species endangerment and ecological degradation were often prioritized much lower than whatever means were deemed necessary to deliver mass quantities of freshwater, but much of that thinking has now shifted. Today we recognize that the long-term survival of human and biological diversity on Earth depends on sufficient ecosystem conservation, and WSP proponents encourage us to achieve this by ushering in a new paradigm of equitable consideration between our economic, social, and ecological needs (Wallace et al. 2003). To again use Sandra Postel's succinct

phrasing, what we must do is find "creative new ways of obtaining both commodity and ecosystem benefits from the same volume of water" (Postel 2009, p. 946)

The reasoning behind the WSP is also key to understanding its difference from older or more traditional approaches (Brooks et al. 2009). Hard path infrastructure projects focus only on the "how" aspect of water management - how to deliver more water for use. This "how" logic applies not only to supply-focused approaches, but also to more recent demand-centered measures that seek to decrease consumption in order to improve efficiency, such as efficient shower heads and toilets. These newer developments in demand management, while beneficial and certainly part of a comprehensive WSP, cannot solve all our water problems because by themselves they only address "how" questions - how to accomplish the same thing only with less water? In contrast, one key aspect of the soft path is that in addition to these kinds of "how" questions, it also asks "why" questions. And as Brandes et al. point out, there is a fundamental "why" question behind soft path thinking. *Why worry about water efficiency issues is the first place?* (Brandes et al. 2009, p. 8). The answer to this fundamental "why" question, of course, is also the central logic behind the WSP approach: a recognition of the need to balance human behavior with ecological sustainability.

In much the same way that ecological sustainability is the umbrella principle that guides soft path thought and practices, the WSP itself is an umbrella management concept. The soft path recognizes the complexity of our water problems, seeking varied and context-appropriate solutions to particular challenges. It is not a one-size-fits-all approach or a neatly-structured model, rather it is a broad concept that asks us to

reconsider the ways humans use water in order to adopt long-sighted strategies for managing this critical resource. There is no single soft path in the sense of a blueprint or technique that can necessarily be replicated and applied successfully to different management scenarios around the world. The term itself - "soft path" - has roots in the concept of soft energy paths developed in the 1970s in response to global energy supply problems (Holtz and Brooks 2009). The basic idea adopted to meet rising energy demands at the time was to use a variety of supply and distribution networks in order to create diverse pathways for energy flow. And like solutions proposed for energy challenges, the idea of a soft path for water implies a multitude of "paths" involving various configurations of complementary centralized and decentralized infrastructure, as well as market-based and non-market-based measures (Gleick 2003). In other words, the WSP is a broad approach that aims to achieve a specific goal: managing human water use within the boundaries of ecological sustainability. Thus in a sense, the WSP is an overarching vision that is implemented through diverse measures and to perhaps varying degrees. For example, managing household or individual building demand by means such as discouraging mid-day lawn watering or rewarding the use of efficient sprinklers with automatic shut-offs are both very basic examples of micro-level WSP practices. Better yet, moving down the spectrum towards more sophisticated WSP practices would mean planting drought resistant greenery that is appropriate to its particular ecosystem and climate - a technique called xeriscaping (Brandes et al. 2009).

As a relatively new phenomenon, the WSP as of now lacks full agreement among experts regarding its definitions, components, and implementation (Gleick 2009b, p. 53).

On the other hand, there are a handful of interrelated principles[3] endorsed by WSP leaders that stand out as specifically distinguishing the soft path from traditional water planning and management:

- *Ecological sustainability.* As discussed above, this is the fundamental principle. A basic example of this would include annual groundwater pumping of a specific aquifer not to exceed determined rates of replenishment.
- *Treating water as a service, not an end in itself.* This principle acknowledges that water has been seen and used differently, at different times, and by different groups throughout history (Linton 2009). People want water in order to produce goods and services - such as clean clothes or the removal of human waste, for example. They do not necessarily care how much water is used, and they might not even care if water is used at all[4] (Pacific Institute 2012).
- *Matching the quality and quantity of water delivered to the needs of a specific use.* There is no need, for example, to flush toilets with gallons of high quality drinking water. Likewise, storm runoff and wastewater harvesting are appropriate for irrigation and some industrial purposes (Brandes et. al 2009). Ideally, systems develop whereby the output of one process becomes the input for another (Pacific Institute 2012).
- *"Backcasting" from the future back to the present*. Traditional water planning starts from the present and projects scenarios forward in order to estimate future water needs.

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[3] Water experts have numerous lists regarding what they describe as core soft path principles and strategies, and items on their lists often overlap with one another. This list is my compilation of WSP proponents' work.

[4] One crucial exception to this principle, as Brandes et al. point out, is drinking water. Although the total quantity of water used for this purpose globally is relatively small, it is worth noting that drinking water can reasonably be thought of as an end in itself (Brandes et al. 2009, p.11).

Backcasting does the reverse. It considers the future sustainable limits of a natural resource, then uses this information in order to determine what present and future desires can be fulfilled within these limits (Gleick 1998b, 2003).

- *Increasing water productivity*. This general strategy is one important aspect of squaring rising global demand with finite freshwater resources. Instead of continuously seeking new supplies, the WSP focuses on increasing the efficiency of each unit of water through creative and renewable means (Gleick 2003). An example of this principle would be price controls that influence demand, such as setting higher prices during times of scarcity in order to closer reflect the true cost of water delivery.
- *Broad democratic participation*. Conventional, hard path water management is governed by a top-down, engineering mentality that seeks the delivery of water for generic needs. While engineering and centralized management knowledge are aspects of effective water management, more input is needed for a thriving WSP approach. Water agency or company personnel must interact with local communities in order to make decisions about management, allocation, and use (Pacific Institute 2012; Wolff and Gleick 2003).

While this list represents a summary of WSP ideals, it helps to have an example. Australia, which is the driest inhabited continent in the world, has been pursuing water policy reforms since the 1990s aimed at demand management which reflect soft path principles. In that country, for example, nationwide backcasting programs identify and define “consumptive pools” of water in ecosystems that then are divided up among water

providers and users through various water market and pricing mechanisms. If a consumptive pool is determined to be volumetrically smaller than the sum of previously secured entitlements, then the gap between new supply and past entitlements is closed by redefining claims on water as shares of the consumptive pool, rather than in volumetric terms. It is then left to individuals to figure out how to reduce their water needs according to the portion of the pool available to them (Bjornlund and Kuehne 2009). Establishing fixed water supplies in Australia is credited with contributing to smooth functioning allocation and demand markets that allow farm irrigators to better manage risks associated with declining access to water and operate sustainably even during dry periods. Additionally, water markets allows users to trade entitlements, which ultimately results in reallocating water from less to more efficient farmers, thus increasing the net return per unit of water used. (Bjornlund 2006).

In Australia we clearly see some of the WSP core principles listed above: sustainability, backcasting, increasing productivity, and arguably even bottom-up democratic processes through participation in water markets. Ecologically sustainable supplies of water are defined in consumptive pools that are distributed through backcasting. This procedure for establishing supplies contrasts with traditional management approaches focused simply on increasing access to water resources. Individual irrigators can then participate in use decisions by trading water rights on an accessible market, and one outcome of this trading is increased productivity of the

resource. It is worth noting that Australia is not necessarily a paragon of soft path management, however it is a country with several examples of WSP principles at work.[5]

1.4 The WSP, basin level management, and a resulting problem

While WSP management principles indeed offer hope that humans might be able to effectively address our twenty-first century water problems, putting these principles into widespread practice is another matter altogether. WSP proponents recognize numerous barriers associated with implementing soft path methods, and they provide promising analysis for how various kinds of challenges might be overcome (Gleick 2009b; Jordaan et al., 2009). There is one pressing problem, however, that supporters of the WSP have not thoroughly grappled with, and that problem involves basin level management at the international level.

WSP principles are water experts' general recommendations for both how and why we should manage water resources in order to progress towards the ultimate goal of ecological sustainability. In addition to soft path thinkers, there are also numerous other analysts and influential voices focused on other aspects of today's water problems. One general trend seen in some these other expert opinions is increasing support for the idea that resource management at watershed and basin levels is the best way to achieve ecological sustainability (Draper 2006). And while it might seem straightforward that

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[5] For more thorough analysis of Australian water policies, practices, and issues, see http://www.awa.asn.au/, the well-developed website of Australian Water Association. Specifically, the policy principles endorsed by this organization are closely aligned with core WSP principles.

WSP principles should mesh neatly with a focus on basin level management, the two are not so easily reconciled.

The remainder of this inquiry is essentially an attempt to tackle the problem of aligning international watershed and freshwater basin management practices with soft path principles, so allow me to explain the logic behind the problem.

Watershed and drainage basin level management

Among voices concerned with ecological sustainability, there is strong support for a holistic approach to managing water resources at the catchment (drainage) basin or watershed level. In an oft-cited piece analyzing global water challenges in the upcoming century, Jackson et al. conclude that problems must be addressed at the individual basin level. Jackson et al. (2001) encourage a global outlook in order to recognize the overall scope of our freshwater affairs, but they argue that a broad perspective is not enough to secure regional and local sustainability. They claim how freshwater is managed in particular basins and individual watersheds is the key to sustainable water management. Echoing these concerns, Stephen Draper, an expert in transboundary water sharing affairs, maintains that planning at watershed and river basin levels is a guiding principle for effective water sharing across political borders. He argues that organizing and planning at this level is the necessary first component of protecting the hydrological integrity of a shared water resource (Draper 2006). Natural resource management experts also support the idea of a basin level approach, viewing water resources as places where

individuals and communities can achieve common ground, as well as share mutual goals and fears through an understanding of how they affect one another through water use (Wondolleck and Yaffee 2000). Additionally, some WSP experts support the idea of watershed basin level management, viewing individual catchment basins as perhaps "the most suitable and effective scales for the application of water soft path analyses" (Isaacman and Daborn 2009). In a more general spirit, WSP proponent Oliver Brandes paints an encouraging picture of soft path approaches as a form of ecological governance that "addresses the way individual and collective decisions are made within watersheds and more broadly within the ecosystem that supports all life" (Brandes 2009).

It is worth stressing that the concept of managing water resources at watershed and individual basin levels is not merely a suggestion endorsed by today's experts, rather it is also a relatively long-standing water management norm that has taken shape in a variety of different historical circumstances. An early example is the work of nineteenth-century U.S. Army Major John Wesley Powell, whose *1878 Report on the Lands of the Arid Region of the United States* proposed partitioning the American West into watershed commonwealths for sustainable settlement and development. Powell advised Congress that "the General Government organize the arid region into irrigation districts by hydrographic basins" (Ewert 2002, p. 439) And when water basins crossed existing state borders, Powell argued that states should ignore "artificial political boundaries and provide statutes for the organization of the districts and for the regulation of water rights, the protection and use of forests, and the protection and use of pasturage" (Ewert 2002, p. 439). Unfortunately for Major Powell, large-scale efforts to survey the West's water

resources took a long time, obstructed eager settlers, and generally conflicted with the nation's Manifest Destiny zeal. Thus Powell's ambitious vision for the American West was never realized (Ewert 2002).

Today, support for watersheds and basins as units of management is a principle widely seen in international treaty law. Numerous interstate compacts around the world have created governing bodies whose sole purpose is to manage a specific watershed or basin. These governing bodies act as management entities to which parties bound by treaties cede designated decision making powers. The International Joint Commission of the United States and Canada, for example, is a treaty regime between the two countries dedicated to maintaining the "chemical, physical, and biological integrity of the Great Lakes Basin Ecosystem" (IJC 2012). These kinds of compacts are common around the world, with roughly two-thirds of all international transboundary surface waters being governed by treaty regimes (Draper 2006).

Looking to customary international law, we also find some limited evidence of the norm supporting watersheds and basins as basic units of management for all international freshwater resources, although it is a relatively "soft" norm in customary law. *The Helsinki Rules on the Uses of Waters of International Rivers* (1966) treat international drainage basins (watersheds extending over two or more states) as indivisible hydrologic units to be managed as a single unit to assure maximum utilization and development of any portion of its waters[6] (International Law Association 1966). More recently, however,

[6] It is worth noting that the 1966 Helsinki Rules extended to groundwater - a resource that has since received significant attention and debate in international affairs and law. Groundwater issues are becoming increasingly pressing worldwide due to widespread and controversial "fracking" practices for natural gas mining.

the *United Nations Convention on the Law of the Non-Navigational Uses of International Watercourses* (UN 1997), which is arguably the closest thing we have to a definitive international treaty on the topic today, notably does not require treating international basins as single management units (Draper 2006, p. 100). This document calls for states to make "sustainable utilization" of international watercourses, taking into account the "interests of the watercourse" (UN 1997, Article 5.1), but unlike *Helsinki*, it does not state that sustainable utilization must be achieved by treating water resources as indivisible units of management. Thus customary international law appears relatively vague regarding whether or not transboundary water resources are single management units.[7]

The general point here is that there is significant support for the idea that the best way to manage water resources is at the watershed or drainage basin level. And while this alone seems like a demanding task to implement, matters become far more complicated when we take into account what the soft path advocates tell us we must do in response to today's water challenges.

The resulting international problem

To review, experts claim that the best way to manage water resources in response to twenty-first century challenges is by embracing the soft path approach to water

[7] Customary international water law is a large topic itself, and my discussion here is deliberately abbreviated in order to make a small point about basin level management as an arguably ambiguous principle in customary international law. There are "harder" principles, which will be discussed later.

management. Ecological sustainability is the WSP's fundamental principle, and a set of secondary principles define the kinds of management practices that qualify as soft path strategies. These WSP secondary principles include increasing water productivity, treating water as a service as opposed to and end in itself, matching water supplies with intended uses, backcasting, and democratic decision making. Soft path thinking rejects a one-size-fits-all approach, and it embraces the idea of diverse practices, or different "paths", as viable means for achieving the goal of sustainable resource management. In addition to soft path practices, there is also broad support for the idea that managing water resources at the watershed or catchment basin level is the key to achieving sustainable management. As discussed above, this principle is shared by water and resource management experts, principles of international law, soft path advocates, and historical leaders concerned with sustainable water management.

Thus water experts claim that WSP principles are the key to effectively addressing current and looming water crises, yet they also support the idea that ecological sustainability can best be achieved by treating individual watersheds or catchment basins as the primary management units. If we take both suggestions seriously, it would be logical to conclude that the best approach to sustainable water management would entail a combination of soft path practices with watershed level management. In other words, perhaps we should hope to see soft path approaches implemented across individual watersheds and catchment basins in order to manage global freshwater resources as sustainably as possible. As discussed above, some WSP thinkers support this approach (Brandes 2009; Isaacman and Daborn 2009).

WSP management strategies applied at the watershed level might indeed be an optimal approach in theory, but implementing such a plan in the real world is another matter altogether. Experts support principles of both soft path and basin-level management, yet it might be neither easy nor perhaps even possible to adopt both strategies simultaneously. And while there are likely numerous barriers associated with such an approach - including esoteric water management topics beyond my expertise - the problem this inquiry addresses involves international issues. Focusing on the simple idea that natural boundaries do not always align with political boundaries, it becomes clear that managing individual watersheds and catchment basins around the world according to soft path principles has significant international implications. Some basic facts are worth noting here to illustrate the potential scope of this management approach:[8]

- Along with the collapse of colonialism in the twentieth century came the emergence of newly independent states, which entailed many new political borders, new diplomatic relationships across these borders, and great artificiality regarding the governance of peoples and their natural environments. Now more than 260 river systems cross international borders, covering roughly two-thirds of Earth's total continental land area, Over 200 nations share water with a neighboring country (Elver 2006; Gleick 1998).
- Roughly two billion people - 40% of global population - live in these transboudary river basins, and just under 25% of all people live in one of Earth's arid or semi-arid zones where water scarcity is often acute (Draper 2006).

[8] The following figures reflect only transboundary surface waters. If we were to consider groundwater resources, which are part of the same hydrological units as surface waters, then matters become far more complicated. Knowledge of global groundwater resources and aquifers is currently incomplete.

- Approximately two thirds of all the 260-plus transboundary river basins are governed by treaties, leaving roughly one third not covered by any international agreement. Of the basins with treaties, only approximately 30 of them have truly cooperative institutional arrangements (Draper 2006).

Accomplishing both aspects of experts' recommendations for managing global freshwater resources - following soft path principles *and* treating watersheds as the basic management units - appears to be no easy task against this backdrop. With the number river basins crossing national borders (let alone aquifers) and the amount of people living in them, it would appear doubtful that any significant number of countries and populations could work together to successfully manage entire watersheds according to WSP principles. Indeed, this approach demands a form of cooperation over water resources among states and peoples that is more sophisticated than what we find in today's international system. For example, if today only roughly 30 transboundary river basins worldwide have highly cooperative arrangements, and one third of all transboundary basins have no existing international agreement whatsoever, the prospects seem quite slim that a large number of states would cooperate to implement WSP management strategies requiring sophisticated basin-level planning and oversight. With the exception of arguably only one example that will be discussed in greater detail below, the European Union Water Framework Directive, we do not see this phenomenon happening anywhere in the world. States are generally not jointly managing individual watersheds and drainage basins crossing their borders according to WSP principles, and

perhaps we have little reason to believe they either would or could. The problem, however, is that expert opinion suggests we should see this happening if we hope to avert current and future water crises.

1.5 A central question

The logic behind this inquiry suggests a central question: To summarize, soft path proponents advise that freshwater resources should be managed according to new WSP principles in order to meet the challenges of a new era of global water scarcity. In addition, water experts encourage us to treat individual watersheds and drainage basins as the appropriate units of management. A combination of these expert opinions results in the suggestion that freshwater resources should be managed according to soft path approaches at the basin level, which is an idea supported by some WSP thinkers. However, the natural borders of watersheds and catchment basins often cross international borders. Thus states that share international watercourses would need to demonstrate sophisticated cooperation in order to manage entire basins according to WSP principles. And this kind of cooperation among states is something that is generally not happening today.

This begs the question, under what circumstances might we expect to see states demonstrate such cooperation? *In other words, when will states, as users of common-pool water resources, self-organize to adopt WSP management approaches in individual*

watersheds or drainage basins in order to effectively address twenty-first century water challenges?

This specific question is one that has gone largely unaddressed by WSP proponents, water affairs experts, and international relations scholars. While there is a substantial volume of academic literature dedicated to international transboundary water issues, very little of it addresses this topic in particular. Scholars and experts on international water affairs have developed relatively thorough knowledge about conflict and sharing, but far less (if any) research has been done to address the possibility of states cooperatively managing shared water resources according soft path principles of ecological sustainability. Aaron Wolf, for example, is a leading scholar on tranboundary conflict and cooperation who has compiled an extensive collection of international waterway case studies. Wolf's analysis draws insightful conclusions and practical lessons about circumstances that contribute to successful and unsuccessful international waterway management, but most of his work focuses on topics relating to conflict resolution and equitable sharing of water resources (Wolf and Newton 2008). And while international water sharing and conflict resolution are certainly important topics of inquiry, if we take heed of the research offered by water and natural resource management experts, we see that our water scarcity problems might not be solved simply by avoiding conflict or by carving-up existing supplies and sharing them equitably.

It is worth acknowledging here that at worst, and in many cases, we do find quite the opposite of sophisticated, cooperative management of international transboundary waters. Violent conflicts over shared water resources around the world extend back 5,000

years or more, including the Nile, Jordan, and Euphrates Rivers in the Middle East; the Indus, Ganges, and Brahmaputra in southern Asia; and the Colorado, Rio Grande, and Parana in the Americas, to name just a few (Gleick 1993a). Some analysts even view water as as a common source of conflict, not cooperation, among states. Supporters of what has been called the "water wars rationale" claim that when demand for freshwater exceeds supply, water becomes a vital security issue over which states will be willing to go to war (Alam 2002). According to this logic, increasing scarcity should give rise to more potential conflicts, leaving little reason to believe that states will adopt the kind of cooperation required to manage tranboundary watersheds in line with WSP approaches.

Use of transboundary waters among two or more states, however, clearly does not always result in warfare. Although there are numerous examples of freshwater conflicts both past and present, it would be unwise to assume that water resources either always have been or will continue to be sources of conflict among states. Some experts are skeptical about the water wars rationale, noting that between 1945 and 1999, cooperative events between riparian states outnumbered conflicts by more than two to one. These observers view water as a vehicle for developing increased cooperation that might prevent conflict, even in especially contentious river basins (Alam 2002; Wolf et al. 2005). Thus we should not assume that water scarcity inevitably leads to conflict among states, and perhaps we might even find evidence of sophisticated cooperation in scenarios of international water scarcity.

The purpose of this study is two-fold: first, to demonstrate how any serious consideration of what experts tell us about how to best manage water resources in a new

era of global water challenges begs the central question above; and second, to offer a strategy for how to answer it. This study uses Elinor Ostrom's recently developed social-ecological system framework to diagnose and compare four cases of international transboundary water situations. Ostrom's new tool allows for analysis that provides a better understanding of when states might manage shared water resources using soft path approaches. Qualitative analysis about international water norms is also used in order to provide appropriate context for the analysis conducted using Ostrom's framework.

Ultimately, this study concludes that the international system is largely not ready for the integrated soft path management of transboundary water resources. However, five variables are identified as affecting the likelihood that states will manage shared waters using soft path approaches, which is itself an indication that Ostrom's new framework is a valid tool for addressing this topic. Finally, this study appeals to a form of ecological political consciousness as a means of working towards sustainable water management at the global level.

Chapter 2: Logic of Inquiry

2.1 Using Elinor Ostrom's research on common-pool resources

Due to strong strong parallels between water experts' claims and Elinor Ostrom's research on the topic of sustainable natural resource management, Ostrom's work is especially helpful for analyzing global water issues. Two connections are especially strong: first, the recognition that shared natural resources such as water are common-pool resources that are not infinitely renewable (Ostrom 1990; Gleick 1993b, 2009a); and second, that effectively addressing problems related to sustainable natural resource use does not involve one-size-fits-all or monolithic solutions [9] (Ostrom 1990; Brandes et al. 2009; Gleick 1998b, 2009a). A closer look at these parallels demonstrates why Ostrom's work applies to shared international water resources.

First, experts describe water as a finite yet renewable resource. There is a fixed amount of it on Earth, but natural hydrological cycles replenish specific water resources at different rates. If water is harvested from any particular resource faster than the rate of

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[9] Before proceeding any further it is worth noting that Ostrom's seminal work, *Governing the Commons* (1990), focuses mainly on small-scale scenarios, whereby the resource analyzed is located within one country and the number of individuals affected varies from 50 to 15,000 persons who are heavily dependent on the resource (Ostrom 1990). Entire drainage basins spanning international borders are much larger resources affecting far more people, and by definition they are not contained within the borders of one country. However, this is not a problem for this inquiry because I only use broad ideas from this book that are relevant to global water resources. I do not rely on her prescriptions for governing small-scale common-pool resources situations put forth in *Governing the Commons* for my analysis of larger, international water basins. For analyzing these international water resources, I use her later developed SES framework (2009), which is a tool that Ostrom does not reserve exclusively for small-scale common-pool resource scenarios.

replenishment, the resource risks facing collapse. This aspect of individual water resources, the idea that they have a limited carrying capacity, is the property that Ostrom calls "subtractability" (Ostrom 1990, p. 32). If a resource is subtractable, it becomes less available for other potential users upon each use. For Ostrom, subtractability is key to distinguishing common-pool resource (CPR) situations from public goods situations, whereby the former is necessarily affected by the number of users and the latter is not. For example, each time users pump an aquifer or withdraw irrigation water from a river, there is less water for immediate and future CPR use. In contrast, an individual's consumption of a public good such as security does not take away from the general level of security in a community. While there might free-rider problems associated with the provision of both water resources and public security, the difference between these resources as CPRs and public goods involves the effects of using them. Ostrom claims that crowding and overuse problems are chronic in CPR situations, but absent in pure public goods situations. Thus there is a limit to the number of resource units produced by CPRs (Ostrom 1990).

Ostrom's conceptual distinction of public goods from CPRs mirrors what water experts tell us about global water problems. Recall Gleick's Water Eras thesis, which is his argument that we have shifted into a new era of global water scarcity and should no longer manage water resources by seeking to exploit what we might wrongly perceive to be unlimited supplies (Gleick 2009a). In Ostrom's terms, Gleick's argument is that water has been treated as a purely public resource throughout human history, but today's circumstances require that we shift our thinking and recognize that water resources are

actually CPRs. They are subtractable resource systems vulnerable to problems associated with overuse, including possible system collapse. Human activity is already exceeding renewable limits of many water systems around the world, and we need new management approaches focused on sharing water between societies and ecosystems (Postel 2000; Wallace et al. 2003).

The second significant connection between Ostrom's research on sustainable natural resource management and water experts' claims about global water issues is that both encourage us to avoid seeking uniform solutions to social-ecological problems. Ostrom is critical of overly generalized approaches that call for a simplified external solution to situations perceived to be commons dilemmas: "The *only way* to solve a commons dilemma is by doing *X*" (Ostrom 1990, p. 13). She disputes "only way" approaches that view commons problems as single problems with single solutions, instead claiming that commons dilemmas are are actually multiple problems with multiple solutions. Specifically, Ostrom is critical of analysts and policy makers who simply recommend two idealized property rights regimes, either total government or total private control of natural resources, as "the" way to escape commons dilemmas. Instead, Ostrom argues that successful CPR situations are actually characterized by what she calls "polycentric" systems, which are complex combinations of interrelated public and private actors and practices (Ostrom 1990, p. 133). More recently, Ostrom has used the term "panacea problem" to identify overly simplified institutional prescriptions for ecological problems (Basurto and Ostrom 2009; Ostrom 2007; Ostrom and Cox 2010) or in other

words, whenever a "single presumed solution is applied to a wide set of problems" (Ostrom and Cox 2010, p. 452).

The idea of avoiding "only way" solutions to problems is also a basic tenet of WSP thinking. Soft path approaches to water management recognize that societies are embedded in particular ecological settings, thus decisions about how to best manage relationships between humans and natural resources should reflect such particularity (Brandes 2009). One-size-fits-all approaches fail here. Recall Gleick's claims about the soft path as actually multiple "paths" to ecologically sustainable water use. And similar to Ostrom's concept of polycentric governance involving complex public and private influences at different levels of resource management, Gleick claims that water management plans should embrace both centralized infrastructure and small-scale decentralized facilities, as well as market and non-market based strategies (Gleick 1998b). Moreover, the WSP itself is not even a uniformly defined concept or set of practices, rather it is a broad approach that embraces certain shared principles of ecologically sustainable water management (Brandes et al. 2009).

Thus we see clear connections between Ostrom's research and the recommendations of water experts: both encourage us to recognize that water resources are CPRs with limited carrying capacities; and both endorse the overarching idea that ecologically sustainable management practices should avoid "only way" approaches. These two connections are part of what creates a specific challenge. As envisioned by Ostrom and Cox, today's challenge is to construct theories for successful environmental conservation that take into account complex relationships among social and ecological

variables occurring in any particular CPR situation (Ostrom and Cox 2010). The central problem in this inquiry about states managing watersheds according to WSP principles is precisely such a challenge, and ultimately this inquiry aims to respond to the challenge by developing a well-constructed theory about when states might implement WSP practices in freshwater basins. Fortunately Ostrom provides a recently developed tool for conducting such an inquiry.

2.2 Ostrom's SES framework

Ostrom's general framework for analyzing sustainability of social-ecological systems (SES) is an appropriate tool for exploring the likelihood that states will cooperate to manage shared water resources according to WSP principles. Ostrom's framework is intended to organize isolated findings from different scientific disciplines in order to better understand processes that lead to improvements in or deterioration of natural resources, which also happens to be the aim of this inquiry about transboundary water basins.

One of the most basic uses of Ostrom's SES framework involves asking a fundamental question: "When will users of a resource invest time and energy to avert a tragedy of the commons?" (Ostrom 2009, p. 420). The central concern of this inquiry - *when will states, as users of common-pool water resources, self-organize to adopt management approaches in individual watersheds that effectively address twenty-first century water challenges?* - is from the same mold as Ostrom's basic question. Both of

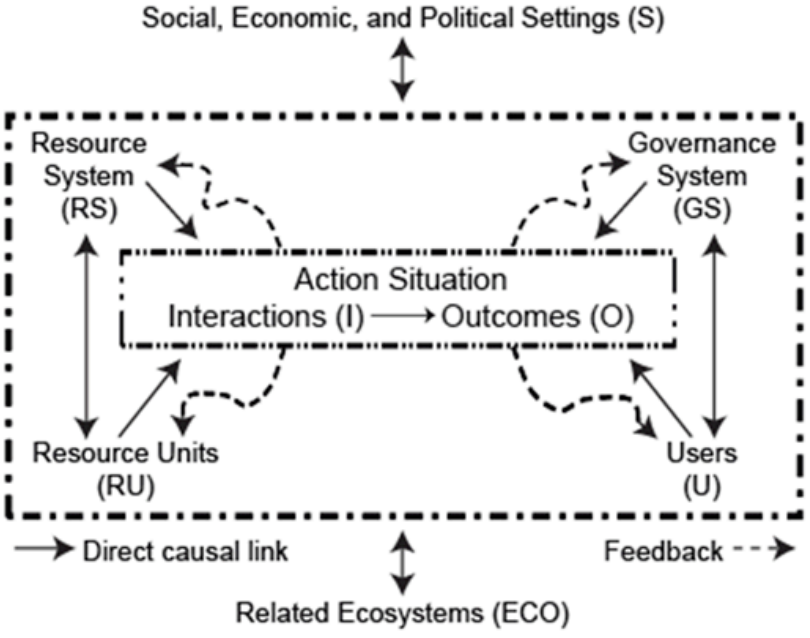
these questions involve asking when resource users will behave according to new rules intended to promote the ecological sustainability of a particular resource.

By asking these questions, both Ostrom's work as well as this inquiry also question the viability of Garrett Hardin's famous "Tragedy of the Commons" thesis about resource system collapse, whereby Hardin argues that users trapped in accelerating overuse inevitably destroy their resources systems by failing to invest in themselves and self-organize (Hardin 1968). Ostrom offers the theoretical answer to her own question that "when expected benefits of managing a resource exceed the perceived costs of investing in better rules and norms for most users and their leaders, the probability of users' self-organizing is high" (Ostrom 2009, p. 420). Thus unlike Hardin's thesis, Ostrom's SES framework assumes the possibility that under certain circumstances users are able to implement new management rules and norms of behavior in order to use natural resources sustainably. Based on what WSP thinkers and what other water experts claim, this inquiry follows Ostrom's lead: In order for individual transboundary watersheds around the world to avoid collapse, or a tragedy of the commons, users in multiple states face the task of self-organizing in order to adopt new rules for managing water resources at the basin level. Thus the phenomena explored in this inquiry - states managing overlapping watersheds according to soft path principles - is a prime example of the type of scenario that Ostrom's framework addresses.

Transboundary water basins are examples of social-ecological systems (SESs). SESs are defined as "social systems in which some of the interdependent relationships among humans are mediated through interactions with biophysical and non-human

biological units" (Anderies et al. 2004, p. 18). In a complex SES, systems are composed of subsystems and internal variables within these subsystems at multiple levels analogous to how organisms are composed or organs, tissues, cells, proteins, etc. Ostrom's SES framework is composed of four first-level subsystems: a resource system, resource units, users, and a governance system. These core subsystems interact in action situations to produce outcomes, which generate feedback for the SES itself well as other related ecosystems and social, economic, and political circumstances (Figure 1).

Figure 1. The dynamics of the four core subsystems in Ostrom's SES framework (Ostrom 2009):



Using Ostrom's SES framework to address the central question in this inquiry, we see the following core SES subsystems:

- *Resource System (RS)*: Individual watersheds or drainage basins that cross one or more international political borders;
- *Resource Units (RU)*: The quantity and quality of water used for human activities;
- *Users (U)*: States (the communities and individuals with their borders);
- *Governance System (GS)*: Governments, treaty regimes, and other entities that manage the water resources, including rules related to water management and how they are made.

These subsystems interact in action situations to produce outcomes, which in turn produce feedback for the SES as well as external factors. The outcomes for which this inquiry aims to achieve a better understanding include the international aspects of sustainable management of global freshwater resources. Specifically, the hope is to learn more about when and why users will adopt WSP rules for international water resource systems by observing outcomes in different cases.

Ostrom then divides each these first-level subsystems into sets of second-level variables (Table 1, from Ostrom 2009).[10] Researchers working within this framework have identified multiple variables that affect the likelihood of users engaging in collective action to self-organize and successfully manage a shared resource. Ostrom identifies ten

[10] These second-level variables are also composed of deeper-level variables, but my inquiry does not include analysis below these second-level variables. I believe my comparative case study of international watersheds would become confused by selecting too many variables. Likewise, Ostrom does not include any deeper-level variables in her general framework.

variables in particular (indicated by asterisks in Table 1) that are frequently associated with positively or negatively affecting the likelihood that users will self-organize (developed from Ostrom 2009).

Table 1. Ostrom's second-level variables in each core SES subsystem (RS, RU, U, GS).

Resource Systems (RS)	*Governance Systems (GS)*
RS1 Sector (e.g., water, forests, pasture) RS2 Clarity of system boundaries *RS3 Size of resource system RS4 Human-constructed facilities *RS5 Productivity of system RS6 Equilibrium properties *RS7 Predictability of system dynamics RS8 Storage characteristics RS9 Location	GS1 Government organizations GS2 Nongovernmental organizations GS3 Network structure GS4 Property rights systems GS5 Operational rules *GS6 Collective-choice rules GS7 Constitutional rules GS8 Monitoring/sanctioning processes
Resource Units (RU)	*Users (U)*
*RU1 Resource unit mobility RU2 Growth or replacement rate RU3 Interaction among resource units RU4 Economic value RU5 Number of units RU6 Distinctive markings RU7 Spatial/temporal distribution	*U1 Number or users U2 Socioeconomic attributes of users U3 History of use U4 Location *U5 Leadership *U6 Norms/social capital *U7 Knowledge of SES *U8 Importance of resource U9 Technology used

Ostrom explains why each of the ten starred second-level variables is often determined to affect the likelihood of users' successful self-organizing (Ostrom 2009):

- *Size of the resource system (RS3)*: Very large systems have high costs of defining boundaries, monitoring use, and gaining ecological knowledge. On the other hand, very

small systems do not generate significant flows of valuable goods. Thus moderate size is most conducive to self-organization.

- *Productivity of system (RS5)*: If a system is perceived to be either already exhausted or very abundant, users will not see a need to manage it for the future. Ostrom also claims that users need to observe some scarcity before they invest in self-organization (Ostrom 2009).
- *Predictability of system dynamics (RS7)*: Systems must be sufficiently predictable so that users can estimate outcomes from particular harvesting rules. Forests, for example, tend to be more predictable than river systems.
- *Resource unit mobility (RU1)*: The costs of observing and managing mobile resource units, such as rivers, is higher than with stationary units such as lakes.
- *Number of users (U1)*: The transaction costs associated with getting users together to agree on management practices tend to be higher with larger groups. However, if the tasks of managing a large resource are very costly, larger groups are more able to mobilize labor and other resources. Thus group size is relevant, but it depends on other SES variables and the types of management tasks involved.
- *Leadership (U5)*: The presence of respected local leaders, such as college graduates and influential elders, as a result of prior organization for other purposes increases the likelihood of self-organization.
- *Norms/social capital (U6)*: Users who share norms of reciprocity, meaning moral and ethical standards regarding how to behave in groups they form, and have sufficient trust

in one another to uphold agreements face lower transaction costs in reaching new agreements and lower costs of monitoring.

- *Knowledge of the SES (U7)*: Users who share knowledge of SES attributes and how their actions affect one another will perceive lower costs of organizing. This is especially important for resource systems that regenerate slowly, such as aquifers, or when populations expand rapidly. In these cases, users may not understand the carrying capacity of the resource and destroy it.
- *Importance of resource (U8)*: Successful self-organization requires that users be at least partially dependent on the resource system for their livelihood, well-being, or survival, or that users attribute high value to the sustainability of the resource.
- *Collective-choice rules (GS6)*: When users have autonomy at the collective-choice level to create, implement, and enforce some of their own rules, they face lower costs of self-organization and lower costs in defending a resource against invasion by others.

Although Ostrom does not consider "history of use" (U3) as one of the second-level variables that impacts user self-organization, I include this variable in my analysis of international transboundary water resources. The logic for including this variable is to test whether past cooperative events and conflicts over water have any bearing on prospects for either present or future self-organization. In other words, an additional task for this inquiry is to analyze international water affairs to test the framework itself. I define "history" of use as simply past successes and failures related to cooperation over international waterways.

The general SES framework is intended to be used for what Ostrom and Cox describe as a diagnostic approach to analyzing individual social-ecological systems (Ostrom and Cox 2010). One intention of this approach is to overcome the panacea, or simplistic cure-all, problem discussed earlier. Ostrom and Cox draw comparisons between SESs and the medical field, noting that medical treatments include a long history of recommending panaceas, such as purges and the use of aspirin, as treatments for wide ranging illnesses. Instead of offering general remedies for most health problems, doctors today ask questions about potential sources of health problems and explore deeper by collecting additional information that might help identify causes of problems, such as temperature, X-rays, blood pressure, and many other indicators. Ostrom and Cox encourage researchers to pursue knowledge of SESs in a similar fashion, unpacking complex social-ecological phenomena into multiple levels of interrelated variables in order to better understand problems and generate more thorough conclusions about particular CPR situations. Quoting Oran R. Young (Young 2002, p. 176), Ostrom and Cox maintain that "the diagnostic approach seeks to disaggregate environmental issues, identifying elements of individual problems that are significant from a problem-solving perspective and reaching conclusions about design features necessary to address each element" (Ostrom and Cox 2010, p. 458).

This inquiry follows such an approach, testing four transboundary case studies within Ostrom's SES framework in order to better understand under what circumstances states will self-organize to manage shared water resources according to WSP principles.

2.3 Four international watershed case studies

In the Chapter 3, international freshwater basin case studies are analyzed within Ostrom's SES framework in order to gain better knowledge about the likelihood that states sharing water resources will implement WSP approaches at the basin level. I have selected four cases based on three factors: general water-related cooperativeness among states, resource scarcity, and evidence of basin-level soft path management strategies.

There is arguably only a single example anywhere in the world of states using WSP approaches to manage shared basins. This lone case is the European Union Water Framework Directive. The EU example represents a case of successful self-organization from which lessons might be learned. It is compared alongside three other cases: the Tigris-Euphrates Rivers Basin, the Indus Waters Basin, and La Plata Basin. None of these three other international basins demonstrate evidence of WSP management approaches, and they represent failure cases. These three failure basins demonstrate varying degrees of interstate cooperation and water scarcity. As discussed above, implementing WSP management strategies at the basin level would require sophisticated cooperation among states in a CPR situation, thus it is logical to analyze failure cases of varying cooperation alongside a successful and highly cooperative case. We might hypothesize, for example, that more cooperative cases are more likely to self-organize, although let us put aside

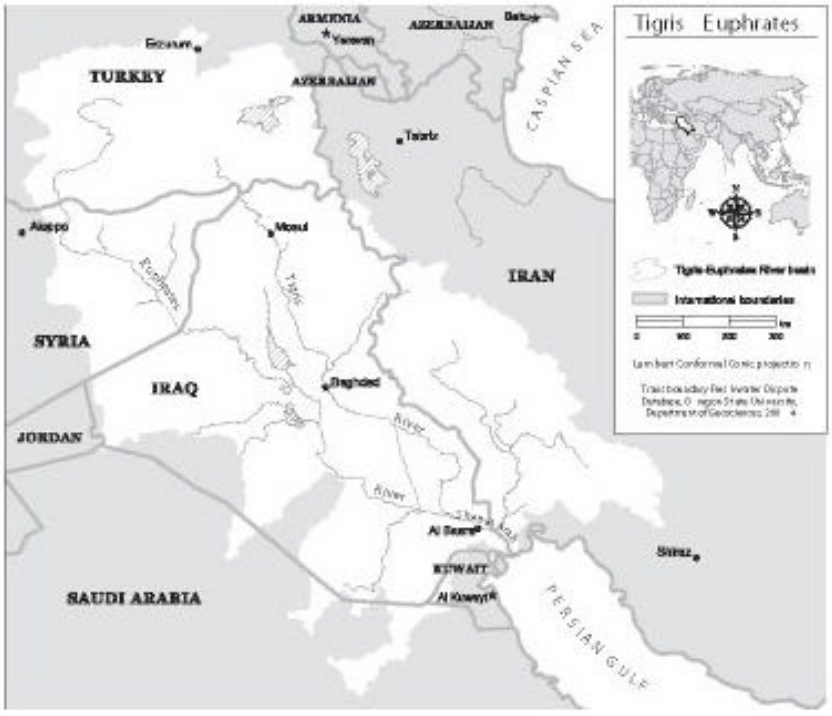
such conjecture for now. First, an introduction to each case provides a more rounded rationale for its inclusion in this inquiry.

The Tigris-Euphrates Basin

In this case, three riparian states - Turkey, Syria, and Iraq - lack a formal agreement about how to share Tigris-Euphrates Basin waters. Of the four cases analyzed, this one represents the largest failure of interstate cooperation.

The Euphrates and Tigris Rivers originate in southeastern Turkey. They meander through this territory before passing through Syria and then across Iraq where they join together just before emptying into the Persian Gulf (Figure 2). The three states are more dependent on the Euphrates than the Tigris, and they have developed it extensively. Turkey, the upper riparian, has the most water resources of the three countries, thus it is the least vulnerable due to both its strategically advantaged geographic position and its total volume of available water. Syria relies on the Euphrates for nearly 90% of its total freshwater, and the river is also the main source of drinking water for the country's major cities. Syria is experiencing both water and electricity deficits and is looking towards developing the two rivers further in order to solve these problems. Iraq is the most vulnerable state. Two-thirds of its territory is desert; the Euphrates and Tigris Rivers compose its only source of freshwater; and it has significantly more people living along the riverbanks than either upstream riparian. Iraq is also now experiencing substantial water shortages associated with warfare and its aftereffects (Klare 2001).

Figure 2. Map of the Tigris-Euphrates Basin (Wolf and Newton 2008)



The water sharing problem in the Euphrates-Tigris basin is multidimensional. It might be best thought of as a collection of interlinking disputes that each impact the greater collective goods problem of sharing the two rivers. Dating back to the 1950s, for example, unilateral development projects have been a continuous source of conflict. Most of these have been Turkish dam and irrigation projects, but Syria is also to blame with construction of the Tabqa dam in the late 1960s. The developments along the Euphrates

drove the three states to the brink of warfare in 1975, and tensions have been relatively high ever since. Problems have been compounded by disputes involving the Kurdish nation that overlaps all three states. Turkey has constructed water projects as a way to punish Syria for their support of Kurdish separatists in Turkey. Tensions also flared between Turkey and Iraq in the late 1990s when Turkey attacked PKK rebels in northern Iraq. To make matters worse, Turkey's military support for Israel is also an issue that has been dragged into the general water dispute. Together, these circumstances suggest that other spheres of conflict seem to influence the water sharing problem. In the Euphrates-Tigris Basin, water disputes have been directly linked to other sources of ongoing conflict, and other aspects of interstate cooperation have subsequently suffered (Wolf and Newton 2008).

As an example of the overall lack of cooperation, the three states have not even been able to agree on the definition of the river system. Turkey argues that it should be viewed as a "transboundary water system," but Syria and Iraq call it an "international water," thus laying claim to a greater share of water. Turkey claims territorial sovereign rights over both rivers, while Syria and Iraq believe that all three riparian states should have equal rights over the waters, with each state receiving one third of the flow. Turkey rejects this egalitarian approach by rationalizing that it deserves more water because of its relatively superior irrigable farmland and greater energy-generating potential. Additionally, Turkey claims that the two rivers are actually one due to the fact that they briefly come together in southern Iraq. Ideally, the UN *Convention on the Law of the Non-Navigational Uses of International Watercourses* should be able to help resolve

some of these general disputes, but the treaty's rather vague concepts of "equitable" and "reasonable" distribution have not aided any decisiveness in this situation (Carkoglu and Eder 2001). Thus it seems that international law itself is merely another venue for power struggles between Turkey, Syria, and Iraq.

One central problem of the CPR situation in the Euphrates-Tigris Basin is Turkey's Southeast Anatolia Development Project, otherwise known by the acronym GAP. As source of Turkish pride and a symbol of national development since the 1950s, GAP projects have increasingly affected water quantity and quality in downstream Syria and Iraq. GAP's nearly two dozen dams along with a series of giant irrigation and energy projects have created the current water shortages in the lower riparians. Turkey views GAP as a driving force behind modernization and development of the southeast portion of the country. Syria and Iraq, on the other hand, share the perspective that unilateral GAP projects amount to water imperialism. Turkey's 1991 construction of the Ataturk Dam, for example, is a project that poses significant threats to Iraq and Syria's immediate and future agricultural plans. This disputed dam has cemented their view that Turkey seeks to control the flow of both rivers to downstream states as a means of asserting dominance over them. In response, the downstream states have resorted to military posturing and attempts to contribute to the turmoil of Turkey's internal Kurdish affairs (Carkoglu and Eder 2001; Kibaroglu 2002).

Thus we observe the following dynamics in the Tigris-Euphrates Basin: Water scarcity is relatively high in this generally arid region, and all three states are highly dependent on waters from this international water basin. The lower riparian states, Syria

and Iraq, are more dependent and more vulnerable than the upper riparian, Turkey, which is the most powerful state whose territory includes all the headwaters of the basin. There is no treaty governing Tigris-Euphrates waters, and overall cooperation over water resources among the neighboring states is generally low, to the point where water disputes have figuratively spilled over into other international conflicts. The basin is certainly not managed according to any WSP principles. Given the overall failure of Turkey, Syria, and Iraq to cooperatively share Tigris-Euphrates waters, it would appear very doubtful that the three states would self-organize to implement soft path management strategies at the basin level.

The Indus Waters Basin

If the Tigris-Euphrates case represents an overall failure of states to cooperate, the Indus case involving India and Pakistan represents a unique mixture of cooperation and conflict. The Indus Waters Basin is governed by the *Indus Waters Treaty* (IWT). Signed and entered into force in 1960, this agreement is often celebrated as one of the most successful water sharing arrangements between two rival, riparian states. The treaty has withstood two relatively large wars and decades of conflict between Pakistan and India. Perhaps remarkably, never once has India seriously threatened to cut-off downstream Pakistan from its sole freshwater supply, and Pakistan has responded by doing its part to uphold the IWT (Doyle and Risely 2008). Thus despite major conflict in other spheres of

the relationship between these two states, cooperation over water resources has remained robust.

Shared between India, Pakistan, Afghanistan, China, and Nepal, the Indus Waters Basin is among the largest in the world. Rugged terrain has largely prevented Afghanistan, China, and Nepal from developing this resource within their borders, and the territory that now composes India and Pakistan has historically been the focus of this river system (Figure 3). The main Indus, along with its two western tributaries and three eastern tributaries, is the site of one of the world's oldest and most sophisticated irrigation networks.[11] Existing projects date back centuries, and the entire system accounts for nearly 6% of the world's irrigated land. The Indus Basin headwaters are located entirely within India's borders, but both India and Pakistan depend heavily on this resource. The relatively dry northwest Indian provinces use Indus waters to irrigate lands that are the country's breadbasket, and Pakistan depends entirely on Indus waters as its only source of freshwater to irrigate an otherwise arid landscape (Gulhati 1973; Wolf and Newton 2008).

[11] The two other eastern tributaries are the ones currently undeveloped in rough terrain. It might be only a matter of time, however, before technology and demand from China, Afghanistan, and Nepal push to develop these rivers. This could potentially impact the India-Pakistan agreement.

Figure 3. Map of the Indus Waters Basin (Wolf and Newton 2008)

India and Pakistan became nation-states in 1947, but formal disputes over Indus waters predate independence. The British colonial government put the Indus basin under provincial control in the 1930s, and by the early 1940s a significant dispute arose between the provinces of Punjab and Sind. Differences went unresolved, and what was a provincial disagreement over access to freshwater became a significant international problem in 1947 between what became the sovereign states of India and Pakistan. It took the efforts of a third party to help foster a successful agreement - the World Bank, in this case. (Gulhati 1973). At the time of negotiations in the 1950s, David Black was both

president of the World Bank and a personal friend of David Lilienthal, the former chairman of the Tennessee Valley Authority. Black outlined two "essential principles" that both India and Pakistan had to agree to in order to receive World Bank support: first, that Indus waters must be managed cooperatively, and second, that problems must be approached on a strictly functional level without regards to past negotiations or claims. The "essential principles" laid the groundwork for curtailing political interference, and keeping political influences to a minimum is recognized as a key factor of the sustained Indus success (Wolf and Newton 2008).

After nearly a decade of negotiations, India and Pakistan finally reached agreement to treaty terms brokered by the World Bank. One reason for World Bank's success is that it has been in a position to address both technical and financial aspects of the Indus agreement. It financed nearly one billion dollars worth of dams and storage facilities for the project, and it also provided the engineering and practical expertise necessary to essentially divide the basin into two separate systems. Previous attempts to develop an integrated approach to the development of Indus waters repeatedly ended in stalemate, so an integrative strategy was abandoned in favor of one that emphasized separation. With a few minor exceptions, Pakistan was awarded full access to flow from the three western rivers, and India was granted access to the three eastern rivers. The problem still remained, however, that the headwaters and much of the infrastructure would remain permanently in India's territory. India agreed not to interfere with the flow of the western rivers, but it was realized at the time that a simple promise would be

insufficient to ensure that India, the more powerful country, would respect the treaty (Wolf and Newton 2008).

To overcome the collective action problem of maintaining the agreement, the treaty created the Permanent Indus Commission (PIC), an institution composed of one commissioner from each country. The PIC's main function is to promote cooperation between the treaty Parties, and it does this through annual Commission meetings, maintaining the total disclosure of all information about development projects, leading full system tours, submitting annual reports to both governments, and providing a venue and procedure for conflict resolution. According to the treaty terms, if the PIC is unable to resolve a dispute, a "neutral expert" appointed by the World Bank becomes a mediator with authority to make legally binding decisions. In the event that mediation fails, treaty provisions call for the convening of a Court of Arbitration, but to date this has never happened. Nearly all disputes since 1960 have been resolved by the PIC, and the "neutral expert" option has been exercised only an few times (Wolf and Newton 2008). The PIC's resilience has been a much lauded success. Commission meetings and full system tours continued throughout the 1965 and 1971 wars, as well as the 1971-75 period that lacked diplomatic relations between the two countries (Zawahri 2009).

Overall, the Indus case represents as an example of interstate cooperation over scarce water resources despite other areas of conflict, and the institutional design of the IWT is regarded as the central reason for sustained success of this potentially dangerous situation (Zawahari 2009). However, it is not a case of states managing a watershed according to soft path principles. While there is clearly more interstate cooperation in the

Indus Basin than the Tigris-Euphrates, it appears unclear whether or not there is realistic hope for Indus waters to be managed by WSP approaches. Ecological sustainability is not the goal of the IWT, rather the agreement centers on resolving and preventing conflicts between two rival states. As discussed above, structurally dividing the watershed into what is now effectively two basins was considered necessary to establish a water sharing agreement between India and Pakistan, but this approach does not reflect best ecological practices. Aaron Wolf concludes the following lesson from the Indus situation:

"In particularly hot conflicts, when political concerns override, a sub-optimal solution may be the best one can achieve. The [IWT] plan pointedly disregards the principle of integrated water management, recognizing that between these particular riparians, the most important issue was control by each state of its own resource. Structural division of the basin, while crucial for political reasons, effectively precludes the possibility of increased integrated management" (Wolf and Newton 2008, p. 8).

La Plata Basin

Of the three so-called failure cases, La Plata Basin represents the highest degree of interstate cooperation. This South American basin is among the largest in the world, second in total drainage area only to neighboring Amazon Basin. La Plata includes territory in five states: Argentina, Bolivia, Brazil, Paraguay, and Uruguay (Figure 4). It also encompasses the Pantanal, which is the world's largest wetland. The basin sustains

much of the agricultural, industrial, and energy sectors of the five countries who share it. Unlike the Tigris-Euphrates and the Indus cases, La Plata's riparian states have a history of cooperation and joint management, and they have viewed the river system as a force that binds them together (Wolf and Newton 2008).

Figure 4. Map of La Plata Basin (Wolf and Newton 2008)

La Plata Basin is a complex system that is essentially indivisible. La Plata waters are vast and interdependent, meaning that each river uses water in ways that depend upon and affect other rivers. Any human interference in one area shows up as effects in another, and successful development or management of this system requires a high degree of

cooperation among users (Levin 1972). Thus what we see as relatively sophisticated cooperation among states in La Plata Basin is perhaps a consequence of ecological conditions that have always demanded a certain approach.

The 1969 La Plata River Basin Treaty is an umbrella treaty that provides a framework for integrated management, development, and preservation of the system. All five nations are signatories, and they also have other multilateral and bilateral agreements regarding specific basin development issues (Wolf and Newton 2008). Unlike the Indus agreement, the La Plata treaty contains no higher legal authority to mandate binding decisions. The basin is overseen by foreign ministers of each state who meet at minimum once a year. All basin projects must be approved in a meeting of the ministers by a unanimous 5-0 decision. If a dispute or legal problem with a project arises, it must be referred back and processed through each country's legal system (Levin 1972).

This process contrasts sharply with the Indus conflict resolution mechanism that relies on a third party - the World Bank - to mediate and potentially arbitrate arising disputes. However, in the La Plata case it should not be assumed that a spirit of friendship and cooperation is the sole reason for the lack of a higher legal authority. The distribution of power in the La Plata basin is significantly different than the situation between India and Pakistan. For example, there are five states as opposed to two. Knowing that any project must gain unanimous backing from all five Parties, La Plata states are probably less likely to propose offensive projects. Also, it seems that it would be relatively more difficult for any single state to pursue its self-interest in ways that would violate the treaty. With five committed members, the La Plata agreement allows for an element of

peer pressure that is not possible between the two-party situation of the Indus basin. In the Indus case, both literally and figuratively, India has the upper hand over Pakistan, and much of the agreement depends on India's willingness to respect the treaty. Pakistan is vulnerable to Indian power in ways that no La Plata state is vulnerable to any other. The World Bank, it seems, is a necessary third party check on India's power. The La Plata situation is much different in that it seems to some have built-in checks on power simply by being a five-party agreement. Generally speaking, it is likely more difficult for one state to dominate four others than it is for one state to dominate one other. This is not to suggest that all that matters is numbers, rather it highlights that an asymmetrical two-party agreement might need third party authority in ways that a more balanced five-party agreement might not.

One key characteristic that distinguishes La Plata from the Tigris-Euphrates and Indus cases is La Plata's abundant freshwater resources. Climate in La Plata Basin is mostly subtropical, and certain geographic zones receive heavy rainfall. Wetlands and swamps characterize much of the western lowlands, and only a relatively small portion of the basin is dry grassland (Levin 1972). On the other hand, the Tigris-Euphrates and Indus regions are mostly arid. These river systems are much more heavily strained to meet the pressing needs of their users. In this Indus case, both India and Pakistan are experiencing population growth alongside declining ecological conditions in the basin, and global warming and deforestation have already led to increasing occurrences of droughts and floods (Klare 2001).

When compared to the water scarcity conditions seen the Tigris-Euphrates and Indus Basins, cooperation appears easy in an environment of abundance such as La Plata. In a sense, one might not even consider La Plata to be a cooperative CPR situation. If resources are sufficiently abundant for each state to fulfill their own self-determined needs, perhaps La Plata waters are closer to Ostrom's conception of a purely public good than a CPR. Recall Ostrom's principle of subtractability, whereby a resource becomes less available for other potential users upon each use (Ostrom 1990). If subtractability is key to differentiating CPR situations from public goods situations, a lack of subtractability in the La Plata could perhaps characterize it as a much different kind of situation than either the Indus or Tigris-Euphrates. In a sense, it seems possible that any spirit of friendship or community on display among La Plata states might simply be due to an absence of the kinds factors conducive to potential conflict in scarce CPR situations.

While the situation of relatively abundant water resources in La Plata obviously deserves consideration when comparing this case to more arid basins, it would be misleading to downplay or dismiss the interstate cooperation in La Plata based solely on this factor. Although abundant, La Plata resources are not infinite. And as discussed above, the interdependency of these waters means that they cannot be exploited in isolation. Use in any one area generates effects in another (Levin 1972), and these effects have given rise to various disagreements. Most notably, ongoing disputes between governments, corporations, and citizens in the region have stalled developments in the large-scale project known as "Hydrovia," a controversial transportation project that

would dredge and straighten major portions of the Parana and Paraguay Rivers in order to open up sea ports to currently landlocked Bolivia and Paraguay. The expansive Pantanal wetland would be strongly affected by Hydrovia, and pointing to significant biodiversity loss and changes to Pantanal hydrology, environmentalists as well as those whose livelihoods depend on traditional economies have protested the construction of the waterway (Huszar and Bucher 1996). Thus Hydrovia is a source of significant international conflict and controversy even amid users who share abundant water resources.

Overall, it would be hard to argue that the situation in La Plata is not significantly more cooperative than either the Tigris-Euphrates or Indus Basins. It is a complex system that is managed at the watershed level by requiring unanimous support from all five countries for any development project anywhere in the basin. However, like the other two cases described above, La Plata does not implement soft path management strategies at the basin level. Thus La Plata Basin is watershed that receives relatively sophisticated interstate cooperation yet no commitment to WSP approaches.

The European Union Water Framework Directive

This case represents arguably the only instance anywhere in the world of countries self-organizing to manage shared drainage basins according to soft path principles. Unlike the other three cases described above, the EU case does not involve only one international

drainage basin. In contrast, this case includes every transboundary watershed in each EU member state.

Adopted in 2000, The European Water Framework Directive (WFD) is a legal regime intended to unify previously fragmented water policy throughout Europe into a single, streamlined piece of framework legislation (EC 2000). The European Commission coordinates the implementation of the WFD, and Water Ministers from each member state report directly to the Commission on the progress of implementation. Each State must pass laws to achieve the results agreed to in the WFD. The two main goals of the WFD are the protection and improvement of aquatic ecosystems, and achieving sustainable, balanced, and equitable water use (Ker Rault and Jeffrey 2008; Lanz and Scheuer 2001). These overarching objectives align with core WSP principles about ecological sustainability, and as a whole the WFD marks several other significant milestones for ecologically sustainable international waterway management (Quevauviller 2010).

A first milestone is the WFD's support of water experts' recommendations for basin-level management approaches, whereby the WFD (Article 3) calls for the establishment of river basin districts with defined boundaries as the units of management (Figure 5). The logic behind this decision is that "the best model for a single system of water management is management by river basin - the natural geographical and hydrological unit - instead of according to administrative or political boundaries" (EC 2012).

Each member state is responsible for producing a comprehensive river basin management plan for each river basin district. Plans must include a summary of all human activity and pressures on water resources, current data on water status, a summary of economic analysis of water use, information about protection measures, and measures for control and remediation. Plans must demonstrate the ability of each district to meet target benchmarks for "good ecological status" within set timelines, and plans are reevaluated every six years. (Quevauviller 2010). If a district is located solely within the borders of one state, only that state is responsible for the plan. In the case that a river basin district overlaps EU member state borders (as many districts do), states must coordinate to produce a single management plan for the basin (Articles 13.1 and 13.2). The WFD also attempts to extend this organizational approach to basins that overlap EU member and nonmember states. EU member states are required to attempt to create a coordinated basin plan for water resources shared with nonmember states. In the event that a nonmember state will not coordinate with a member state to develop a basin plan, EU member states must still create a plan for the portion of the basin within EU territory (Article 13.3).

Assigning management duties to districts that are organized according to natural borders instead of international political borders is one strategy used by the WFD in an effort to manage overall hydrological ecosystem system health, not just water quality (Hatton-Ellis 2008). Managing system health requires relatively thorough knowledge of what are called "environmental interfaces", including things such as soil-water interactions, pollutant pathways, and virtually any other information the contributes to a

more clearly developed description of human pressures on natural resources and ecological processes. This system-level focus represents a shift away from traditional "vertical" approaches to water resource management, meaning targeting specific areas such as drinking water or groundwater, towards a more holistic approach that better reflects the interconnectedness among human activities and ecological processes (Bouleau 2008; Quevauviller 2010). The WFD, for example, extends to groundwaters and classifies groundwaters as part of the overall hydrological unit that is each river basin district (Section 1.33). This integrated approach seen in the WFD is an example of what WSP and other water experts encourage as a shift to an "ecosystem perspective" for natural resource management, which is a long-sighted view of ecological sustainability that seeks to bring human activities into a more balanced relationship with the ecosystems they impact (Brandes et al. 2009; Postel 2000).

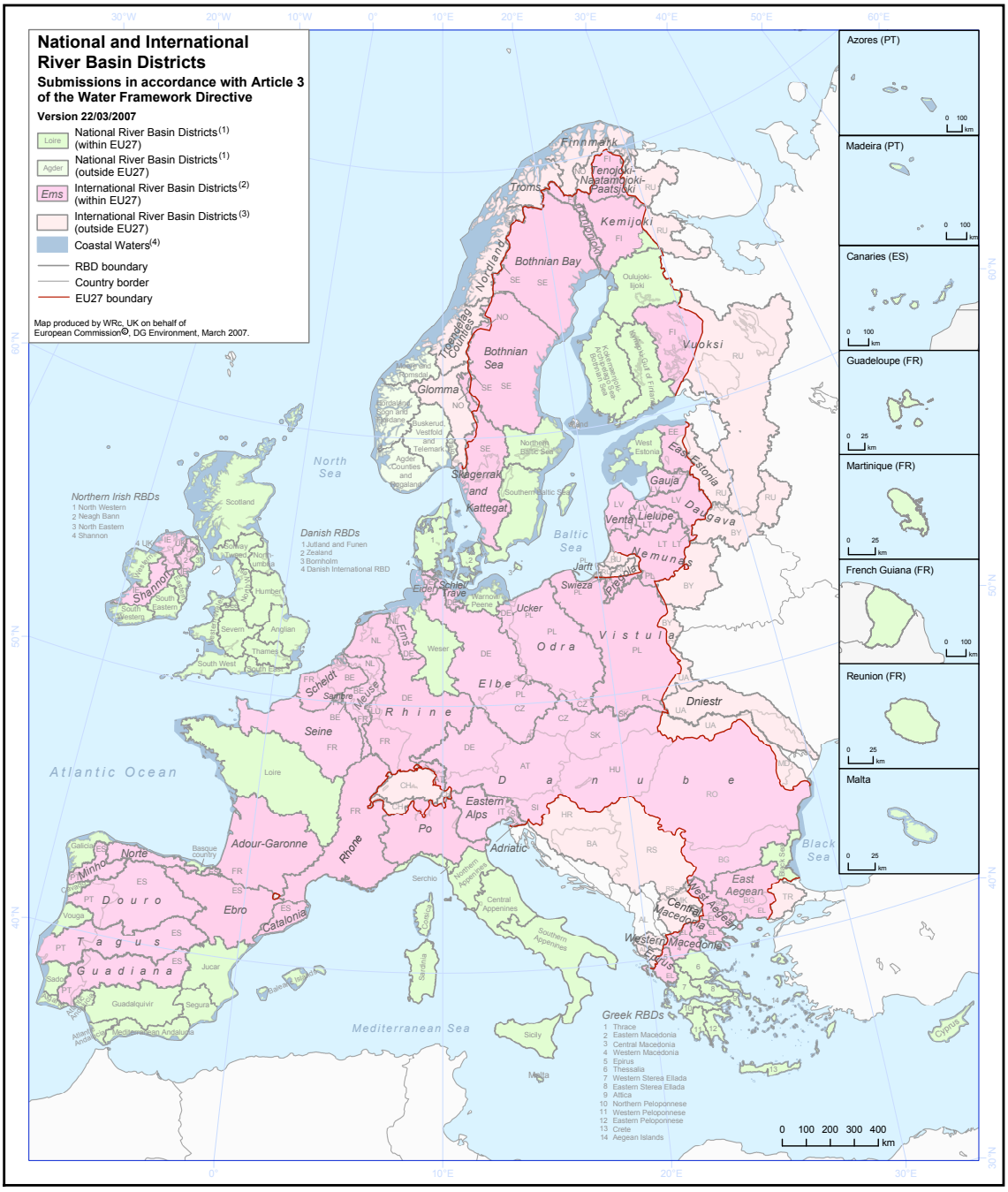


Figure 5. Map of EU river basin districts (EC 2012)

In addition to the overall goals and organizational structure of the WFD broadly reflecting soft path principles, two management practices in particular are clear examples

of WSP thinking. These practices, which are also considered milestones for transboundary water management (Quevauviller 2010), are the use of economic tools to increase water productivity, and democratic participation throughout planning and management processes (Klawitter 2009).

The WFD calls for member states to account for the recovery of the true costs of water use, including environmental costs as well as economic costs (Bouleau 2008; Grimeaud 2004). Article 9 requires that "water-pricing policies provide adequate incentives for users to use resources efficiently, and thereby contribute to the environmental objectives of this Directive" (9.1). Specific policies are to be aligned with economic analysis of water use (required by Article 5) that identifies the most cost-effective strategies for reaching the environmental objectives of the WFD. Together, Articles 5 and 9 lay out a general plan for a "strict water pricing policy to achieve a more demand-driven water management and more efficient use of water" (Klatwitter 2009, p. 215). This strategy reflects the soft path principle of using economic tools to manage demand, which is one method of achieving the larger goal of increasing the productivity of each unit of water used (Gleick 2003).

The second WFD management practice indicative of soft path thinking is a commitment to democratic processes at different levels of water management. This is thought to be especially important for a holistic approach to ecosystem management because the creation of effective policy for overall system health requires input from all stakeholders in the ecosystem. The WFD accounts for this by creating an information exchange platform that builds up communication about best practices among all actors

involved in EU water management, including policy makers and implementers, technology providers, scientific communities, industrial stakeholders, NGOs, individual citizens, and others. One aspect of this platform is the WFD Common Implementation Strategy launched in 2001, which has apparently been a useful measure for allowing member states to informally exchange technical information and best practice examples, share experiences and resources, and avoid duplication of efforts (Ker Rault and Jeffrey 2008; Quevauviller 2010). Additionally, the WFD seeks scrutiny and input from citizens and citizen groups affected by WFD policies. The logic here is that transparency ultimately promotes implementation and enforcement, as seen in the Introduction to the WFD:

"The greater the transparency in the establishment of objectives, the imposition of measures, and the reporting of standards, the greater the care Member States will take to implement the legislation in good faith, and the greater the power of the citizens to influence the direction of environmental protection, whether through consultation or, if disagreement persists, through the complaints procedures and the courts. Caring for Europe's waters will require more involvement of citizens, interested parties, and non-governmental organisations" (EC 2012).

This commitment to transparency, democratic involvement, and the open and easy exchange of information is an example of the kind of democratic participation called for by water experts and WSP thinkers (Wolff and Gleick 2003; Pacific Institute 2012).

Overall, what we observe in the European Union case demonstrates international watersheds being managed by states at the basin level according to soft path approaches. However, we should not necessarily conclude that the WFD is a flawless case, as there are certain core soft path principles that appear to be missing. For example, nowhere in the WFD do we find a commitment to matching the quality and quantity of water delivered with intended uses. Additionally, river basin plans are not required to employ backcasting strategies that would identify total water use that could be fulfilled within the limits of each resource. These principles are integral to soft path thinking, but there is little or no evidence of either in the WFD.

It is also worth highlighting that the WFD is not without its critics, especially with regards to implementation. Thorough discussion of WFD criticism is beyond the scope of this piece, but note the following:

- Harmonized implementation in all EU member states (and preferably nonmember states that share transboundary waters) is needed if the WFD is to be successful. Currently some states lag behind in schedule, and additional financial and technical assistance from the European Commission would help certain countries pull alongside others (Hontelez 2010).
- Quevauviller (2010) argues that not enough is being done to facilitate the exchange of esoteric scientific research from different disciplines between scientists and WFD policy makers. Quevauviller would like to see the development of what he calls a "science-policy interfacing mechanism" (p. 184) to mitigate the many challenges associated with putting science into EU water management practices.

- The European Environmental Bureau's (EEB) ten-year review of the WFD finds three major problems with WFD implementation (Hontelez 2010). First, river basin plans lack sufficient transparency and/or robustness, and many are behind schedule. Only six basin plans provide data and objectives for restoring nutrient conditions to water bodies, a measure which is considered essential for achieving overall "good ecological status" required by the WFD. Secondly, the EEB report finds massive procrastination with the restoration of waters contaminated by excessive nutrients. These delays are argued to be in violation of minimum WFD legal criteria, and for each delayed case the EEB rejects what it views as generic excuses stating high costs and lack of knowledge. A third criticism issued by the EEB report is that too many basin districts are able to purse status quo approaches by using exemptions that allow them to avoid moving on from old approaches. This third problem is central to the EEB's overall harsh criticism of the WFD's ten-year progress of implementation. The EEB summarizes their findings by stating that "the result shows very little progress and does not meet basic expectations for legal correctness, let alone expectations for environmental ambitions and systematic reforms as required to set the path towards sustainable water management" (Hontelez 2010, p. 4).

Given this criticism of implementation, as well as the lack of certain WSP principles, the WFD is in all likelihood an imperfect example of soft path water management approaches to international watersheds. However, perfection does not appear to exist anywhere in the world. While the EU case might not represent an ideal

type, it nonetheless comes closer than any other international situation. And of the four cases analyzed in this inquiry, the WFD clearly stands alone as what could be reasonably considered a successful example of states self-organizing to manage CPRs according to rules and norms focused on ecological sustainability.

As discussed above, experts' recommendations for addressing twenty-first century water problems suggest a form of interstate cooperation far more sophisticated than most practices currently occurring in international water management affairs. Arguably, the only successful case in the world is Europe's WFD, yet even this promising example is not free of shortcomings and implementation problems. The other three cases are all examples of failures to manage international water basins according to soft path principles, and they vary according to general levels of interstate cooperation. The Tigris-Euphrates Basin is the least cooperative, thus it might be expected to be the least likely to self-organize. Although the Indus Basin countries of India and Pakistan have fought wars against one another, their water sharing agreement has robustly withstood an otherwise hostile relationship between the two countries. Perhaps this success includes factors indicative of potential to develop more sophisticated water cooperation. The five La Plata states are the most cooperative of the three failure cases, yet there must be factors that account for its difference from the success seen in the EU case. Each of these cases in now tested in Ostrom's SES framework in order to help develop understanding of when and why states might self-organize to manage CPR water resources using approaches that focus on ecological sustainability.

Chapter 3: Findings

3.1 Methodological limitations

This chapter uses Ostrom's SES framework to analyze the four cases discussed above in order to contribute to better understanding of state self-organization in water-related CPR situations. However, a preliminary word of caution is due here.

More than half a century ago Gilbert White (1957) outlined certain pitfalls of comparative river basin studies. White argued that researchers and policy makers should use some restraint when comparing river basins. White claimed that:

"Natural features of basins cannot be regarded as interchangeable, and while they may be grouped into broad classes according to their combinations of characteristics, the planning of their development always involves a new, adventurous exploration for each stream, revealing differences in flow, channel, sediment, and chemical quality. . . If there is any conclusion that springs from a comparative study of river systems, it is that no two are the same" (White 1957, p. 160).

White's comments here are limited solely to the natural characteristics of river basins, or in terms of Ostrom's framework, the Resource System (RS) first order variable in an SES. Thus even when considering just this first-order variable, White's conclusion

suggests that comparisons between cases will be imperfect. Moreover, things become for more complicated when when considering social factors that influence CPR situations.

Research conducted by Giordano et al. shows that water-related events at the international level are related to other water and non-water events at both the national and international levels. Water-related state behavior, therefore, is a product of intricate hydro-political dynamics distinct to each regional basin. Different cases show significant overall variation, so there is a need to consider historical and political considerations specific to each basin when analyzing transboundary water relationships between states (Giordano et al. 2002). Ostrom's SES framework accounts for this dynamic, connecting causal links between factors internal to a CPR action situation with external factors such as other social, economic, and political settings, as well as related ecosystems (Figure 1 above; Ostrom 2009). Thus the eco-social processes unique to any international water situation are sufficiently complex to render certain comparisons between cases myopic. Ostrom and Cox offer this warning for case-based uses of the SES framework, recommending that only general conclusions be drawn from analysis of sufficiently large sets of case studies: "For a large number of cases, highly specific rules that produce particular outcomes across every case are unlikely to be found. What is more likely is that, when generalizing to a large number of cases, broad social and biophysical attributes associated with general categories of outcomes may be identified" (Ostrom and Cox 2010, p. 458).

The following analysis proceeds accordingly, appreciative of such limitations when using Ostrom's SES framework to compare international basins. Although certain

variables are selected and tested, this inquiry aims to avoid a purely "command-and-control" approach, whereby exclusive focus is given to one or a few target variables in order to generate management prescriptions using highly simplified models. The "command-and-control" approach is similar to the panacea problem described above, and it also goes against water experts' recommendations for sustainable resource management. Instead, this inquiry is an example of Ostrom and Cox's "diagnostic approach" to environmental problems that deconstructs components of complex eco-social phenomena in order to gain better overall understanding about factors contributing to outcomes in particular cases (Ostrom and Cox 2010). Sweeping recommendations based on only four case studies is kept to a minimum.

3.2 First-order SES variables

Using Ostrom's SES framework (Figure 1 above) to diagnose water management affairs in the four international basins described above results in four arrangements of first-order SES variables. Recall each SES has four first-order variables: Resource System (RS), Resource Units (RU), Users (U), and Governance System (GS). Thus for each basin:

European Union WFD

RS = WFD river basin district waters

RU = waters used for human activities

U = EU member states

GS = management rules outlined by the WFD

La Plata Basin

RS = La Plata waters

RU = waters used for human activities

U = Argentina, Bolivia, Brazil, Paraguay, and Uruguay

GS = management rules outlined by the La Plata River Basin Treaty

Indus Waters Basin

RS = Indus waters

RU = waters used for human activities

U = India and Pakistan

GS = management rules outlined by the Indus Waters Treaty

Tigris-Euphrates Basin

RS = Tigris-Euphrates waters

RU = waters used for human activities

U = Iraq, Syria, and Turkey

GS = currently no treaty regime governs this RS

This inquiry seeks to gain better understanding about when each users in each SES will self-organize to manage international drainage basins according to soft path approaches.

Now that the basic first-order variables for each SES have been identified, the next task is to select second-order variables and assign values to them.

3.3 Second-order SES variables

Selecting relevant second-order variables and obtaining measures for them is the first step in analyzing whether the users of CPRs in a SES would self-organize (Ostrom 2009). As described above, Ostrom has identified ten second-order variables that are frequently identified as positively or negatively affecting the likelihood of users self-organizing to manage a resource. In an effort to keep true to Ostrom's research, each SES case is analyzed with reference to nearly all of these variables, with two exceptions.

First, variable U1, which is the number of users, is left out of this analysis. Recall Ostrom's claim that more users typically results in more transaction costs to self-organization, but for a sufficiently large resource it can be beneficial to have more users and resources to meet the demands of managing a large resource (Ostrom 2009). There might be no reliable rationale for determining an optimal number of states that might self-organize to manage watersheds according to WSP approaches. The one successful case involves 27 EU member states, which is a relatively large number, yet this example is also counterintuitive to logic of increased transaction costs with a large set of users. However, the EU case also has governance structures, including the European Commission, to help overcome transaction costs in ways the other cases do not. Thus determining a favorable number of users for these SESs appears to be a complex question

itself that might involve consideration of multiple other variables. Variable U1 has been omitted due to no clear basis for judgment.

The second exception to Ostrom's set is the inclusion of variable U3, which is the history of use among users. It seems plausible that a history of cooperative water management among states could encourage the likelihood of more sophisticated WSP management approaches, and vice-versa. The inclusion of this variable could help provide better knowledge about the relevance of past international water management to current and future SES situations.

Below is the list of second-order variables to be tested within the four SESs, including what Ostrom (2008) describes as optimal conditions for each[12] (Table 2). I have adapted her user variable descriptions (U3, U5, U6, U6, and U8) for SESs whose users are states. Thus the leadership variable (U5), for example, is interpreted to be of leaders of state whose job it is to manage international water affairs. Each variable is assigned a numerical value: 2, 1, or 0. A score of 2 represents optimal conditions; 1 is fair or moderately good; and 0 indicates poor circumstances:

[12] Ostrom does not provide optimal conditions for SES variable U3, history of use, so I have provided a definition.

Table 2. Second-order variables and optimal conditions

Variable #	Variable description	Optimal conditions (score of 2)
RS3	Size of resource system	Moderate size
RS5	Productivity of system	Moderate scarcity
RS7	System predictability	Sufficient predictability
RU1	Resource unit mobility	Very little or no mobility
U3	History of use	Recent history of cooperative use
U5	Leadership	The presence of state ministers, delegates, or other individual leaders whose duties include managing international water affairs
U6	Norms/social capital	States maintain generally cooperative relationships
U7	Knowledge of SES	Thorough knowledge of watershed conditions
U8	Importance or resource	Users are highly dependent on the resource
GS6	Collective-choice rules	Users have full autonomy to craft and enforce management rules

3.4 Measuring second-order SES variables

Below, each of the four international watersheds is measured according to the ten second-order variables selected above (Tables 3-6). An overall score is provided for each SES. A maximum score of 20 (2 points for optimal conditions for each of the ten variables) is presumed to represent a situation whereby states would be most likely to self-organize,

and a minimum score of zero is thought to indicate a lowest likelihood of self-organization.

It is important to emphasize here that raw scores are to be interpreted only as guiding indicators of SES dynamics. It should not be assumed, for example, that one SES case study with a hypothetical score of 10 would be twice as likely to self-organize than another SES with a score of 5, nor should it be assumed that 10 out of a possible 20 points represents a 50% likelihood of self-organization, and so on. As described above, this inquiry uses Ostrom's SES framework as a diagnostic tool for analyzing complex international SES situations occurring among neighboring states, and the raw scores generated from applying the SES framework should not be interpreted as pure statistical metrics that might result from more traditional command-and-control methods (Ostrom and Cox 2010). Subsequent analysis of these four cases discusses, for example, that certain second-order variables might be more significant than others, and that it would be unwise to assume that all second-order variables should be weighted the same. The general point here is that the scores, variables, and SES framework itself are all merely tools for better understanding the circumstances under which states might manage shared freshwater basins using ecologically sustainable methods.

Additionally, the scores for each second-order variable represent my most well-informed opinion about the circumstances of each case study. I have not visited any of these basins to conduct field research on any of these variables, rather I have assigned values based on research of relevant scholarly literature done for this project and others. An explanation for each variable score is provided below, and it is possible that other

researchers might assign different values or perhaps use different methods altogether. As with a medical diagnosis, each doctor can only be as accurate as the available knowledge and tools with which he or she works. This inquiry represents one researcher's best effort, and a second opinion could yield differing results.

The following is a diagnosis of ten second-order SES variables deemed relevant in each case study. Recall a score of 2 indicates optimal conditions for user self-organization, 1 fair to moderately good, and 0 signifies poor conditions.

European Union WFD second-order variable values and rationale

- RS3 scores 1. WFD river basin districts are generally relatively large resource systems. Ostrom (1990) describes small-scale CPRs as being within the borders of one country and affecting 50 to 50,000 individuals. Based on this description of a small resource, the size of the international basins in the EU are generally much larger than what might be considered to be the next size up, or moderately sized resource systems. The Danube River Basin District alone, for example, encompasses over 800,000 square kilometers, territory from 18 countries, and approximately 82 million people (ICPDR 2005). Other river basin districts are significantly smaller, but the reach of the WFD is relatively large when considered across 27 EU member states. RS3 is not scored as 0 because neither the individual river basin districts nor the sum of them together constitutes a resource that is so large such that it is ungovernable.

- RS5 scores 2 due to overall optimal conditions of scarcity. While there is great variance in productivity between individual WFD river basins, water resources are sufficiently scarce such that users recognize a need to manage them for the future (Ostrom 2009). Presumably if water resources were perceived to be unlimited, EU states would not have self-organized to implement any soft path management strategies. Thus scarcity is determined to be sufficient.
- RS7 scores 1, reflecting the idea that water resources are generally less predictable than land-based resources such as forests (Ostrom 2009).
- RU1 scores 1 because river basin waters are generally more mobile than relatively fixed resource units such as trees (Ostrom 2009). However, WFD waters are governed by international treaties and national laws, which safeguard against unregulated or unlimited withdrawal of water resources.
- U3 scores 2. The WFD has roots in decades of generally cooperative management of international European waterways (EC 2012).
- U5 scores 2. The European Council, which is the body responsible for the WFD, includes one Commissioner each EU member state (EC 2012). Additionally, leaders from each member state had to agree to WFD terms. Overall, there appears to be no lack of leadership among all 27 member states.
- U6 scores 2 due to the relatively cooperative relations among EU member states. The very existence of the EU indicates a commitment to shared norms of reciprocity among states, which Ostrom claims is necessary in order to lower transactions costs associated with reaching agreements and monitoring (Ostrom 2009).

- U7 scores 2. Scientific knowledge of EU river basins is thorough and extensive. The WFD has also implemented its Monitoring Programme that reports on the conditions of all water bodies in each river basin district. The Monitoring Programme is overseen by the EU Environmental Protection Agency (EEA 2012).
- U8 scores 2. Freshwater is a fundamental resource, integral to all environmental and social processes. Thus it is an extremely important resource.
- GS6 scores 2. Presumably any set of sovereign states in the international system has autonomy to self-organize and craft rules regarding how they manage a shared resource.[13] In other words, there is no supranational authority anywhere in the world that prohibits states from managing shared watersheds according to WSP principles.

[13] This simple claim might be disputed by certain IR theorists, including perhaps liberal or constructivist IR theorists who envision an international system governed by rules. My statement here does not dispute the idea that the international system might include rules for state behavior, rather I am simply claiming that individual states have the power to both abide by and break rules. For example, if an EU member state disagreed with the certain WFD provisions or sought to break WFD rules, presumably a last resort action could be to withdraw from the EU altogether.

Table 3. European Union WFD second-order variable values

Variable #	Variable description	Score (0-2)
RS3	Size of resource system	1
RS5	Productivity of system	2
RS7	System predictability	1
RU1	Resource unit mobility	1
U3	History of use	2
U5	Leadership	2
U6	Norms/social capital	2
U7	Knowledge of SES	2
U8	Importance or resource	2
GS6	Collective-choice rules	2
	Total Score	*17*

La Plata Basin second-order variable values and rationale

- RS3 scores 1. La Plata territory covers 3 million square kilometers, 5 countries, and more than 100 million people (Wolf and Newton 2008). As one of the world's largest freshwater systems, La Plata Basin is larger than what could be reasonably viewed as a moderately sized resource system, yet La Plata is not so large that it is ungovernable.
- RS5 scores 0. Compared to the other three SESs, La Plata waters are very abundant. There is little or no evidence that users perceive widespread water scarcity in La Plata Basin, but small-scale conflicts have arisen over ecological harm done by dams, and a small number of isolated instances of scarcity have resulted from damming projects. However, as whole a resource system, the productivity of La Plata waters is such that

users likely do not recognize sufficient scarcity to self-organize and manage the basin according to WSP approaches. Disputes regarding the "Hydrovia" project center on ecological and social harm, not overall water scarcity (Wolf and Newton 2008).

- RS7 scores 1 (same logic as above).
- RU1 scores 1 because river basin waters are generally more mobile than relatively fixed resource units such as trees (Ostrom 2009). However, La Plata waters are governed by the La Plata Basin Treaty (1969), which safeguards against unregulated or unlimited withdrawal of water resources.
- U3 scores 2. La Plata states have numerous relatively longstanding treaty regimes and a history of cooperative management of shared water resources (Wolf and Newton 2008).
- U5 scores 2. Leaders from each La Plata state have already self-organized to implement and maintain a successful water treaty regime, which suggests there is sufficient leadership for further self-organization.
- U6 scores 2. La Plata states have a long history of cooperation and joint resource management, and they view La Plata waters as a force that binds them together (Wolf and Newton 2008). This is strong evidence of shared norms and significant social capital.
- U7 scores 2. Knowledge of the La Plata system is extensive and thorough (Gleick 2009c).
- U8 scores 2 (same logic as above).
- GS6 scores 2 (same logic as above).

Table 4. La Plata Basin second-order variable values

Variable #	Variable description	Score (0-2)
RS3	Size of resource system	1
RS5	Productivity of system	0
RS7	System predictability	1
RU1	Resource unit mobility	1
U3	History of use	2
U5	Leadership	2
U6	Norms/social capital	2
U7	Knowledge of SES	2
U8	Importance or resource	2
GS6	Collective-choice rules	2
	Total Score	*15*

Indus Basin second-order variable values and rationale

- RS3 scores 1. The Indus Basin is certainly very large, but apparently not too large to be governed by a successful two-party treaty regime. The Indus spans over 1 million square kilometers, five countries[14], and many millions of people. Indus waters account for nearly 6% of the world's irrigated land (Gulhati 1973).

[14] Two eastern Indus tributaries are currently undeveloped in rough terrain within the borders of Afghanistan, China, and Nepal, leaving Pakistan and India as the only significant users in the Indus SES. However, it might only be a matter of time before technology enables development of eastern Indus waters to feed demand in Afghanistan, China, and Nepal (Wold and Newton 2008). This could someday impact the Indus SES situation, as well as the agreement between India and Pakistan.

- RS5 scores 2. The Indus is one of the most strained basins in the world, but users have not exhausted the resource. This high degree of scarcity alongside an avoidance of system collapse is deemed optimal for users to recognize the need to manage the resource for the future (Ostrom 2009).
- RS7 scores 1 (same as above).
- RU1 scores 0. Here I am using the resource unit mobility variable to account for the fact that the Indus Basin has been structurally divided into what is essentially two resource systems. The system headwaters and much of the infrastructure are in India's territory. Pakistan has been awarded full access to the three major western rivers, and India has full access to the eastern three rivers (Wolf and Newton 2008). Thus water resources that had once constituted a single resource system have since been "moved" into two separate systems. This divided approach does not allow for integrated management strategies between the two states. Arguably this is not a prime example of resource unit mobility in the sense that Ostrom's framework suggests. However, the division of the Indus Basin into two separate systems is a significant characteristic that distinguishes it from the three other SES cases, and this fact should be somehow recognized as a variable. Resource unit mobility (RU1) appears to be the most relevant variable that Ostrom (2009) provides. Another option would be to diagnose the Indus situation as two distinct SESs, using two different first-order resource system (RS) variables, one for the three western rivers granted to Pakistan and another for India's three eastern rivers. However, this approach wold defeat the purpose of exploring the

likelihood that the Indus Basin itself - the whole resource as it exists naturally - could be managed according WSP principles.

- U3 scores 2. While relations between Pakistan and India have been characterized by dispute and event violent conflict, the two states have managed to share Indus resources relatively successfully. The Indus Waters Treaty has withstood two relatively large wars between the two states. Although history between Indian and Pakistan includes some water disputes, including provincial disputes predating Indian and Pakistani statehood, the two states have cooperated more successfully in water-related matters than in other spheres of their relationship (Doyle and Risley 2008). Additionally, the Indus Basin is site to one of the world's oldest and most sophisticated irrigation networks, which indicates a long history of coordinated resource management among users (Gulhati 1973).
- U5 scores 2. The IWT agreement between Pakistan and India established the Permanent Indus Commission, and institution composed of one Commissioner from each state whose job it is to promote cooperative support for all IWT provisions. Commission meetings and full system tours have endured uninterrupted, including during the 1965 and 1971 wars, as well as the 1971-75 period that lacked diplomatic relations between the two states. If Commissioners are unable to resolve a dispute, the World Bank "neutral expert" intervenes to mediate and reach legally binding decisions (Zawahari 2009). Overall, there appears to be ample leadership in this SES.
- U6 scores 1. Despite what appears to be the existence of relatively well-recognized norms about sharing water resources, the relationship between Pakistan and India has

been otherwise generally generally cool (Wolf and Newton 2008), and at worst it has deteriorated into warfare. The 1 score is intended to reflect this mixed dynamic that is neither a best nor worst-case scenario.

- U7 scores 2 (same as above).
- U8 scores 2. In addition to water being a fundamental resource for all circumstances, Indus waters in particular are especially important to both India and Pakistan. Both states are heavily dependent on this resource. The relatively arid region of northwest India that uses Indus waters is the country's breadbasket, and Pakistan is entirely dependent on three Indus rivers as its only source of freshwater (Gulhati 1973).
- GS6 scores 2. Although the Indus situation involves the World Bank as a third party in its treaty regime, as sovereign states both India and Pakistan have autonomy to craft new rules for managing Indus waters. Some analysts have argued that the World Bank is a hegemonic actor in Indo-Pakistani water affairs (Zawahari 2006), yet others have disputed this interpretation (Kraff 2010). Regardless, there does not appear to be any reasonable evidence that the World Bank could somehow prevent the two states from self-organizing to implement basin-wide WSP management practices, thus both Pakistan and India are sufficiently autonomous to craft their own rules of use.

Table 5. Indus Basin second-order variable scores

Variable #	Variable description	Score (0-2)
RS3	Size of resource system	1
RS5	Productivity of system	2
RS7	System predictability	1
RU1	Resource unit mobility	0
U3	History of use	2
U5	Leadership	2
U6	Norms/social capital	1
U7	Knowledge of SES	2
U8	Importance or resource	2
GS6	Collective-choice rules	2
	Total Score	*15*

Tigris-Euphrates Basin second-order variable values and rationale

- RS3 scores 1. The Tigris-Euphrates Basin covers approximately 789,000 square kilometers in three countries: Turkey, Syria, and Iraq (Wolf and Newton 2008). Like the cases above, it is larger than a moderately-sized resource system, yet possibly not too large for states to manage.
- RS5 scores 2. Tigris-Euphrates waters are scarce but not exhausted. Downstream Syria and Iraq routinely experience water shortages. Similar to the Indus case, scarcity without system collapse is deemed optimal for users to recognize the need to manage the resource for the future (Ostrom 2009).

- RS7 scores 1 (same as above).
- RU1 scores 0. Users have not agreed to any treaty regime to govern use of this resource system. These unregulated waters have high mobility, as evidenced by Turkey's controversial GAP projects that have significantly altered the resource system and decreased flow to downstream riparian states. This resource unit mobility is virtually the opposite of what Ostrom (2008) describes as optimal.
- U3 scores 0. These three states lack a history of cooperative use of water resources. Water has been a source of conflict between the riparian states dating back to the 1950s. A water war nearly broke out in 1975, and tensions have been very high ever since. Additionally, other spheres of conflict influence water sharing problems in the region (Wolf and Newton 2008).
- U5 scores 0. It appears that ongoing crises in Syria and Iraq have resulted in conditions not conducive to leadership sufficiently focused on water problems. Syria is currently experiencing civil war, and Iraq is still in the process of emerging from ongoing warfare and water-related problems dating back to 1990 U.S. led invasion (Benvenisti 2003).
- U6 score 0. There appears to be a deficiency of shared norms between these three states. As discussed above, among the three countries there are other spheres of conflict in addition to water. Also, in addition to the lack of a formal treaty regime, there is even insufficient informal agreement regarding Tigris-Euphrates water use. The three states even disagree over how to define the system. Moreover, upstream Turkey rejects claims from Syria and Iraq that waters need be shared equitably (Carkoglu and Eder 2001). All of this indicates a significant lack of shared norms of reciprocity.

- U7 scores 2. Data on ecological conditions of Tigris-Euphrates waters is well-documented (Gleick 2009c).
- U8 scores 2. Similar to the Indus case, Tigris-Euphrates waters are extremely important to users. Numerous GAP water projects in southeast Turkey are a source of national pride and development. Syria depends on the Euphrates River for 90% of its total freshwater, including all the drinking water for its major cities. The Tigris and Euphrates Rivers are Iraq's only source of freshwater (Klare 2001).
- GS6 scores 2. Although the user states have thus far failed to craft shared rules of resource management, there is nothing formally preventing them from doing so (same as above).

Table 6. Tigris-Euphrates Basin second-order variable scores

Variable #	**Variable description**	**Score (0-2)**
RS3	Size of resource system	1
RS5	Productivity of system	2
RS7	System predictability	1
RU1	Resource unit mobility	0
U3	History of use	0
U5	Leadership	0
U6	Norms/social capital	0
U7	Knowledge of SES	2
U8	Importance or resource	2
GS6	Collective-choice rules	2
	Total Score	*10*

The following table summarizes total raw scores of each SES situation for the ten second-order variables selected (Table 7):

Table 7. Total SES scores for ten second-order variables.

SES	EU WFD	La Plata	Indus	Tigris-Euphrates
Total Score	17	15	15	10

Note that of the ten second-order variables selected above, five were scored the same for each SES situation: RS3 (size of resource system), RS5 (system predictability), U7 (knowledge of SES), U8 (importance of resource), and GS6 (collective choice rules). Thus SESs appear to be sufficiently similar for these five variables, meaning that differences in results among these four cases can be attributed to the other five second-order variables tested: RS5 (productivity of system), RU1 (resource unit mobility), U3 (history of use), U5 (leadership), and U6 (norms/social capital). Retesting each SES for the five second-order variables whose values differed among the cases generates the following results (Tables 8-11). For this five variable retest, a perfect score of 10 would represent conditions most conducive to self-organization.

Table 8. Retest of five second-order variables in EU WFD SES.

Variable #	Variable description	Score (0-2)
RS5	Productivity of system	2
RU1	Resource unit mobility	1
U3	History of use	2
U5	Leadership	2
U6	Norms/social capital	2
	5-Variable Score	*9*

Table 9. Retest of five second-order variables in La Plata SES.

Variable #	Variable description	Score (0-2)
RS5	Productivity of system	0
RU1	Resource unit mobility	1
U3	History of use	2
U5	Leadership	2
U6	Norms/social capital	2
	5-Variable Score	*7*

Table 10. Retest of five second-order variables in Indus SES

Variable #	Variable description	Score (0-2)
RS5	Productivity of system	2
RU1	Resource unit mobility	0
U3	History of use	2
U5	Leadership	2
U6	Norms/social capital	1
	5-Variable Score	*7*

Table 11. Retest of five second-order variables in Tigris-Euphrates SES

Variable #	Variable description	Score (0-2)
RS5	Productivity of system	2
RU1	Resource unit mobility	0
U3	History of use	0
U5	Leadership	0
U6	Norms/social capital	0
	5-Variable Score	*2*

The following table summarizes total raw scores of each SES situation when retested for the five second-order variables whose values differ among cases (Table 12):

Table 12. Summary of five variable retest total scores.

SES	EU WFD	La Plata	Indus	Tigris-Euphrates
5-variable score	9	7	7	2

Analysis and discussion of these findings proceeds in Chapter 4.

Chapter 4: Analysis and Discussion

4.1 SES raw score analysis

General trends in the data generated above appear to reinforce what might be hypothesized or informally assumed about the four international basins analyzed above. The European WFD case, which is the one example that represents a somewhat successful instance of countries self-organizing to manage international freshwater basins according to soft path approaches, scores the highest according to the variables selected. Likewise the generally most mismanaged basin, the Tigris-Euphrates, scores the lowest. When comparing these two cases according to the five variables that were not held constant in each SES (RS5, RU1, U3, U5, U6), the raw scores seem to indicate that the EU example is far more likely than the Tigris-Euphrates to self-organize by a score of 9 points to 2 out of a possible 10 (Table 12). The EU WFD is an example of successful self-organization (although not perfect), so we should expect this case to score highest. The Tigris-Euphrates Basin lacks both a treaty regime and successful sharing among its user states, and its lowest overall score should also be expected. Total raw scores for the Indus and La Plata SESs are identical, which suggests that the two might be equally likely to self-organize despite the very differing interstate relationships seen in each case.

Relations among La Plata states are generally much more cooperative than the overall cooler situation between Pakistan and India (Wolf and Newton 2008), but successful self-organization appears to require more than merely a high degree of

interstate cooperation. As determined by the variable measurements assigned above, the biggest difference between these two SES situations is the productivity of the resource system (RS5), and it is possible that this variable should receive more weight or consideration than some others.

Recall that Ostrom (2009) claims that research shows that users must perceive scarcity in order to recognize the need to manage a resource for the future, thus it could be argued that the relatively water-rich circumstances in La Plata Basin could prevent even these generally cooperative states from self-organizing. Additionally, if the Indus SES had not been assigned a zero value for resource unit mobility (RU1) due to water being "moved" in the sense of dividing the basin into two halves, then the Indus case would score 1-2 points higher than La Plata. Thus despite a relationship marred by warfare, perhaps India and Pakistan might actually be more likely to self-organize around shared water resources than La Plata states. It is worth noting here that one of the founding principles of the Indus Waters Treaty is a strictly functional approach to water sharing, keeping political and other outside influences to a minimum (Gulhati 1973). Perhaps this commitment to focusing rather narrowly on water sharing issues is also a factor contributing to the likelihood of Indus self-organization. Regardless, the point here is that resource system productivity appears to be a very important indicator of the likelihood of self-organization. According the the method employed above, the overall far less cooperative Indus Basin states might be as likely to self-organize as the generally friendly La Plata states. Given that one of the most striking differences between these two

SESs is resource system productivity, this variable could account for why La Plata states are not more likely to manage waters according to soft path approaches.

Comparing La Plata to the European Union case yields additional evidence for the significance of resource system productivity. Note that the overall scores resulted in the EU WFD scoring two points higher than La Plata, 9-7 for five variables and 17-15 for ten variables. System productivity (RS5) is the only difference in variable measurements between the two cases, yet the WFD is an example of a degree of successful self-organization and La Plata is a failure. Keeping true to the diagnostic analysis approach described above, it would be unwise to assume that this single variable is the sole reason for the different outcomes. Indeed, there are likely numerous other differences between these two SESs that are not accounted for by the ten variables analyzed in this inquiry, and we should not assume that even that most stark single difference between these basins is the only causative factor involved. Recall Ostrom's description that SESs are multivariable and multilevel phenomena, whereby each variable is nested in interdependent relationships with other variables at different SES levels (Ostrom 2009), thus causation is not thought to be a linear or singular phenomenon. Nevertheless, resource system productivity could be a significant component of the causative forces at work here. Perhaps if La Plata states perceived more water scarcity, they might be more likely to successfully use WSP techniques to manage their shared water resources.

Two variables that correlate with an increased likelihood of self-organization are history of use (U3) and leadership (U5). Ostrom (2009) does not include history of use among the ten second-order variables that affect self-organization, but in these four cases

there is as much a positive correlation with history of use as there is with leadership. The one successful case, WFD, and two failure cases that appear to be relatively more likely to self-organize, La Plata and Indus, all have optimal scores for recent history of cooperative use of water resources and leadership. Likewise, the lowest scoring and seemingly least likely case to self-organize, Tigris-Euphrates, lacks both a recent history of successful water sharing and sufficient leadership. These scores alone do not necessarily prove that either leadership or history of use are significant causative factors at work in any of these four cases, but a positive correlation exists nonetheless. If research indicates that leadership is a variable that affects the likelihood of self-organization (Ostrom 2009), then perhaps history of use might well be as well. Raw scores from these four cases do not suggest otherwise.

One general problem that emerges when comparing these data sets is that is appears to be difficult to determine the specific causative power of any variable in each SES. We can observe, for example, that the European Union WFD case represents a successful example and it also scores the highest, but we do not know whether or not the La Plata and Indus Basins are actually as close to being successful as the scores indicate. If the WFD scores 17 out of 20 and the Indus and La Plata each score 15, it might seem logical to conclude that the Indus and La Plata Basins are close to achieving some degree of successful soft path water management. Moreover, as discussed above, it might appear that their identical overall scores suggest that these two international basins are equally close to being successful. However, neither the Indus nor La Plata SESs might actually be close to managing their water resources according to WSP principles, and one might be

more or less likely than the other depending on the significance of the barriers involved in each case.

One way to illustrate this problem is to consider one barrier from La Plata and one from the Indus. In La Plata, for example, the abundantly productive resource system is determined to be a barrier to self-organization. In the Indus case, the fact that the resource system is essentially divided in half and managed separately is determined to be a barrier. The corresponding variables from each case (RS5 in La Plata and RU1 in the Indus) were each assigned values of zero, but it is not clear that each zero value is equally important. It might be that users' perceptions of scarcity more strongly affects the likelihood of self-organization than does a currently divided management approach, or perhaps the opposite is true. There is no way of knowing by looking at the SES data. Worse yet, the same goes for any of the variables tested above. For example, it might be more important that states share norms of reciprocity (U6) than it is that they have adequate leadership within their societies (U5), or it might be the reverse.

The problem we encounter here is that raw data scores might not be sufficiently descriptive of the causative dynamics in each SES. Consequently raw data alone might not provide us with enough information to draw meaningful conclusions regarding the likelihood of managing international basins according to WSP approaches. In order to help fill in some of the blanks left by this SES data, let us explore the topic of barriers associated with the sustainable management of international basins.

4.2 Barriers to soft path water management

The fact that there are very few examples of states using soft path practices to manage international basins suggests the likelihood of a wide variety of barriers to this phenomenon. For current purposes, it is helpful to conceptualize barriers according to two categories. First, there are barriers associated with managing any water resource according to WSP approaches, including relatively small or even portions of small water resources located entirely within the borders of one country. This category of barriers alone poses serious challenges and has received attention from water experts. The second and more demanding category of barriers entails the international aspects of implementing soft path methods throughout basins that cross national borders. This category of barriers has received far less attention, and as discussed below, it presents additional layers of extremely difficult challenges.

General WSP barriers

There are many barriers to implementing water soft path practices, even in a small-scale, domestic setting. Jordaan et al. (2009) identify what they call "institutional barriers" to advancing alternative water management, meaning specific impediments that make it difficult or undesirable to implement a specific action (p. 149). These barriers occur at different levels within even one society, and there is no simple recipe to overcome all of them. Jordaan et al. divide these barriers into five subcategories: attitudes and

perceptions; organization and management; financial; data and information; and policy and governance. A summary of the institutional barriers they identify within each category illustrates the many difficulties associated with managing any water resource according to soft path approaches, and these challenges are likely far more acute at large-scale, international levels.

First, Jordaan et al. claim that common perceptions about water abundance are often misinformed. It is difficult to encourage conservationist behavior whenever dominant social attitudes encourage beliefs that freshwater resources are unlimited and that no significant water problems exist. These kinds of barriers might be expected when considered against the backdrop of Gleick's Water Eras thesis (Gleick 2009a). If we really are entering a new era of global water scarcity, having only recently exited a centuries-long period of general abundance, it seems logical that general perceptions about water scarcity could lag behind the reality of the new challenges we've only recently begun to face. Jordaan et al. also identify a parallel barrier to misperceptions about water scarcity, which is a common belief that efforts to conserve water will lead directly to economic losses and reductions in standards of living. I suspect these beliefs are related in some way. If using less water is thought to have negative economic impacts, perhaps the belief in boundless water resources becomes more appealing.

Next, Jordaan et al. identify a series barriers associated with organizational structures and data problems. Soft path water management requires a generally integrated approach, but management structures and functions are often compartmentalized into segregated agencies and departments. This problem of "fragmented

management" (Jordaan et al. 2009, p. 152) can impede information exchange and generally result in ineffective interagency cooperation. Matters become more complicated when information and data itself is a barrier. Jordaan et al. note that even in Canada, a developed and generally environmentally conscious country, data on water resources is often incomplete or outdated. Additionally, Canadian privacy laws prevent the release of some water use data to the public. Consequently certain industrial sectors, including many apparently notoriously secretive Canadian golf courses, shield their water use from public scrutiny. The general idea here is that insufficient data and monitoring is a barrier to any effective water management, especially management practices that emphasize data monitoring to achieve ecologically sustainable conditions.

Jordaan et al. also identify several financial barriers to implementing WSP practices. Most notably, they recognize that some agencies and utilities depend on revenue from water sales to remain fiscally viable, thus policies and management practices that deliver smaller quantities of water can threaten important revenue streams. In these circumstances there are incentives for suppliers to sell more water, not conserve. Additionally, incomplete markets and pricing structures nearly always fail to account for the full cost of water supply and the externalities associated with water use. For example, pricing rarely reflects capital invested in infrastructure, which is often paid for with general tax revenues. Externalities such as degradation to watersheds is paid for by society at large, not water sales.

Finally, Jordaan et al. identify significant policy and government barriers. One problem clearly not limited to water issues is that political leaders are often preoccupied

with short-term gains, not long-term solutions to ongoing problems such sustainable water management. This problem highlights the need for long-term public involvement in water policy making and management. Jordaan et al. are proponents of using ongoing public input to inform and shape policy initiatives, as opposed to single or sporadic open public consultation sessions, yet they recognize this kind of public involvement is neither easy nor inexpensive. Also, certain existing policies are barriers to sustainable water management approaches. For example, 'use it or lose it' policies based on quota systems encourage users to consume all the water that's available to them in the short-term, else risk losing long-term access due to reduced quotas. These 'use it or lose it' policies are common in the agricultural sector, and they eliminate incentives to conserve water across the entire sector.

The good news is that water experts also offer hope that these kinds of general barriers to soft path water management might be overcome (Gleick 2009b; Jordaan et al. 2009). Notably, Peter Gleick claims that traditional, 'hard path' water management approaches are kept in place in part by a series of misunderstandings and misconceptions about the soft path. He argues that the WSP is not a utopian dream and that working toward soft path water management begins by overcoming what are essentially informational problems (Gleick 2009b). For example, in response to common assumptions that decreased water consumption results in economic losses, studies demonstrate the numerous ways that water efficiency can be increased without diminishing economic benefits in agricultural and industrial sectors (Cooley et al. 2007; Vickers 1999). Additionally, despite water managers' common assumption that water

demand is always independent of price and market forces, data and studies show that water users actually do change their behaviors in order to conserve water when prices increase (Brandes and Ferguson 2003; Cooley et al. 2007). These studies support the idea that 'smart pricing' practices can be used to influence demand and increase conservation. Studies show that demand management is neither too risky, too complicated, nor too expensive (Brooks 2006; Dziegielewski 1999; Dziegielewski 2003). Overall, Gleick's optimistic view is that today's initial tasks involve chipping away at these kinds of misconceptions in order to fully expose the ineffectiveness of using hard path water management approaches to meet the challenges of a new water era (Gleick 2009b), and this optimism is supported by findings from numerous studies.

These general WSP barriers could exist in any of the countries and international basins analyzed above. Additional research in each case could yield better understanding of barriers specific to each case, as well as more better knowledge about how certain barriers might be overcome. Also, the cases analyzed above might include barriers not described in this discussion of general WSP barriers.

The most important message to note here is that general barriers to any soft path water management are currently rather extensive, and measures to overcome barriers might be as diverse as the challenges posed by the barriers themselves. Additionally, local conditions in the international basins analyzed above likely affect the possibility of soft path practices taking root within any particular country or political jurisdiction. Gleick's assessment of misunderstandings and misinformation offers hope that water management could change with better information and thinking, but in practical terms, a mass shift in

the consciousness of water managers around the world could be extremely difficult to achieve. It is worth noting that attempts to implement soft path water management practices at watershed and provincial levels in Canada have generally failed, thus demonstrating how difficult it can be to implement WSP practices at any sizable scale even within a single country (Isaacman and Daborn 2009; Kay and Hendriks 2009). And as described below, water soft path barriers take on additional layers of challenges when considered at international levels.

International WSP barriers

Any analysis about why states in the international system either succeed or fail to demonstrate specific behaviors has the potential to spiral in limitless directions. If we conceptualize the management of shared water resources according to soft path approaches as a form of cooperative behavior among states, then we open the door to countless questions and arguments relevant to the sprawling topic of interstate cooperation. In other words, a comprehensive exploration of all the possible factors preventing states from managing shared water resources according to WSP principles is beyond the scope of this inquiry.

In an effort to narrow the focus about international WSP barriers, this study conceptualizes international soft path water resource management as a particular international water management behavioral norm or principle. Therefore, one way of viewing the central question of this study - *when will states manage shared water*

resources according to WSP approaches? - is that it is actually a question about when states' practices will reflect this new norm. The strategy used here to address this issue is to explore the norms of international water management, and I shall argue that existing norms and principles themselves are currently barriers to international WSP management practices.

The substance for the argument that existing international water norms and principles are themselves barriers to the development of new soft path norms comes from past and present principles of international water law. One way of thinking about international law is that it represents the codification of norms and principles that are presumed to be accepted by states in the international system[15], so it makes sense to explore international law as a source of knowledge about the principles that shape norms of international behavior regarding transboundary water issues. The general structure of this argument is that by looking to the historical development of international water law principles, we see very little support for the norm of managing international water resources according to WSP approaches.

The history of international water law has parallels to Gleick's argument about eras of water management approaches, and the connection is that different eras are characterized by different norms and principles. Hilal Elver (2006) identifies the first era of international water law as starting in the 17th century with the Peace of Westphalia and ending after World War II, which is also generally the colonial era. During this largely Euro-centric period of international water law, European states relied heavily on

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[15] This perspective was shared with me in a discussion with Prof. David Kinsella in May, 2012.

transboundary waterways for international trade and transportation. The dominant international water law principle of this era was navigational freedom of international watercourses. European states were among the first to sign treaties protecting free passage on transboundary waters, and by the 19th century European colonial powers had reached extensive multilateral agreements with colonies in Asia and Africa in order to protect European states' navigational uses of waterways across the eastern hemisphere. Water for consumptive use was thought to be generally abundant, so international law was largely not focused on regulation of non-navigational uses of international water resources (Elver 2006).

Perhaps not coincidentally, Elver's description of this first period of international water law sounds similar to Gleick's first era of global water management. Both periods treated water as a cornucopian resource, and both were largely unconcerned with regulating consumptive use. In the colonial period, some of the most important uses of transboundary water resources involved transportation and trade, and international law focused largely on these uses. Interestingly, this historical periods argument supports the WSP idea that water has been used for different purposes by different peoples throughout different time periods.

As the colonial period ended alongside the conclusion of World War II, the rise of nationalism around the world led to a new dominant principle of international water law. The formation of many newly independent states meant more players became global economic competitors, and states increasingly adopted the principle of territorial sovereignty over water and other natural resources in order to bolster their economic

standing. Navigational regulations eventually lost their importance and other aspects of water use became more significant. States increasingly sought short-term economic benefits through large-scale, centralized water infrastructure developments such as dams, irrigation canals, and hydroelectric power stations. In developing countries, many of these projects were made possible by technical, financial, and institutional assistance from international organizations, and often without adequate considerations of environmental impacts, long-term sustainability, or adverse effects upon neighboring states. In the international arena, water became a more scarce and strategic resource. Newly formed states, many of which had long histories of colonial exploitation, sought to protect their sovereignty by controlling and developing water within their borders. Not surprisingly, the assertion of absolute territorial sovereignly over water resources has led to many international conflicts, especially in regions experiencing significant water scarcity (Elver 2006).

Again, here we see parallels between Gleick's water eras argument and the concept of international water law periods. In Gleick's second water era, management approaches focus on the delivery of mass quantities of water through large-scale infrastructure projects. Demand management is given little or no consideration, and efforts are focused on meeting demand by continually seeking out and developing new supplies (Gleick 2009a). It appears that the same could be said for Elver's description of the post-colonial era of international water law that is dominated by the principle of state sovereignty over water resources.

Today, absolute territorial sovereignty over water resources a principle that is not widely seen in sources of international water law (Elver 2006). Although many states still use transboundary water resources without regard for neighboring states that also depend on the same water systems, it seems very reasonable to criticize such practices. It is simple enough, for example, to recognize the unfairness and danger of Tigris-Euphrates Basin water management practices. This water resource is not governed by any treaty among its user states, and upstream Turkey and Syria use water with little or no regard for downstream states. As previously described, this scenario has led to extreme shortages in downstream Syria and Iraq, which have driven tension and conflict in the region. Transboundary water situations involving states asserting absolute sovereignty over scarce water resources are not in line with contemporary principles of international water law (Dellapenna 2001; Draper 2006; Elver 2006).

Experts today claim that international water law is now characterized by certain principles of restricted sovereignty. Collectively, these international legal norms form what is widely regarded as the customary international law of transboundary freshwater resources (Dellapenna 2001; Draper 2006; Elver 2006). Although the exact content of this customary law is debatable, the following is a summary of sources of principles that substantiate the international legal norms of transboundary freshwater:

- The United Nations' International Law Commission has declared that states have two obligations regarding transboundary water resources. States' first duty is to share water equitably, and the second duty is to exchange data and information (Draper 2006).

- A series of notable U.N. declarations and conventions uphold principles of restricted sovereignty. The 1966 *Helsinki Rules on the Uses of the Waters of International Rivers* claims that riparian states are entitled to "a reasonable and equitable share in the beneficial use of the waters of an international drainage basin" (ILA 1966). Building on *Helsinki's* example, the 1972 *Stockholm Declaration on the Human Environment* adds a "no damage" principle, claiming that states have "the responsibility to ensure that activities within their jurisdiction or control do not cause damage to the environment of other States or of areas beyond the limits of national jurisdiction" (UN 1972, Principle 21). The 1992 *United Nations' Convention on the Protection and Use of Transboundary Watercourses and International Lakes* reinforces Stockholm's "no damage" principle and also Helsinki's "reasonable and equitable":

"Parties shall take all appropriate measures to prevent, control and reduce any transboundary impact ... and ensure that transboundary waters are used in a reasonable and equitable way, taking into particular account their transboundary character, in the case of activities which are likely to cause transboundary impact" (UN 1992, Articles 2.1, 2.2).

- The 1998 *U.N. Convention of the Law of the Non-Navigational Uses of International Freshwaters*, which is arguably the clearest statement we currently have about customary water law (Dellapenna 2001; Draper 2006), supports the standard of "equitable and reasonable utilization" as an international legal norm (Articles 5.1, 5.2,

6.1). Additionally, this convention calls "sustainable utilization" of water resources and "adequate protection of the watercourse" (Article 5.1)

These developments in international water law signify a shift away from absolute sovereignty towards norms of restricted sovereignty. These two principles clearly conflict, and although there is arguably no definitive, widely recognized international treaty that resolves all the tension between these principles of water management, there is a general consensus that there is a shift towards the principle of "equitable sharing" in customary international law (Dellapenna 2001, p. 47). One significant problem, however, is that throughout the historical development of international water norms, there seems to be little or no support for anything having to do with managing international watersheds according to soft path approaches. Herein lies the argument that historical and contemporary international water norms are themselves barriers to the realization of managing international water resources according to soft path principles

As discussed above, the European WFD is perhaps the only international treaty in the world that incorporates aspects of WSP management. Thus treaty law, one of the two sources of international law, is extremely limited with regards to managing international waters according to soft path principles. Looking to the other source of international law, which is customary law, we find virtually no support for international norms that reflect WSP principles. The 1998 *U.N. Convention of the Law of the Non-Navigational Uses of International Freshwaters* mentions "sustainable utilization", but it would be hard to argue that this principle is the centerpiece of that document in the same manner that

ecological sustainability is the fundamental principle of the WSP. Rather what we see in the development of international water norms is only a relatively recent emphasis on obligations to share international waters equitably among states.

The problem here is that international legal norms are lacking far behind what water experts propose for effectively addressing current and future global water crises. The most commonly accepted international water norm today appears to be the principle of equitable sharing, but simply sharing water resources is itself a far cry from states co-managing waters using soft path methods. In a way, the WSP presupposes that states should be able to share water resources equitably. In other words, it is a far more sophisticated form of international cooperation than the relatively simple concept of states dividing-up water resources equitably and then being left alone to use those resources in any manner they wish. An international WSP approach requires states to do far more than share. It affects not only *what* water is available for a state to use, rather is impacts *how* a state should use water within its borders. Thus the WSP itself is a set of new norms that is perhaps far ahead of what we see happening in today's international water practices.

The four case studies above support the argument that international water norms lag behind water experts' claims about what needs to be done to address global water issues. One of the four, the Tigris-Euphrates Basin, fails to demonstrate equitable water sharing among the affected states, and this one-in-four failure to share rate might be lower than what we see happening around the world. Recall that one out of every three international basins in the world is not governed by an interstate treaty (Draper 2006). Of

the three basins that manage to cooperate and share water resources equitably, two of them do not manage international waters using soft path practices. And even the European Union WFD, the one case in the world that does seem to reflect some WSP practices, is struggling to implement the soft path management practices that aims to achieve. Moreover, one could make the argument that the WFD is not a case that demonstrates any international norms of soft path water management. After all, the European Union is a governing body with the kind of supranational authority not seen in the Tigris-Euphrates, Indus, or La Plata Basins. Perhaps with the WFD, the European Union is simply demonstrating that is has the power to legislate water principles to its member states, as opposed to showing that any truly international soft path norms are taking root among sovereign states in Europe.

The general point here is that the international system might be much further away from managing transboundary waters according to WSP approaches than we might hope. Thinking in terms of periods of international water norms, it wasn't until the end of the Second World War, or little more than a handful of decades ago, that there were any international legal norms at all regarding non-navigational uses of international waters (Elver 2006). In the scheme of the long history of human water use or even the relatively shorter history of international water use dating back the to Treaty of Westphalia, the several decades since the conclusion of WWII is a very short amount of time. Since 1945, the beginning of the period development of international norms regarding non-navigational uses of water, there appears to be a slow progression from the principle of absolute sovereignty towards a restricted sovereignty principle of sharing water equitably

among states. Even so, many transboundary water resources around the world are still not shared equitably. And while the international system today is focused on states simply sharing water, experts tell us that far more has to be done in order to meet the water challenges we face today and tomorrow. International soft path water management requires a form of cooperation far more sophisticated than equitable sharing of resources among states. There is a sense in which it asks us to forgo all questions of state sovereignty, focusing our efforts instead on creating integrated government structures capable of adopting holistic approaches to the sustainable management of entire watersheds.

4.3 Summary of analysis and discussion

The raw scores generated from Ostrom's SES framework in each of the four cases above appear to validate the framework itself. A higher total score correlates positively with what appears to be a greater likelihood of self-organization to manage international waters according to WSP approaches. The EU WFD is a case with some aspects of international soft path water management, and it scores the highest. The two cases that cooperate to share water resources equitably but lack soft path management, La Plata and the Indus Basins, have equal total scores that are lower than the EU but significantly higher than the totally uncooperative case. The Tigris-Euphrates Basin fails to share water equitably among states and obviously does not manage the entire watershed according to

WSP principles. As expected, The Tigris-Euphrates case scores significantly lower than the other three more cooperative examples.

The problem with this use of Ostrom's SES framework to generate raw scores, however, is that the data itself might not yield sufficiently reliable information about the causative dynamics at work in each SES. As discussed above, perhaps we cannot assume that each second-order SES variable should be weighted equally across cases, and the variables themselves might interact differently in different cases. For example, system productivity might be a more causative variable in the Indus than La Plata, or shared norms in La Plata might be more a powerful variable than system productivity in the Indus, and so on. A higher overall score in each SES does appear to indicate a greater likelihood of managing international watersheds according to WSP approaches, and vice-versa, but it is not clear that we should conclude anything more detailed or meaningful about each SES beyond this relatively simple correlation. However, to be fair to Ostrom's framework and the effort to apply it to the four international international basins above, perhaps a simple correlation of variables with likelihood of self-organization is successful enough. Ostrom's SES framework is a diagnostic tool, not a fully-formalized test for causative variables.

Looking beyond the SES data in order to develop a better understanding of when states will self-organize to manage shared watersheds according to WSP approaches, it is clear that there are extensive barriers on small-scale and large-scale levels. Thorough field research in each basin on local, state, and international level conditions relevant to the likelihood of soft path water management would be helpful. However, if the historical

development of international water norms is any indication, it appears that we might be a long way from expecting states to manage entire watersheds according to WSP principles. Sharing water equitably appears to be the standard of what's expected in the international system, but this bar of cooperative behavior is lower than states managing entire freshwater basins using soft path practices.

Chapter 5: Suggestions for Additional Research and Conclusion

5.1 Summary of findings and suggestions for additional research

In response to the central question of this inquiry - *when will states, as users of common-pool water resources, self-organize to adopt WSP management approaches in individual watersheds or drainage basins in order to effectively address twenty-first century water challenges?* - we might reasonably conclude from the above analysis that perhaps there are no definitive answers just yet. This is not necessarily a bad thing, nor should it be thought of as some sort of dangling problem that this inquiry fails to effectively resolve. Instead, one emphasis of this inquiry has been to build a strong case that this question is indeed worth asking. It is a problematic question that has received little or no attention from scholars concerned with international affairs, so the first logical step is to clearly articulate the nature of the problem, as well as why it deserves our attention.

In addition to posing this important yet oft-overlooked question about the sustainable management of international freshwater, this inquiry explores ways that the question might be answered. As shown above, Ostrom's recently developed SES framework is a helpful tool for diagnosing international transboundary water situations. In the four SESs above, applying Ostrom's framework reveals five variables that appear to correlate with the likelihood of states self organizing in order to manage international basins using WSP practices. They are: resource system productivity, resource unit

mobility, history of use, leadership, and shared norms or social capital. Although Ostrom's claims that research indicates that history of use (second-order variable #U3) does not affect the likelihood of user self-organization, the cases analyzed in this study appear to indicate otherwise. The SES with optimal values for the history of use variable were also more likely to self-organize.

Optimal values for these five variables indicate an increased likelihood that states analyzed in the cases above will self-organize to manage shared waters more sustainably, and likewise suboptimal values for these variables indicate a lower likelihood of self-organization. Here it appears difficult to argue against the validity of Ostrom's framework. The SES that scores the highest, the European Union Water Framework Directive, is also the only case that contains aspects of international freshwater management using soft path practices. The next two highest scoring SESs, the Indus and La Plata Basins, demonstrate robust equitable water sharing practices among states, but they do not use WSP approaches. The least cooperative SES, the Tigris-Euphrates Basin, is also by far the lowest scoring case. Here we see that Turkey, Syria, and Iraq fail to effectively share a common-pool water resource, and it appears that these three states are nowhere near achieving the kind of sophisticated interstate cooperation needed in order to manage Tigris-Euphrates waters according to WSP principles.

Together, these four case studies show that Ostrom's SES framework can be used to produce data that indicates general degrees of likelihood of state self-organization around shared water resources. Higher overall SES appear to correlate with an increased likelihood of self-organization, and vice-versa. One problem, however, is that the data

sets above do not provide convincing evidence about the specific causative power of any single variable the SESs. And without sufficiently thorough knowledge about what is either driving or preventing successful self-organization in these cases, it is difficult to draw meaningful conclusions about the real likelihood of the basins being managed using soft path practices. Although we can determine, for example, that the Indus and La Plata Basins each score 7 out of a possible 10 points for the five second-order variables analyzed above, we do not really know the full meaning of these scores. The data indicates that La Plata and the Indus are equally likely to adopt international WSP management, but in reality the situation could be much different. The problem here might be that causative dynamics in any transboundary water situation are more complex than what can be diagnosed and compared across cases using Ostrom's SES tool.

Field research in any of these international freshwater basins could lead to a better understanding of when the states in these SESs might cooperate to implement international WSP management. Each SES might warrant a specific adaptation of Ostrom's framework that might not be the same for all SESs. For example, perhaps variables should be selected or weighted according to the most significant factors in each case. More thorough and detailed individual case studies might be the best way to eventually conduct cross-case studies that could yield more broad conclusions about when watershed soft path management might be possible at the international level.

An additional suggestion for further research includes the broad topic of international norms development. Specifically, it would be worth exploring the possible relevance that Ostrom's earlier work on institutional norms changes might have upon her

later SES framework. The reasoning behind this suggestion is worth explaining in some detail.

In *Governing the Commons*, Ostrom uses the example of groundwater pumpers in Los Angeles to illustrate how resource users rely on institutions in order to overcome transaction costs of adopting more effective group norms. Ostrom describes this as an incremental process, whereby groundwater pumpers engaged in face-to-face discussions about joint problems and potential joint strategies. Over time, groundwater pumpers in Los Angeles took steps that resulted in a new institutional arrangement that included revised rules better suited to the problems they collectively faced. Previous rules that granted exclusive groundwater rights based on overland rights were causing damage to groundwater conditions across the region, and these rules were eventually replaced by ones that took into account the overall health of the entire groundwater system in Los Angeles (Ostrom 1990).

The Los Angeles groundwater pumpers example bears certain resemblances to the scenarios of states using international waters. In the small-scale example, the pumpers are users who initially behaved according to rules that failed to address the problems they faced together. By allowing each pumper to withdraw unlimited amounts of water so long as they pumped from within the borders of their overland property, the common-pool resource - the entire groundwater system - was being destroyed. Through incremental changes, the once unregulated pumpers eventually self-organized to implement new rules and regulatory institutions in order to preserve common-pool groundwater resources.

In a sense, the previously recognized overland rights of the Los Angeles pumpers is analogous to the concept of state territorial sovereignty in the international system. The pumpers were free to do whatever they wanted with groundwater that could be accessed from within the territory of their overland property rights, which seems analogous to the international norm in the period following WWII of states exercising absolute sovereignty over water resources within their territory. In both scenarios, the users have autonomous control over practices within their borders, and they both have worked towards adopting new rules about how to use common-pool resources, albeit to different degrees.

The Los Angeles pumpers' self-organization has parallels to states in the international system moving towards the international water norm of equitable sharing. In the international-scale scenario, the question at hand is how might states develop a new rule of managing shared waters according to WSP approaches. Thus it might be worth exploring to what degrees processes of self-organization in the small-scale case might inform how changes happen in international-level scenarios. The incremental processes of self-organization among the Los Angeles pumpers might provide useful information about how states might overcome the transaction costs of developing international water norms that effectively address the challenges of a new water era.

I argued above the the international system might be far from demonstrating a norm of international soft path water management. Additional research on the development of international norms might provide a better understanding about just how far we might actually be. Given that the Europe's WFD is the sole example anywhere in

the world with even relatively limited aspects of international soft path water management of entire freshwater basins, it seems unlikely that we should expect to see a whole lot more of this practice anytime soon.

5.2 Concluding thoughts

Despite this somewhat unpromising assessment about the sustainable management of international freshwater resources, there is some good news. Not all international water experts offer a doom and gloom forecast of international water management affairs. For example, some experts such as Uitto and Duda (2002) view shared water resources as a vehicle of cooperation among states, arguing that more often than not states choose cooperation over conflict as the best long-term strategy to secure water supplies. Uitto and Duda recognize that international basin management is not an easily or quickly reached achievement, but they point to numerous successful examples in the global North and argue that perhaps it might be only a matter of time before the South catches up (Uitto and Duda 2002).

There is an optimistic conclusion than can be drawn from the perspective that states are generally willing to cooperate in the management of international waters. The point here is that if we can expect states to be generally cooperative when it comes to water, perhaps over time they can become cooperative enough to use new WSP management practices in response to a new era of water challenges. Note that over the last several decades leading up to today, the concept of international water cooperation

has meant a certain standard of reasonable and equitable sharing among states. This form of water cooperation developed in response to challenges associated with nationalism and the expansion of many new states in the international system following WWII (Elver 2006). Perhaps sometime in the near future, the meaning of the concept of interstate water cooperation will change in order to meet a new set of challenges. Yesterday's form of cooperation centered on preventing conflict among states in the international system competing for water resources, and perhaps tomorrow's interstate cooperation will embrace ecological sustainability as a fundamental principle. In other words, if water cooperation actually is a norm of state behavior that way experts such as Uitto and Duda (2002) see it, then perhaps what we need to effectively address our new global water issues is a shift in the meaning of interstate cooperation. In other words, cooperation remains constant, and all that changes is the standard of what it means for states to cooperate in response to new collective challenges. This perspective is a more hopeful interpretation of today's global water challenges.

The is some evidence to support this optimistic interpretation of states' potential to cooperate in order to effectively address shared water problems. For example, the International Joint Commission (IJC) is an relatively long-standing international institution that manages Great Lakes affairs. It was established in 1909 by a bilateral treaty between Canada and the United States, and it has responded to various challenges throughout the Great Lakes Basin since its implementation over a century ago (IJC 2012). The IJC has played a significant role in successfully resolving problems ranging from water and air pollution, to the coordination of international shipping and commerce, to

real-time date monitoring, and so on. If the IJC were to decide that the Great Lakes Basin should be increasingly managed according to WSP approaches, it might indeed happen. If nothing else, the IJC itself is an example of an institution devoted to the management of an entire international watershed, so perhaps it could continue operating in its present institutional role but with a new emphasis on soft path sustainability. The IJC mission statement itself seems to suggest this form of flexibility:

"The International Joint Commission prevents and resolves disputes between the United States of America and Canada under the 1909 Boundary Waters Treaty and pursues the common good of both countries as an independent and objective advisor the the two governments. In particular, the Commission rules upon applications for approval of projects affecting boundary or transboundary waters and may regulate the operation of these projects; it assists the two countries in the protection of the transboundary environment, including the implementation of the Great Lakes Water Qualilty Agreement and the improvement of the transboundary air quality; and it alerts the governments to emerging issues along the boundary that may give rise to bilateral disputes" (IJC 2012).

Here we see a commitment to one meaning of cooperation, which entails preventing and resolving disputes between states, as well as the recognition that "emerging issues" could necessitate IJC involvement. Using the IJC's language, serious efforts to manage the Great Lakes according to soft path principles could itself be an "emerging issue" along the boundary that could give rise to bilateral disputes. Thus in the Great Lakes Basin it

appears that there already exists one significant international institution that could perhaps someday lead efforts to manage a large international watershed using WSP approaches.

Another point of encouragement is that research supports the idea that watersheds are increasingly viable units of public administration (Nelson and Weschler 2001). In a piece the explores some of the practical aspects of how public administrators might conduct place-based governance based on watersheds, Nelson and Weschler conclude improvements in both natural resource management and local political participation have allowed watersheds to take a more central position in small-scale systems of local governance. They argue that natural resource professionals are becoming more accustomed to working across agency boundaries and increasingly view public support as the key to effective ecosystem management. At the same time, citizens are becoming increasingly attuned to the nuances of their natural environments and watershed conditions, as well as their capacity to act on that understanding. The result is that watersheds are increasingly vehicles for finding common ground between institutionalized administrative concerns and citizens' environmental interests. In the terminology of natural resource theory, watersheds can be "the common ground established be a sense of place or community, mutual goals or fears, or a shared vision" (Wondolleck and Yaffee 2000, p. 20).

It is worth noting that Nelson and Weschler's conclusions about watersheds as units of governance are focused on the local or community level, not large-scale international levels. Common sense seems to suggest that organizing local government at

the watershed level should be much easier than doing the same at the international level. Indeed, it is rather plausible to believe that a handful of natural resource specialists and local government officials could self-organize rather easily with, say, a few thousand citizens who rely on a particular lake or river.

On the other hand, there is also research to suggest that we should not necessarily make these kinds of assumptions about the inherent goodness of small-scale ecological practices and the inevitable difficulties of larger scales. Smith and Pangsapa summarize this position:

"We should also remember that small can be ecologically ugly as well as beautiful; there are no guarantees that reducing the scale of production of production is the best remedy for many environmental issues. For instance, much of the timber in China during the 1950s was cleared in a very wasteful way for use in small-scale, village-based iron and steel forging. At the end of the day, it is the impact of social practices on ecosystems, rather than the scale or a particular political affiliation, which matters" (Smith and Pangsapa 2008, p. 81).

Joni Mitchell's famed lyrics also serve as a reminder that small-scale relationships between humans and nature can be ugly and destructive:

"They paved paradise
And put up a parking lot,

With a pink hotel, a boutique

And a swinging hot spot,

Don't it always seem to go

That you don't know what you've got

Till it's gone,

They paved paradise

And put up a parking lot" (Mitchell 1969).

Thus we should not assume that small-scale WSP governance is the only practical choice, and that large-scale international efforts are more likely to fail. Recall that efforts to manage water resources at the watershed level in the relatively small Annapolis Valley Basin in Canada resulted in failure (Isaacman and Daborn 2009). Meanwhile, efforts to manage every river basin across the much larger European Union according to some soft path principles have been to some degree successful.

There is one final topic that should not be overlooked by the central question raised in this inquiry - *when will states, as users of common-pool water resources, self-organize to adopt WSP management approaches in individual watersheds or drainage basins in order to effectively address twenty-first century water challenges?* Although this particular question has not yet been adequately explored by scholars, there is an underlying topic that has received significant attention. This broader issue here is the problem that natural borders often do not align with political borders. In a sense, the

central question raised and explored in this inquiry is basically a more specific, contextualized rehashing of the disconnect between Earth's natural features and human political organization. This broader topic has been addressed by environmental political theorists, and some of their insights are helpful for thinking about the future of sustainable international water management.

Andrew Hurrell frames the broad disconnect between ecological affairs and state-level political structures as the "ecological challenge" to the concept of the state itself (Hurrell 2006, p. 168). He argues that "the state" now has a contested and ambiguous relationship with nature: "on the one hand, as an agent deeply implicated in many of the most serious processes of environmental harm; and, on the other, as the still-dominant form of political organization that will inevitably have to play a central role in facilitating progressive environmental change" (Hurrell 2006, p. 180). In other words, state-driven practices and pressures are often to blame for ecological harm, yet the state is also the tool that we posses to organize ourselves in order to solve complex, large-scale ecological problems. We can see this dynamic on clear display in international water affairs. For example, nationalistic and economic ambitions in Turkey are driving social and ecological harm in the Tigris-Euphrates Basin, but on the other hand, European states are self-organizing to manage all their water resources more sustainably.

Hurrell and other environmental thinkers, such as Robin Eckersely, recognize that this tension likely cannot be resolved easily. The state is a very pronounced - if not obviously dominant - institution in global politics, and it is unlikely to fade away anytime soon. Perhaps at best we can work towards is what is commonly called the "greening of

sovereignty" (Eckersely 2004; Hurrell 2006). As these kinds of thinkers see it, the major task facing us today is to "tame the state", harnessing its destructive potential while using its productive potential to solve widespread and overlapping global ecological problems (Eckersely 2004). Certainly this is easier said than done, but it should not be assumed that a reconfiguration of the state's role in international affairs is impossible. Inspirational ideas out forth by John Dewey nearly a century ago should remind us why people should be capable of wielding the state for uses of their choosing.

In *The Public and Its Problems*, Dewey lays out a vision of the democratic state that is based on a foundation of citizens' recognition of the need to form practical associations to pursue common interests and solve common problems (Dewey 1927). Dewey's work is effectually a call for a certain form of sociability. He asks us to consider the ways our behaviors affect one another, and he encourages us to think of the political state as something we bring into existence for the purpose of managing the various problems we cause for one another indirectly.

The key idea here, and what is most relevant to the ecological task of "taming the state", is Dewey's conviction that what we call "the state" is not a permanent concept with its own purpose or identity. Rather, the democratic state is a human innovation, something that citizens create and use to solve specific problems. As he puts it: "By its very nature, a state is ever something to be scrutinized, investigated, searched for. Almost as soon as its form is stabilized, it needs to be re-made" (Dewey 1927, pp. 31-32). In other words, citizens recognize the kinds of problems that should be addressed by the

state, and citizens define what role the state plays in problem solving processes. Dewey drives this point home:

"There is no more an inherent sanctity in a church, trade-union, business corporation, or family institution than there is in the state. Their value is also to be measured by their consequences ... Just as publics and states vary with conditions of time and place, so do the concrete functions which should be carried on by states. There is no antecedent universal proposition which can be laid down because of which the function of a state should be limited or should be expanded. Their scope is something to be critically and experimentally determined" (Dewey 1927, p. 74).

The emphasis here is that it is up to all of us in the world - at least perhaps all of us citizens who have the power to shape our democratic states - to recognize the collective problems we face and try to use a specific conceptualization of "the state" to solve our problems. This could mean surrendering state sovereignty to international institutions such as the International Joint Commission or the Indus Waters Commission. On the other hand, perhaps states might expand a form of pooled sovereignty in order to implement measures such as "smart pricing" practices that manage demand across an entire international basin. The point here is that, ultimately, people decide the makeup and functions of "a state". So if we recognize that we should "tame the state" in order to solve global ecological problems, then we should also accept that we are capable of acting accordingly.

Taking this resurrection of Dewey's thoughts about the state one step further, a few words about the nature of citizenship shed additional light on the issue of when we should expect to see states manage international basins according to soft path approaches. Dewey's perspective stresses a form of citizenship based on the recognition of common problems. To this I would add that there is one aspect of human existence that is perhaps more common than any other: our shared dependency on Earth's natural resources. Thus as either members of states or simply inhabiters of a shared planet, the concept of citizenship deserves to be attuned to the ecological circumstances of our existence as human beings living on Earth, not just our existence as human beings living within political borders. Perhaps our prospects of managing shared international water resources sustainably has roots in our ability to embrace a form of citizenship that considers our ecological role in our natural settings, especially our individual and collective impacts on the natural environments of which we are a part. Perhaps we can only expect to respond to a new era of global water challenges according to whatever degrees we recognize the ecological aspects of our existences and incorporate them into our meanings of citizenship.

Thinkers such as Andrew Dobson and William Shutkin argue in favor of forms of ecological citizenship as the only logical response to the kinds of ecological problems we face today. Problems such as water crises, climate change, as well as many others are indifferent to political borders, and all of us on Earth are likely to increasingly face challenges associated with these kinds of problems in the future. Dobson and Shutkin both encourage us to be aware of how we live in our natural settings and to recognize that

familiar government institutions such as the state should not be the only determiners of how we identify as citizens (Dobson 2003; Shutkin 2000). In particular, Shutkin is confident that when we consider the long-term environmental effects of our social practices, even the most diverse set of stakeholders will be able to work together and forge plans for how to live together in environmentally healthy communities. He believes we have most of the ideas and technologies necessary to do so (Shutkin 2000, pp. 140-141). And if this can be done at the community level provided a sufficient degree of consideration given to the ecological aspects of what it means to be a citizen, perhaps we can extend this concept of ecological citizenship to national and international levels in order to meet the shared challenges we face in a new era of global water management. In a Deweyian sense, the idea of attuning questions of citizenship and the state to shared water and related ecological problems offers hope for how we might design and use government and other social institutions to address shared ecological problems. Moreover, there is a sense in which we might have an ethical obligation to do so.

James Tully's concept of "Gaia citizens" is a promising one for the possibility of humans working together to address new water challenges, even large-scale ones across international borders. A Gaia citizen is someone who recognizes that humans live in an interconnected web of life, whereby citizenship is tied to being a caretaker of the natural processes that occur in our natural dwelling places (Tully 2008, pp. 293-294). This biocentric view emphasizes the concept of "humans-in-nature", as opposed to an anthropocentric view of "humans-and-nature" that treats the natural environment as something external that has instrumental or material value to people (Capra 1996; Low

and Gleeson 1998; Moran 2006). Gaia citizens "listen and respond to nature carefully as a living being (Gaia) in their ecological sciences and daily practices of treading lightly" (Tully 2008, p. 293). If we think of human life and experiences as part of Gaia, or all living things together, it is easy to understand that humans can have ethical relationships with water and all other aspects of Earth, including other people. As Tully claims:

"If the basic aspect of the human condition is an interdependent relation in the environmental network or web of life, then the question arises as to what ethical comportment should humans take to this relationship of interdependency within the larger eco-communities or ecosystems? The answer is that we should take up the appropriate attitude of care, concern, respect, responsibility and perhaps awe for the value of all living things which compose the larger web of life" (Tully 2008, p. 76)

According to this view, not only should we hope to see the sustainable management of international watersheds, there is a sense in which we have an ethical obligation to achieve such practices. Arguably, we are all Gaia citizens whether or not we acknowledge it because we are all involved in interdependent relationships with Earth's various life forms and resources, and we should demonstrate stewardship accordingly.

Despite the many challenges associated with managing entire international basins according to WSP principles, I am confident that humans can learn how to do it. Gleick's water eras argument shows that humans have successfully faced different water

management challenges through time. Today's water experts identify the substance of our water problems, as well as what we should be doing to address them. Perhaps if enough of us recognize our new water problems and show a willingness to respond - that is, if enough of us practice sufficient Gaia citizenship - over time we might even bring a new international or global norm into existence that reflects using soft path approaches to manage water resources sustainably. Let us hope so, because nature can be what Lester Milbrath calls a "powerful teacher" (Milbrath 2003 p. 48). Let us change our approach to water management and use before "biosphere systems no longer work the way they used to and people are shocked into realizing how much their lives depended on the continued good functioning of those systems" (Milbrath 2003, p. 49).

In closing, for those who might not care to believe that humans are creatures situated within a natural web of life, or those who believe that humans have no ethical obligations to manage watersheds sustainably, or those for whom my arguments have not been adequately powerful or convincing, I offer one more passage about why we should support the soft path approach for managing international freshwater basins:

"It has now become clear that the long-term survival of human and biological diversity on Earth will be dependent on a new paradigm of equitable allocation between our economic, social and ecological needs. More equitable sharing of water resources between society and nature will require values to be placed on both human and aquatic ecosystem requirements ... not only to meet the needs of our current population but also the needs of continually growing future generations" (Wallace et al. 2003, p. 2024).

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