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Robin K. Craig

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CLIMATE CHANGE, REGULATORY FRAGMENTATION, AND WATER TRIAGE

by Robin Kundis Craig*  

ABSTRACT

Fresh water is a regulatorily fragmented resource – that is, water is subject to multiple assertions of regulatory authority and to multiple types of use right claims that those authorities regulate. As fresh water supplies become increasingly unequal to task of meeting the multiple demands for both consumptive and in situ use, and as consumptive and in situ uses of water come increasingly into irreconcilable conflict, the various regulatory schemes governing water have also increasingly come into legal conflict. These courtroom battles have revealed many tensions, overlaps, and gaps in the overall governance of water as a natural resource, especially when viewed from the watershed level.

Such conflicts in water management are only likely to increase as climate change alters the expected availability of water in many areas of the country. In particular, in those regions where climate change reduces water supplies, competition for water resources in general, and conflicts between consumptive and in situ users in particular, are likely to increase. As such, climate change is likely to underscore two significant weaknesses of the current regulatory fragmentation of water resources that the nation should address: (1) the lack of any comprehensive public debate that acknowledges and weighs the cross-jurisdictional tradeoffs among water uses that insufficient supply makes necessary; and (2) the general failure of fresh water regulation, particularly consumptive use regulation, to acknowledge watersheds’ “end of the line” – the oceans.

This Article focuses primarily on the second and logically prior weakness of current water resource management. Specifically, this Article argues that marine ecosystems have often been the largely unnoticed casualties of water’s regulatory fragmentation but that these ecosystems are nevertheless too valuable to continue to be left unconsidered in fresh water regulation. This Article also argues that considering marine ecosystems could provide output-focused, ecosystem-based regulatory goals that could provide one basis for coordinating and, when necessary because of water shortage, prioritizing regulatory choices for fresh water. Moreover, by adding weight to existing arguments for leaving water in situ and highlighting additional sensitivities to water pollution, marine ecosystem output goals could suggest regulatory adjustments to inputs that would better protect the entire watershed – including the human health that depends upon the health of that watershed.

INTRODUCTION

* Attorneys’ Title Insurance Fund Professor of Law, Florida State University College of Law, Tallahassee, Florida. I would like to thank the FSU College of Law for supporting my work on this article through a summer research assignment and in other ways. I would also like to thank my colleagues at the FSU College of Law, who provided feedback on a very early draft of this article at a Summer Faculty Workshop, with particular thanks to Wayne Logan, Tamara Piety, J.B. Ruhl, and Mark Seidenfeld for their comments and suggestions. My presentation on “Florida Water Law and the Endangered Species Act” at the Water Law Institute’s and CLE International’s Florida Water Law CLE, Supply and Quality: Issues, Challenges and Solutions, held May 21-22, 2007, in Tampa, Florida, formed the basis of portions of this article. Comments may be directed to me at rcraig@law.fsu.edu.
On July 9, 2007, the National Council for Environmental Policy and Technology advised the federal Environmental Protection Agency (EPA) “that ‘neither policymakers or the public have a clear understanding of the concept of a watershed approach to water management, the relationship between a watershed approach and the urgent need to address water supply, water quality, and insufficient deteriorating water infrastructure, or the benefits of a watershed approach.’”1 It further advised the EPA to “‘lead by example’”2 and appoint someone to coordinate a watershed approach to managing storm water, wastewater, and drinking water systems.3

Unlike air, which is only rarely usefully captured and reduced to private possession, and hence tends to be regulated as an unownable medium,4 water is both a capturable natural resource and an environmental medium that supports other ecological processes. Partially as a result of this dual nature, water is a regulatorily fragmented resource – that is, water is subject to multiple assertions of regulatory authority and to multiple types of use right claims that those authorities regulate. For example, there is a general understanding in the law that states control the fresh water resources within their borders. Indeed, pursuant to the American adaptation of English common law and the equal footing doctrine, states own the beds and banks of all the waters that were navigable-in-fact4 or subject to the ebb and flow of the tide5 at the date of statehood. However, the test of navigability that determines state ownership also establishes the federal government’s authority to regulate those waters for navigation and interstate commerce,6 immediately fragmenting regulatory authority in these waters.7 Moreover, as the history of the Clean Water Act and other related statutes indicates, federal Commerce Clause and state police power authority overlap in the non-navigable-in-fact waters.8 Finally, both the state and federal governments further subordinate their regulatory interests in waters among multiple agencies to address particular sources of problems and/or particular uses of the waters – for example,

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2 Id. (quoting National Advisory Council’s draft report).
6 Utah v. United States, 403 U.S. 9, 10 (1971) (quoting The Daniel Ball, 77 U.S. (10 Wall.) 557, 563 (1870)).
8 See Richard J. Lazarus, Changing Conceptions of Property and Sovereignty in Natural Resources: Questioning the Public Trust Doctrine, 71 Iowa L. Rev. 631, 636 (1986) (noting that “the common interest of both sovereigns in those water resources was clear in the nineteenth century.”).
polluters, hydropower facilities, obstructions to navigation, public recreation, consumptive withdrawals, habitat and biodiversity.  

Conflict over fresh water tends to derive from the fact that many users need to consume fresh water, while many other users of water from the same source need usable quantities to remain in the stream. As fresh water supplies become increasingly unequal to task of meeting the multiple demands for both consumptive and in situ use, and as consumptive and in situ uses of water come increasingly into irreconcilable conflict, the various regulatory schemes governing water have also increasingly come into legal conflict. These courtroom battles have revealed many tensions, overlaps, and gaps in the overall governance of water as a natural resource, especially when viewed from the watershed level.

Tensions and conflicts in water management are only likely to increase as climate change alters the expected availability of water in many areas of the country. In particular, in those regions where climate change reduces water supplies, competition for water resources in general, and conflicts between consumptive and in situ users in particular, are likely to increase. As such, climate change is likely to underscore two significant weaknesses of the current regulatory fragmentation of water resources that the nation should address – preferably before competition and conflict lead to additional unintended and undebated damage to aquatic resources, marine ecosystems, and human health.

The first of these weaknesses is the lack of any comprehensive public debate that acknowledges and weighs the cross-jurisdictional tradeoffs among water uses that insufficient supply makes necessary, let alone any public process that openly, consciously, and explicitly chooses among or prioritizes those competing uses in particular watershed. As Richard Lazarus has noted, two of the most important trends in environmental and natural resources law have been the development of information analysis and disclosure requirements and mandated public participation. The absence of a comprehensive fresh water management regime means that these features largely do not exist at the watershed level, especially in the absence of federal action and the consequent inapplicability of the National Environmental Policy Act (NEPA).

This lack of comprehensive oversight and decision making has led, and will continue to lead, to unconscious de facto tradeoffs “in the cracks” of regulatory authorities and agency missions. As one example, in the West, rivers are often sucked dry long before they reach their natural destinations, at the expense of potential recreational and biodiversity goals in the waterway and marine ecosystem health at the end of the line, as a result of the de facto prioritization of state-authorized consumptive appropriations. As another example, the lack of any comprehensive oversight and the existence of regulatory fragmentation has led to pollution

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9 See infra Part I.A. See also LAZARUS, supra note 6, at 33-35 (describing lawmaking and regulatory fragmentation within the federal government).

10 LAZARUS, supra note 6, at 185-91.


12 See, e.g., ROBERT W. ADLER, RESTORING COLORADO RIVER ECOSYSTEMS: A TROUBLED SENSE OF IMMENITY 20, 22, 206-36 (2007) (noting in connection with the Colorado River that “[b]ecause water is fundamental to all economic growth in the arid West, the basin states will resist any restoration efforts that jeopardize the fundamental ‘deal’ struck in the Colorado River Compact” – a deal that leaves Mexico and the Gulf of California with far too little water).
standards established on the basis of immediate human health concerns, at the expense of more protective standards that would both better protect human health and simultaneously safeguard downstream species and ecosystem health. Such *de facto* tradeoffs result not just from the fact of regulatory fragmentation but also from the input focus of most regulatory regimes, rather than an output focus that can comprehend the watershed and its ecosystems as a whole.

This Article, however, will focus primarily on the second and logically prior weakness of current water resource management: the general failure of fresh water regulation, particularly consumptive use regulation, to acknowledge watersheds’ “end of the line” – the oceans. The health of marine ecosystems depends intimately upon both the quality and the quantity of fresh water arriving from the relevant watersheds. While upstream pollution problems have been acknowledged in some coastal ecosystems – Chesapeake Bay pollution issues and the hypoxia problem in the Gulf of Mexico are notable examples – upstream states and the EPA still rarely set water quality standards and discharge limitations with the ocean in mind, particularly when the ocean is several states away. Even less marine-focused regulatory attention is paid to water flow, but reduced quantities of fresh water both cause independent problems for marine ecosystems and compound pollution problems. Moreover, as the U.S. Supreme Court has acknowledged, the distinction between water quantity and water quality “is an artificial distinction. In many cases, water quantity is closely related to water quality; a sufficient lowering of the water quantity in a body of water could destroy all of its designated uses, be it for drinking water, recreation, navigation, or . . . a fishery.”

This Article first argues that marine ecosystems have often been the largely unnoticed casualties of water’s regulatory fragmentation but that these ecosystems are nevertheless too valuable to continue to be left unconsidered in fresh water regulation, as the 2003 and 2004 reports of the Pew Oceans Commission and U.S. Commission on Ocean Policy make clear. Second, this Article argues that considering marine ecosystems could provide output-based ecosystem regulatory goals that could provide one basis for coordinating and, when necessary because of water shortage, prioritizing regulatory choices for fresh water. Moreover, by adding weight to existing arguments for leaving water *in situ* and highlighting additional sensitivities to water pollution, marine ecosystem output goals could suggest regulatory adjustments to inputs that would better protect the entire watershed – including the human health that depends upon the health of the watershed.

Part I of this Article outlines the existing regulatory fragmentation that dominates the management of fresh water, using the specific example of atmospheric deposition of mercury. The problem of mercury deposition into water demonstrates not only how multiple regulatory agencies and regimes might be brought to bear on one environmental problem but also how certain environmental outputs are elided from regulatory attention. Positing that water’s regulatory fragmentation reflects an input-focused or source-based management philosophy that is out of step with the increasing interest in ecosystem-based management and, specifically, the renewed regulatory interest in watersheds, Part I concludes by arguing that output-based

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13 See infra Part I.B.2.
14 See infra notes 320–328 and accompanying text.
15 See infra notes 313–319 and accompanying text.
management could provide one means of directing all of the water management regimes to a more common overall regulatory goal.

In Part II, this Article suggests why such increased harmonization is legally and ecologically desirable. It outlines the increasing number of legal conflicts regarding the use and regulation of water, suggesting that these conflicts are driven in large part by systemic states of water shortage. In particular, the increasing number of lawsuits to resolve conflicts between water law and endangered species underscores the fundamental conflict that exists between consumptive users of water and users who need water in situ – a conflict that climate change is likely to exacerbate for many parts of the United States in coming decades. Part II concludes by providing examples of watersheds and ecosystems where regulatory fragmentation has impeded the attainment of ecosystem-based restoration goals.

Part III discusses one of the primary regulatory orphans of water’s regulatory fragmentation: the oceans. It begins by providing an overview of the value of healthy marine ecosystems to the United States, then emphasizes the fact that both the Pew Oceans Commission and the U.S. Commission on Ocean Policy identified regulatory fragmentation as the most important impediment to rational and sustainable regulation of marine resources. Noting that oceans are a textbook example of William Buzbee’s theory of the regulatory commons, Part III concludes with examples of specific sacrifices of healthy marine ecosystems that have resulted from a failure to prioritize or, often, even consider marine outputs in the regulation of fresh water.

This Article concludes that, given the existing and more-or-less permanent states of water shortage in many parts of the country, and as the United States faces the probability of climate change-induced increased water stress and water shortage in many regions of the country, the nation needs to consider the possibility of both national and watershed-based water triage. As in medicine, water triage would acknowledge that some systems need little intervention, some are doomed (or, to move from the human to the ecological, sacrificeable), and some are worth the intervention to save and restore. To make water triage a truly valuable tool, however, marine ecosystems must be part of the discussion.

I. WATER’S REGULATORY FRAGMENTATION AND THE EVOLUTION TO ECOSYSTEM-BASED REGULATION

The regulatory fragmentation of water, and the conflicts that derive therefrom, reflect the numerous values of water to humans and to the aquatic ecosystems more generally. The multiplicity of human uses has prompted an input-based – that is, source- or user-based – approach to regulation of water resources. The following sections outline some of the more important uses of water resources, discuss how input-focused regulation leads to regulatory fragmentation in water, and posit that this input-focused regulatory fragmentation is at odds with environmental law’s progression to an ecosystem approach, as typified in water resource management with a renewed interest in watershed management.

A. Competing Uses of Fresh Water
1. Water as Commodity: State Water Law and Federal Water Projects

One of the most basic regulatory aspects of water – and arguably, the aspect with the most ability to influence downstream ecological outputs, particularly in areas experiencing fresh water shortages – is the law governing who has the right to remove fresh water from its natural watercourse and to use that water for some consumptive purpose, such as irrigation, drinking water, or industrial manufacturing. From this perspective, fresh water resources, both surface water and groundwater, are generally considered the property of the states, and state water law dominates in regulating the removal and use of fresh water.\(^{17}\)

Because water law is largely state law, the exact principles and requirements governing the withdrawal and consumptive use of water can vary considerably from location to location. However, in broad brush strokes, the eastern states inherited from England the doctrine of riparianism, which ties the right to use water to ownership of the land adjoining the water source – i.e., the riparian landowners.\(^{18}\) Common law riparian doctrine emphasizes domestic use,\(^{19}\) water sharing,\(^{20}\) correlative and adjustable rights to water,\(^{21}\) and a limit on withdrawals from the natural watercourse.\(^{22}\) Riparianism works adequately in areas with plenty of water,\(^{23}\) and it is fairly supportive of aquatic ecosystems.\(^{24}\) However, the legal connection of consumptive use rights to riparian land ownership limits non-riparian development,\(^{25}\) and most eastern states have transitioned to “regulated riparianism” and administrative permitting,\(^{26}\) which allow for increased consumptive and off-site use of water.

In contrast, the perpetually drought-threatened western states, especially in connection with their origins as territories and with the presence of extensive federal lands, generally rejected riparianism in favor of the prior appropriation doctrine.\(^{27}\) Prior appropriation operates on a principle of “first in time, first in right” – the first user to apply water to a beneficial use,\(^{27}\)

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\(^{17}\) Charlton H. Bonham, Perspectives from the Field: A Review of Western Instream Flow Issues and Recommendations for a New Water Future, 36 ENVTL. L. 1205, 1208 (Fall 2006); George A. Gould, Douglas L. Grant, & Gregory S. Weber, Water Law 23 (7th ed. 2005).


\(^{23}\) Gould, supra note 18, at 9.

\(^{24}\) Muench v. Public Service Comm’n, 53 N.W.2d 514, 522-24 (Wis. 1952).

\(^{25}\) Richard F. Ricci, Franklin W. Boenning, & Kristina D. Pasko, Battles over Eastern Water, 21 NATURAL RESOURCES & ENVTL. 38, 38 (Summer 2006).


\(^{27}\) Ricci, Boenning, & Pasko, supra note 25, at 38; Gould, supra note 18, at 9.
without waste or abandonment, acquires a continued right to a water supply superior to that of later users drawing water from the same source.\footnote{28} Moreover, given its origin in western mining on federal public lands,\footnote{29} prior appropriation doctrine has never linked water use to riparian land ownership,\footnote{30} making it relatively easy to transport water from its source to distant farms or other uses. However, the prior appropriation doctrine has also traditionally lacked any legal impetus to leave water \textit{in situ}, promoting (especially in conjunction with natural conditions where drought is already common) far more destruction of and stress upon aquatic ecosystems than eastern riparianism.\footnote{31} Legal mechanisms that allow for the protection of ecological values, such as the recognition of instream rights,\footnote{32} expansion of the state public trust doctrine,\footnote{33} and incorporation of public interest review into permitting regimes,\footnote{34} are relatively recent innovations in prior appropriation states.

A few federal law doctrines are relevant to the implementation of state water law, especially when viewing water in a large ecosystem context. First, the federal common law doctrine of equitable apportionment controls – absent interstate compact\footnote{35} or direct congressional action\footnote{36} – the division of interstate water resources among the relevant states.\footnote{37} As applied by the U.S. Supreme Court, equitable apportionment generally follows the legal regime of the relevant states (prior appropriation in the West, riparianism in the East) and generally strives to

\textsuperscript{30} Lux v. Haggin, 10 P. 674, 697-705 (Cal. 1886).
\textsuperscript{35} Gould, Grant, & Weber, \textit{supra} note 18, at 486-94.
\textsuperscript{36} Id. at 494-508.
preserve existing uses. As such, states with interstate waterways have strong incentives to
develop that water quickly and extensively. Indeed, fears about downstream California’s rapid
development helped to drive interstate and congressional apportionment of the Colorado River.

Second, the public trust doctrine limits the states’ ability to abdicate title to and especially
regulatory authority over the beds and banks of waters that are navigable-in-fact or influenced by
the tides. This doctrine seeks to preserve the public’s right to use these waters for, at minimum,
navigation, commerce, and fishing and hence provides some impetus for leaving water in its
natural location.

Finally, the doctrine of federal reserved rights recognizes that, in some circumstances, the
federal government will be deemed to have reserved water rights for federal purposes that trump
state water rights, particularly in connection with tribal reservations and federal parks. While
many such reserved rights have yet to be fully litigated, when these rights are finally
acknowledged in prior appropriation states, they tend to have early priority dates and hence can
significantly alter the implementation of other water rights. In addition, the federal presence is
often dominant in the variety of federal reclamation and irrigation projects that exist in the
United States, especially in the West.

2. Water as Human Service Provider

a. Navigation and Commerce

While state water law generally governs the withdrawal and consumption of fresh water,
water in situ also provides a number of human services – services often protected by federal law.
Perhaps most obviously, large waterways in the United States have long been important to

39 ADLER, supra note 12, at 21; J.B. Ruhl, Equitable Apportionment of Ecosystem Services: New Water Law
for a New Water Age, 19:1 J. LAND USE & ENVTL. L. 47, 51 (Fall 2003).
40 ADLER, supra note 12, at 21.
41 Martin v. Waddell’s Lessee, 41 U.S. 367, 383-88 (1842); The Volant, 59 U.S. 71, 74-75 (1855); Illinois
42 Martin v. Waddell’s Lessee, 41 U.S. 367, 383-88 (1842); The Volant, 59 U.S. 71, 74-75 (1855); Illinois
43 E.g., Idaho v. United States, 533 U.S. 262, 274-79 (2001) (holding that the United States intended to
reserve Coeur d’Alene Lake and the St. Joe River for the Coeur d’Alene Tribe, defeating Idaho’s claims); Arizona v.
California, 530 U.S. 392, 418-19 (2000) (awarding rights to Colorado River water to the Colorado River Indian
Reservation); Cappaert v. United States, 426 U.S. 128, 138-41 (1976) (upholding a reservation for water for Devil’s
Hole); Winters v. United States, 207 U.S. 564, 577 (1908) (enjoining a diversion of the Milk River in Montana
because of an 1888 reservation for the Fort Belknap Reservation for irrigation).
44 John E. Thorson, Ramsey L. Kropf, Andrea K. Gerhak, & Dar Crammond, Dividing Western Waters: A
Century of Adjudicating Rivers and Streams, Part II, 9 DENVER U. L. REV 299, 358 (Spring 2006); Thomas H.
Pacheo, How Big Is Big? The Scope of Water Rights Suits After the McCarran Amendment, 15 ECOLOGY L.Q. 627,
Western Water Fight, 15 HASTINGS CONST. L.Q. 125, 139-40 (Fall 1987).
River water despite an interstate compact allocating that water).
46 See, e.g., U.S. Bureau of Reclamation, Operations within the Bureau of Reclamation,
navigation and commerce. Given the federal government’s constitutional authority over interstate commerce, the U.S. Supreme Court lodged final authority over navigation in the navigable-in-fact waters in Congress. Congress exercised this authority primarily through the various Rivers and Harbors Acts, culminating in the Rivers and Harbors Act of 1899 (RHA).

The RHA prohibits the construction of actual obstructions in the navigable waters – specifically, “the construction of any bridge, causeway, dam or dike over or in any port, roadstead, haven, harbor, canal, navigable river, or other navigable water of the United States” – without Congress’ explicit consent. The building of lesser structures in the navigable waters, such as “any wharf, pier, dolphin, boom, weir, breakwater, bulkhead, jetty or other structures in any port, roadstead, haven, harbor, canal, navigable water, or water of the United States,” requires a permit from the U.S. Army Corps of Engineers. Similarly, “it shall not be lawful to excavate or fill, or in any manner to alter or modify the course, location, condition, or capacity of, any port, roadstead, haven, harbor, canal, lake, harbor of refuge, or inclosure within the limits of any breakwater, or of the channel of any navigable water of the United States,” without a permit from the Army Corps. Finally, the RHA also makes it illegal “to throw, discharge, or deposit, or cause, suffer, or procure to be thrown, discharged, or deposited either from or out of any ship, barge, or other floating craft of any kind, or from the shore, wharf, manufacturing establishment, or mill of any kind, any refuse matter of any kind or description whatever other than that flowing from streets and sewers and passing therefrom in a liquid state, into any navigable water of the United States, or into any tributary of any navigable water . . . .”

Read on its face, the RHA would seem to preserve the more-or-less natural state of navigable waters, and it certainly has been implemented so as to preserve actual navigability. However, the history of the U.S. Army Corps is a history of altering aquatic features, and the RHA has been instrumental in expanding the Army Corps’ regulatory presence in navigable waters. Indeed, in its navigation regulatory capacity, the Army Corps now “maintains more than 12,000 miles (19,200 km) of inland waterways and operates 235 locks”; it also maintains 300 commercial harbors and over 600 smaller harbors.

b. Hydropower

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47 U.S. CONST., Art. I, § 8, cl. 3.
48 Gibbons v. Ogden, 22 U.S. (9 Wheat.) 1, 3, 9-12, 22-28 (1824) (holding that the power to regulate commerce includes the power to regulate navigation and the navigable waters).
50 33 U.S.C. § 401; see also 33 U.S.C. § 403 (“The creation of any obstruction not affirmatively authorized by Congress, to the navigable capacity of any of the waters of the United States is prohibited”).
52 Id.
54 United States v. San Juan Bay Marina, 239 F.3d 400, 404 (1st Cir. 2001) (upholding an RHA order to remove piers from San Juan Harbor); United States v. Members of Estate of Boothby, 16 F.3d 19, 21 (1st Cir. 1994) (upholding an ejection of houseboats under the RHA); United States v. Nassau Marine Corp., 778 F.2d 1111, 1115 (5th Cir. 1985) (holding that the RHA compels removal of a sunken barge that was an obstacle to navigation).
Large river systems also supply the nation with hydropower, and the building and operation of hydroelectric dams currently falls within the jurisdiction of the Federal Energy Regulatory Commission (FERC) pursuant to the Federal Power Act of 1935. Under this Act, FERC is to investigate the use of water resources throughout the country for hydropower. It may also issue licenses to private entities, states, or municipalities “for the purpose of constructing, operating, and maintaining dams, water conduits, reservoirs, power houses, transmission lines, or other project works necessary or convenient for the development and improvement of navigation and for the development, transmission, and utilization of power across, along, from, or in any of the streams or other bodies of water over which Congress has jurisdiction . . . .” In addition, the agency must determine which hydroelectric powers the federal government should develop instead of private entities, states, or local governments.

In exercising its licensing authority, FERC must consider whether a project is “best adapted to a comprehensive plan for improving or developing a waterway,” including consideration of other uses, such as recreation and environmental values. While FERC and its predecessor, the Federal Power Commission (FPC), have denied hydropower licenses on environmental grounds, application denials have been the exception rather than the rule . . . . Amendments in the Electric Consumers Protection Act of 1986 required FERC to give “equal consideration” to “energy conservation, . . . fish and wildlife, . . . recreational opportunities, and the preservation of other aspects of environmental quality” as well as to “power and development purposes.”

Other federal agencies play more specific roles in hydropower. For example, in the Columbia River in the Pacific Northwest, the Bonneville Power Administration (BPA) allocates the power, including entering into contracts, from the hydroelectric dams in the Columbia River; the Army Corps has operational control over the dams themselves. In parts of the southeastern United States, the Tennessee Valley Authority (TVA) has authority to provide affordable electricity to local residents. Under this authority, the TVA operates 29 hydroelectric dams.

c. Waste Disposal and Assimilation

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56 16 U.S.C. §§ 792-825r.
58 16 U.S.C. § 797(e).
59 16 U.S.C. § 800(b).
61 See, e.g., In the Matter of Namekagon Hydro Company, 12 F.P.C. 203 (1953), aff’d 216 F.2d 509 (7th Cir. 1954).
64 16 U.S.C. § 797(e).
65 16 U.S.C. §§ 832a-832m, 838a.
68 Tennessee Valley Authority v. Whitman, 336 F.3d 1236, 1243 & n.10 (11th Cir. 2003).
Another service that aquatic media provide is waste disposal and assimilation. Long before the federal Clean Water Act – indeed, one of the reasons Congress eventually enacted the Clean Water Act – industries and municipalities exploited waterways’ capacities to dilute, disperse, and in some cases, to effectively treat industrial and municipal wastes and sewage. Other aquatic ecosystems such as wetlands are particularly good at filtering and containing toxics and other pollutants. Similarly, undisturbed river and lake sediments can sequester toxic pollutants from the water column.

Nevertheless, abuse of these ecosystem services led to excessively polluted waterways – rivers that could catch on fire, toxic lakes – and the enactment of the federal Clean Water Act. Two federal agencies, the U.S. Environmental Protection Agency (EPA) and the U.S. Army Corps of Engineers, oversee implementation of the Act and engage in permitting and the setting of water quality requirements when the states fail to do so. However, the Act gives primary authority over water quality requirements and exclusive authority over nonpoint source regulation to the states, and it encourages state to take over Clean Water Act permitting.

In addition to providing grants for sewage treatment facilities, this Act makes “the discharge of pollutants” by any person illegal. Sorting through the Act’s definitional complexities reveals that it is illegal for any person, including municipalities, states, and business associations, to add pollutants (broadly defined) to “the waters of the United States” or the oceans from “discernible, confined, and discrete conveyances” without a permit. Moreover, the Act establishes national goals that “the discharge of pollutants into the navigable waters be eliminated” and, in the interim and where attainable, “water quality which provides for the protection and propagation of fish, shellfish, and wildlife and provides for recreation in and on the water be achieved . . . .” Thus, the Act pursues larger ecosystem goals as well as pure

69 CRAIG, supra note 8, at 10-18, 56-62.
71 U.S. EPA, Hudson River PCBs. http://www.epa.gov/hudson/ (last updated July 16, 2007) (chronicling the controversy over dredging the PCB-contaminated Hudson River); Northwest Envtl. Advocates v. National Marine Fisheries Serv., 460 F.3d 1125, 1141-42 (9th Cir. 2006) (discussing the need to evaluate, pursuant to NEPA, the toxicity from dredging the Columbia River).
73 33 U.S.C. § 1251(d).
74 33 U.S.C. § 1344(d).
75 33 U.S.C. §§ 1342(a), 1344(a).
76 33 U.S.C. § 1313(c), (d).
77 33 U.S.C. § 1313(c), (d).
79 33 U.S.C. §§ 1251(g), 1342(b), 1344(g).
82 33 U.S.C. § 1362(5), (6), (7), (10), (12), (14).
83 33 U.S.C. § 1251(a)(1), (2).
water quality goals, although how thoroughly its water quality regulation promotes ecosystem health generally depends on how states set the specific water quality standards for each waterbody within their respective borders.  

d. Fishing and Hunting

Most aquatic ecosystems, including coastal ecosystems, support some form of fishing, whether recreational or commercial; many also support hunting, such as hunting for waterfowl. The presence of such fisheries and game birds generally triggers the regulatory authority of the relevant state fish and game agencies. In addition, the presence of certain species, such as migratory birds, may also give the U.S. Fish & Wildlife Service a say in how the waterway is managed, while the presence of anadromous fish – that is, fish such as salmon and sturgeon that spend part of their life cycles in fresh water and part at sea – will trigger the regulatory authority of the National Oceanic and Atmospheric Administration (NOAA), acting through the National Marine Fisheries Service (NMFS), also known as NOAA Fisheries.

At the coast and out to sea, the federal Magnuson-Stevens Fishery Conservation and Management Act becomes relevant. NOAA and NMFS have oversight authority over federally managed commercial marine fisheries under this statute, although the eight regional Fishery Management Councils (FMCs) most directly manage these fisheries and regulate the fishers. Within the first three miles of marine waters, however, state fisheries agencies also play a large role in fisheries regulation, although the federal FMCs and agencies can supersede state regulation if state regulation conflicts with federal Fishery Management Plans.

e. Recreation

Aquatic ecosystems undeniably produce recreational opportunities in the form of recreational fishing, kayaking, birdwatching, ecotourism, and swimming. The Clean Water Act’s general goal of restoring and maintaining waters that are fishable and swimmable promotes preservation of aquatic recreation.

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84 See 33 U.S.C. § 1313(c) (describing state water quality standard authority).


86 Migratory Bird Treaty Act, 16 U.S.C. §§ 703-712. In particular, the Secretary of the Interior (acting through the U.S. Fish and Wildlife Service) must consider “breeding habitats” when it promulgates migratory bird regulations. 16 U.S.C. § 704(a). See also Consejo de Desarrollo de Mexicali, A.C. v. United States, 482 F.3d 1157, 1162-63, 1166 (9th Cir. 2007) (challenging the United States’ decision to line the All-American canal pursuant to the Migratory Bird Treaty Act).

87 16 U.S.C. §§ 756 (imposing a duty on the Secretary of Commerce (acting through NOAA) to conserve salmon in the Columbia River); 1801(a)(1), (b)(1), 1811(b)(1), 1857(2)(B), 1855(b)(3)(B) (giving salmon special attention under the Magnuson-Stevens Fishery Conservation and Management Act).


In addition, individual states can protect recreational uses through their water quality standards designations under the Clean Water Act and/or through “Wild and Scenic River Designation” state public trust doctrines or other state laws. The presence of federal or state parks (involving, respectively, the National Park Service or state parks agencies) or other public lands such as National Forests (U.S. Forest Service) or rangelands (Bureau of Land Management (BLM)) or other kinds of state lands (state lands agencies) can also affect the recreational use of water.

3. Water as Habitat and Ecosystem

Finally, aquatic ecosystems are just that – ecosystems that provide habitat and life support to numerous species, including humans. Nevertheless, no single federal or state statute addresses all of the considerations relevant to water’s status as habitat, especially not at the ecosystem level.

The Clean Water Act does encourage states, the EPA, and the Army Corps to think about water’s status as habitat. As noted, one of the Act’s overall goals is to restore and maintain the fishability of rivers. The EPA must establish guidance water quality criteria that reflect “the latest scientific knowledge” regarding “plankton, fish, shellfish, wildlife, plant life, shorelines, [and] beaches” and regarding “the effects of pollutants on biological community diversity, productivity, and stability . . . .” States, in turn, use these criteria in setting their water quality standards.

95 33 U.S.C. § 1313(c)(2)(A) (requiring states to consider “recreational purposes” when setting water quality standards).
98 E.g., ALAS. STAT. §§ 41.21.455, 41.21.475 (establishing state recreation areas in Narcy Lake and Chenal River); ALAS. STAT. §§ 41.23.400-41.23.510 (establishing six recreation rivers); COLO. REV. STAT. §§ 33.12.5-101 to 33.12.5-105 (Arkansas River Recreation Act); IDAHO CODE §§ 14-29-8-1 to 14-29-8-5 (governing recreational streams); LA. STAT. ANN. §§ 38:2610 to 38:2612 (establishing the Cypress-Black Bayou Recreation and Water Conservation District); MD. CODE §§ 5-215 to 5-215.1 (laying out the Deep Creek recreation plan); N.M. STAT. ANN. §§ 16-4-4 to 16-4-16 (establishing the El Rio Chama Science and Pastoral River and Rio Grande Valley State Park).
100 33 U.S.C. § 1314(a)(1).
standards,\textsuperscript{101} which the EPA must approve;\textsuperscript{102} moreover, states must consider their waters’ uses for “propagation of fish and wildlife” when establishing the water quality standards.\textsuperscript{103} Permit standards for discharges into the oceans must consider the effects of the pollutants on “plankton, fish, shellfish, wildlife, shorelines, and beaches” and on marine life generally, including “changes in marine ecosystem diversity, productivity, and stability” and “species and community population changes.”\textsuperscript{104} Similar considerations govern when the Army Corps issues permits for discharges of dredged or fill material.\textsuperscript{105} Moreover, the U.S. Fish & Wildlife Service is supposed to comment on all such “dredge and fill” permits.\textsuperscript{106}

Nevertheless, the Clean Water Act’s regulatory focus remains pollution prevention and mitigation, not habitat preservation \textit{per se}. Direct considerations of aquatic habitat impairments are far more likely to come about as a result of the federal Endangered Species Act (ESA)\textsuperscript{107} or similar requirements of state law.\textsuperscript{108}

The U.S. Fish & Wildlife Service implements the federal ESA for terrestrial species, including most freshwater species, while the National Marine Fisheries Service (NMFS, also known as NOAA Fisheries) implements the Act for marine and anadromous species.\textsuperscript{109} The ESA states explicitly that one of its purposes is “to provide a means whereby the ecosystems upon which endangered and threatened species depend may be conserved,”\textsuperscript{110} and “the present or threatened destruction, modification, or curtailment of [a species’] habitat or range” is the first reason given for listing a species for protection.\textsuperscript{111}

Once the appropriate agency lists a species, it is supposed to both designate critical habitat for the species\textsuperscript{112} and develop and implement a recovery plan.\textsuperscript{113} “Critical habitat” includes both “the specific areas within the geographical area occupied by the species, at the time it is listed . . ., on which are found those physical or biological features (I) essential to the conservation of the species and (II) which may require special management considerations of protection” and “specific areas outside the geographical area occupied by the species . . . upon a determination by [the appropriate agency] that such areas are essential for the conservation of the species.”\textsuperscript{114} Both critical habitat and recovery plans are supposed to accomplish the “conservation” of the endangered or threatened species, which means “bring[ing] any endangered species or threatened species to the point at which the measures provided pursuant to

\textsuperscript{101} 33 U.S.C. § 1313(c)(2)(B).
\textsuperscript{102} 33 U.S.C. § 1313(c)(3), (4).
\textsuperscript{103} 33 U.S.C. § 1313(c)(2)(A).
\textsuperscript{104} 33 U.S.C. § 1343(c)(1)(A), (B).
\textsuperscript{105} 33 U.S.C. § 1344(b)(1); see also 40 C.F.R. § 230.10.
\textsuperscript{106} 33 U.S.C. § 1344(m).
\textsuperscript{107} 16 U.S.C. §§ 1531-1544.
\textsuperscript{108} E.g., ALAS. STAT. ANN. §§ 16.20.180 to 16.20.210; CAL. FISH & GAME CODE §§ 2050-7710.5; CONN. GEN. STAT. Ann. §§ 26-303 to 26-316.
\textsuperscript{109} 16 U.S.C. § 1532(15); 50 C.F.R. § 402.02.
\textsuperscript{110} 16 U.S.C. § 1531(b).
\textsuperscript{113} 16 U.S.C. § 1533(f).
\textsuperscript{114} 16 U.S.C. § 1532(5)(A).
this [Act] are no longer necessary,” including through the use of “habitat acquisition and maintenance . . . .” 115

Once a species is listed and its critical habitat determined, all federal agencies must “insure that any action authorized, funded, or carried out by such agency . . . is not likely . . . to result in the destruction or adverse modification of” critical habitat, 116 and individuals wishing to “take” listed species incidental to otherwise lawful activities must complete a habitat conservation plan for the species. 117 Moreover, under the agencies’ regulations, habitat destruction can constitute a prohibited “take” of the species. 118

Finally, state endangered species protections and state water permitting requirements can serve to acknowledge and protect aquatic ecosystems and the habitat they provide. State endangered species protections vary, but many states protect species not already protected under the federal ESA. 119 In addition, many states have incorporated ecosystem and habitat considerations into their water law and consumptive use permitting. Most often, these considerations are incorporated into permitting decisions through a public interest review. For example, under Oregon statutes, the state Water Resources Department may deny a reservoir owner’s water right permit application if the reservoir “[w]ould pose a significant detrimental impact to existing fishery resources.” 120 Other states have found other ways to incorporate such considerations. California and Hawaii, for example, use their public trust doctrines to harmonize water law and species protections. 121

B. Input-Based Regulation: An Example of Regulatory Fragmentation, Conflict, and Choice

1. Input-Based Regulation and the History of Environmental and Natural Resources Law

Richard Lazarus has observed that, “[b]roadly stated, environmental law regulates human activity in order to limit ecological impacts that threaten public health and biodiversity.” 122 As such, “[e]nvironmental law must necessarily be responsive to the types of problems it seeks to address, including the physical causes and effects of environmental degradation.” 123

These statements suggest that environmental and natural resources law could adopt at least two approaches to regulation: input-based regulation that focuses on controlling the human

118 50 C.F.R. § 17.3 (defining “harm” in the definition of “take” for purposes of 16 U.S.C. § 1538(a)(1) to “include significant habitat modification or degradation where it actually kills or injures wildlife”); Babbitt v. Sweet Home Chapter of Communities for a Great Oregon, 515 U.S. 687, 696-703 (1995) (upholding this definition).
120 OR. REV. STAT. § 537.409(5)(b).
122 LAZARUS, supra note 6, at 1.
123 Id. at 5.
activities that cause problems; or output-based regulation that focuses on reaching particular public health and environmental goals. Nevertheless, it is input-focused regulation that has dominated environmental and natural resources law, concentrating regulatory attention on emissions, technological controls, best management practices, and access limitations.\textsuperscript{124}

However, this input-focused approach may impede the progressive evolution of environmental and natural resources law to ecosystem-based approaches. As Robert Adler has recently described that evolution, “[f]irst, we tried to mitigate the increasingly severe environmental damage caused by our accelerating industrial economy and our thirst for more and bigger things.”\textsuperscript{125} “Mitigation is somewhat like a paramedic treating an accident victim. The immediate task is to stop the bleeding and to minimize the resulting harm.”\textsuperscript{126} At the second stage of environmental law’s evolution, the focus shifted to “prevent[ing] environmental harm by providing the same or similar goods and services in ways that cause less damage to the environment, thereby avoiding the debates over the value of environmental mitigation. This second-phase strategy is like the efforts of an epidemiologist to prevent accidents and causes of disease in the first place, rather than treating patients once they become injured or ill.”\textsuperscript{127}

Although Adler does not emphasize this point, input-based regulation is acceptable, perhaps even necessary, at both the mitigation and the prevention stages because both mitigation and prevention tend to focus on individual sources of specific environmental problems — the factories emitting smoke into the atmosphere, the public facilities discharging raw sewage into the waterways, the fishers who catch overfished species and vulnerable bycatch species, the activities that kill animals whose species is at risk of extinction. In other words, mitigation and prevention efforts both generally focus on regulatory inputs — the “what is being added or done to” the environment — in order to reduce relatively quickly obvious environmental stresses.

If the immediate goal is reduction of harm, or even prevention of future harm of the same type, this input focus can accomplish a fair amount. When dischargers became subject to technology-based effluent limitations pursuant to the Clean Water Act, rivers stopped burning.\textsuperscript{128} When the EPA demanded, pursuant to the Clean Air Act, that lead be taken out of gasoline, blood lead levels in most children dropped below the lead poisoning threshold.\textsuperscript{129} A moratorium

\textsuperscript{124} To provide just three non-water examples: The Clean Air Act imposes technology-based standards on stationary and mobile sources to limit pollutant emissions into the air. 42 U.S.C. §§ 7661-7661f. The Resource Conservation and Recovery Act (RCRA) imposes technological requirements on waste disposal facilities to prevent contamination of land and ground water. 42 U.S.C. §§ 6901, 6902, 6921-6926, 6944, 6945. The Magnuson-Stevens Fisheries Conservation and Management Act requires regional Fisheries Management Councils to create Fisheries Management Plans to manage the fishing of commercially important species, often through restrictions on fishing gear and fishing seasons. 16 U.S.C. §§ 1852(a), 1853. See also LAZARUS, supra note 6, at 72 (describing Congress’s deliberate turn from water quality standards to source permit requirements in the Clean Water Act), 174-75 (describing the evolution of source-based requirements in the Clean Air Act); 232-33 (describing the evolving attention to diffuse sources).

\textsuperscript{125} ADLER, supra note 12, at 17.

\textsuperscript{126} Id. at 8.

\textsuperscript{127} Id.


\textsuperscript{129} It is estimated that in the 1970s, 88 percent of children in the United States had blood-lead levels greater than 10 micrograms per liter, which defines lead poisoning. Lead Poisoning Resource Center,
on whale hunting removed the most immediate threat to these species’ survival and even allowed some species to partially recover. However, once those initial efforts are made – in Adler’s terminology, once we stop the bleeding and eliminate the immediate danger – it turns out that “the environment” is more complex than environmental law usually acknowledges, especially when one starts to think about restoring and maintaining ecosystem health.

2. The Limitations of Input-Based Regulation of Water Resources: The Example of Mercury Deposition

If, as Richard Lazarus has stated, “[e]nvironmental law’s challenge is to regulate, where possible, the process of ecological transformation,” understanding the overall scope and complexity of that transformation and then setting ecosystem-based – that is, output-focused – goals to limit or reverse that transformation would seem to be necessary first steps. Nevertheless, as the discussion of water uses in Subpart A suggests, the regulation of fresh water resources to date has consisted almost entirely of medium-specific, source-based regulation – that is, input-based regulation.

While the federal/state jurisdictional overlap suggests a starting cause of water’s regulatory fragmentation, the various uses of water, and their differing impacts on the relevant water resource, suggest why further fragmented, source-based, input-focused regulation is the norm. For instance, despite some prominent examples of direct connections (agricultural irrigation comes immediately to mind), regulators concerned about the amount of water withdrawn from a stream need not think about pollution inputs to the same stream. Moreover, limitations on the timing and amount of the water withdrawn, and even prescriptions regarding the amount of return flows, do not address the quality of the returning effluent.

Even when necessary connections among different uses and their effects exist, regulation of those interactions is often unidirectional in focus. For example, while the construction of hydropower facilities might well impact navigation, comprehensive regulation and preservation of navigability has little to say about hydropower planning.


See, e.g., LAZARUS, supra note 6, at 6-8 (discussing the complexity of Earth’s ecosystems).
Finally, historical progression of uses has also contributed to input-focused regulatory fragmentation. For example, the federal government was concerned about preserving navigation long before it was concerned about hydropower or water pollution, and this historical progression helps to explain the uneasy divisions of regulatory authority between the U.S. Army Corps of Engineers and, respectively, the Federal Energy Regulatory Commission (FERC) and the Environmental Protection Agency (EPA).

Nevertheless, water resources impacts have reached the points of both understanding and complexity that input-based regulation alone is insufficient to address identified environmental *uber*-problems – multi-source, multi-jurisdictional, and cross-media problems that no one regulatory authority or one set of sources can redress. Climate change, of course, is the looming environmental and natural resource *uber*-problem of the 21st century, but other such problems have been recognized. For example, in many waterbodies, atmospheric deposition of mercury132 can account for over 90 percent of existing mercury pollution.133 However, as the very phase “atmospheric deposition” suggests, the source of this mercury pollution is not industrial or municipal effluent discharges, the normal subjects of the federal Clean Water Act, but rather emissions of mercury into the air.134 These inputs are most naturally the subject of Clean Air Act regulation, but the environmental outputs clearly invoke water quality concerns.

However, regulatory complications from atmospheric deposition of mercury do not end with a simple choice between the Clean Water Act and the Clean Air Act. The most important problem resulting from mercury pollution is the bioaccumulation of methylmercury in fish tissue,135 a biological process that allows fish to become more toxic than the water in which they swim.136 Mercury-contaminated fish is a food-related health issue for humans, giving the federal

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134 See generally, e.g., U.S. EPA & EPA REGION 4, TOTAL MAXIMUM DAILY LOAD (TMDL) DEVELOPMENT FOR TOTAL MERCURY IN THE OCHLOCKONEE WATERSHED, GEORGIA (Feb. 28. 2002).


136 Mercury bioaccumulates and biomagnifies in the fatty tissues of organisms that, because of contamination of their environment, continually consume mercury, with the result that the fish and wildlife consumed by humans and other animals high on the food chain can contain mercury in concentrations far greater than the mercury concentrations in the ambient water. U.S. Department of the Interior & U.S. Geological Survey, Mercury Contamination of Aquatic Ecosystems (FS-216-95), at 1 (1995).
Food and Drug Administration (FDA) some jurisdiction over the mercury pollution issue. However, mercury-contaminated fish is also a survival issue for many species higher up the food web. In Florida, for example, officials have designated mercury contamination in prey (raccoons, which eat the mercury-contaminated fish) as the cause of at least one death among critically endangered Florida panthers, which are listed for protection under the federal ESA and hence fall within the U.S. Fish & Wildlife’s jurisdiction. Finally, atmospheric deposition of mercury in the fresh waters also contributes to methylmercury bioaccumulation in marine fish. While marine fishing falls within the jurisdiction of the National Oceanic and Atmospheric Administration (NOAA), the regional Fisheries Management Councils, and the states, marine fish contamination is a bit of a regulatory orphan, slipping as a practical matter through the Clean Water Act’s state/federal regulatory interstices and the ESA’s listing requirement to almost purely reactive state public health measures. As a result, many saltwater species are now subject to state fish consumption advisories, often based on FDA criteria and recommendations, with little regulatory focus on connecting mercury inputs to these ecological outputs.

C. Ecosystem-Based Regulation and Output Measures

Atmospheric deposition provides one example of how fragmented input-based regulation can be insufficient to meet ecosystem- or public-health-based output goals. Nor is atmospheric deposition an isolated example. As scientific interest and environmentalist attention increasingly

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140 16 U.S.C. §§ 1802(39), 1851(b), 1854.


focus upon ecosystems, ecosystem function, ecosystem services, and overall ecosystem health, the limitations of fragmented input-focused regulatory regimes are becoming apparent in a variety of contexts, including marine ecosystem preservation, fisheries management, and terrestrial biodiversity protection.

See Adler, supra note 12, at 177 (noting restoration efforts “for large aquatic ecosystems such as the Chesapeake Bay, the San Francisco Bay delta, and the Everglades,” which “were prompted initially by more traditional concerns about chemical pollutants. But all evolved into efforts that focus more broadly on a range of chemical, physical, and biological impairments, because eliminating individual sources of harm did not suffice in restoring the integrity of whole ecosystems.”); U.S. EPA, DRAFT HANDBOOK FOR DEVELOPING WATERSHED PLANS TO RESTORE AND PROTECT OUR WATERS, EPA 841-B-05-005, at 2-4 (Oct. 2005), available at http://www.epa.gov/owow/nps/watershed_handbook/#contents (advocating the development of watershed plans for water quality management and advising that “[a] watershed plan should address a geographic area large enough to ensure that implementing the plan will address all the major sources and causes of impairments and threats to the waterbody under review.”) [hereinafter 2005 DRAFT WATERSHED HANDBOOK]; Bruce A. Wilcox, Ecosystem Health in Practice: Emerging Areas of Application in Environmental and Human Health, 7:4 ECOSYSTEM HEALTH 317, 319 (Dec. 2001) (“Ecosystem health’s potential for indicator based assessment and monitoring probably will best be realized in its application to catchments (or watersheds.”).


Ecosystem services and natural capital, which are ubiquitous, with ecosystem services, which are the consequence of only some ecosystem functions. The critical difference between the two . . . is that ecosystem services have relevance only to the extent human populations benefit from them. They are purely anthropocentric.” J.B. Ruhl, STEVEN E. KRAFT, & CHRISTOPHER L. LANT, THE LAW AND POLICY OF ECOSYSTEM SERVICES 15 (2007). Ecosystem services intrigue researchers in a variety of fields. For representative examples, see generally Boris Worm, et al., Impacts of Biodiversity Loss on Ocean Ecosystem Services, 314 SCIENCE 787-90 (Nov. 3, 2006); James Salzman, A Field of Green? The Past and Future of Ecosystem Services, 21 J. LAND USE & ENVTL. L. 133 (Spring 2006); J.B. Ruhl, Ecosystem Services and the Common Law of “the Fragile Land System, 20 NATURAL RESOURCES & ENVTL. L. 133 (Spring 2006) (noting that the two ocean Commissions stressed an ecosystem-based approach); E.K. Pikitch, et al., Ecosystem-Based Fishery Management, 305 SCIENCE 346-47 (July 16, 2004); Robin Kundis Craig, Taking the Long View of Ocean Ecosystems: Historical Science, Marine Restoration, and the Oceans Act of 2000, 29:4 ECOLOGY L.Q. 649, 673-97 (2002) (discussing restoration efforts for marine ecosystems and the scientific problem of baselines); Jeremy B.C. Jackson, et al., Historical Overfishing and the Recent Collapse of Coastal Ecosystems, 293 SCIENCE 629-37 (July 27, 2001).


See ADLER, supra note 12, at 177 (noting restoration efforts “for large aquatic ecosystems such as the Chesapeake Bay, the San Francisco Bay delta, and the Everglades,” which “were prompted initially by more traditional concerns about chemical pollutants. But all evolved into efforts that focus more broadly on a range of chemical, physical, and biological impairments, because eliminating individual sources of harm did not suffice in restoring the integrity of whole ecosystems.”); U.S. EPA, DRAFT HANDBOOK FOR DEVELOPING WATERSHED PLANS TO RESTORE AND PROTECT OUR WATERS, EPA 841-B-05-005, at 2-4 (Oct. 2005), available at http://www.epa.gov/owow/nps/watershed_handbook/#contents (advocating the development of watershed plans for water quality management and advising that “[a] watershed plan should address a geographic area large enough to ensure that implementing the plan will address all the major sources and causes of impairments and threats to the waterbody under review.”) [hereinafter 2005 DRAFT WATERSHED HANDBOOK]; Bruce A. Wilcox, Ecosystem Health in Practice: Emerging Areas of Application in Environmental and Human Health, 7:4 ECOSYSTEM HEALTH 317, 319 (Dec. 2001) (“Ecosystem health’s potential for indicator based assessment and monitoring probably will best be realized in its application to catchments (or watersheds.”)).
Irreversible effects are one obvious result of the increased pace of [ecological] change. . . . Even “flow” resources, which are theoretically renewable to the extent that their supplies may be replenished by natural processes, can become irretrievably lost when the pace of their consumption outstrips the potential for their replenishment.

The now-looming threatening cataclysmic collapses within various aquatic ecosystems suffering from overexploitation are emblematic of the problem. Technological advances in commercial fishing techniques have decimated fishing grounds that not long ago were considered too enormously abundant to be threatened. The rapid destruction of wetlands risks destroying an essential ecological link between land and water ecosystems, both as a place of interaction and redistribution and as an important buffer protecting one system from the excesses of the other.150

However, an ecosystem-based approach to environmental and natural resources law means both that output goals and measures should play a larger role in regulation and that environmental law needs to address multiple media and multiple resources simultaneously. While some output-focused requirements do exist in the current laws, they both are rarer than input-based regulation and still focused on specific resources or media. Perhaps the most obvious example is NEPA’s “requirement that each federal agency assess and consider the significant environmental impacts of its actions and alternative courses of action before the agency acts . . . .”151 However, NEPA imposes no substantive output requirements on federal agencies.152 With regard to substantive requirements, the Clean Air Act requires the EPA to set general health-based national standards for air quality, the National Ambient Air Quality Standards or NAAQS, which all areas of the country are (eventually) supposed to attain.153 The Clean Water Act encourages states (with the EPA acting as the backup) to set water quality standards for specific waterbodies, and these standards establish the water quality goals for those water segments.154 The Magnuson-Stevens Act requires NOAA and the regional Fisheries Management Councils to establish optimum yields for each managed fishery, defined as “maximum sustainable yield” limits for all federally managed fisheries.155

150 LAZARUS, supra note 6, at 11.
151 Id. at 68; 42 U.S.C. § 4332(2)(C).
153 42 U.S.C. § 7409. See also LAZARUS, supra note 6, at 17 (“National ambient air quality standards for particulate matter under the federal Clean Air Act, for instance, have to take into account not just one source of particulate matter, but all possible sources, both regulated and unregulated, natural and manmade.”).
154 Id. § 1313(a), (b), (c).
155 16 U.S.C. §§ 1802(33) (defining “optimum”), (34) (defining “overfished”), 1853(a)(3) (requiring a fishery management plan to assess maximum sustainable yield and optimum yield). See also U.S. COMMISSION ON OCEAN POLICY, FINAL REPORT: AN OCEAN BLUEPRINT FOR THE 21ST CENTURY 287 (Sept. 2004) (“Recognizing the dangers posed by overfishing, managers began to regulate fishermen by placing controls either on input or output. Input controls include such measures as closing access to fisheries by limiting permits, specifying allowable types and amounts of gear and methods, and limiting available fishing areas or seasons. Output controls include setting total allowable catch (the amount of fish that may be taken by the entire fleet per fishing season), bycatch limits (numbers
Nevertheless, none of these output measures necessarily takes account of larger ecosystem effects, nor are they necessarily set with the goal of protecting the overall health and function of the relevant ecosystem(s) – NAAQS focus on human health needs,156 which are often but not always the most sensitive impact of air pollution157; water quality standards support whatever the state or the EPA decides the designated use of the water segment should be, not the needs of the water system per se158; and even fishing regulation, which has evolved to be more sensitive to general impacts on the relevant ecosystem, such as through by-catch,159 remains primarily focused on the commercially fished species being regulated.160

This legal elision of ecosystem-level output measures and goals is increasingly becoming an ecological and policy handicap. Indeed, while medium- and resource-specific statutory regimes remain the norm, administrative agencies are increasingly attempting to address ecological issues – such as atmospheric deposition of mercury – that do not fit neatly or completely into any single statutory regime.

Environmental law’s general lack of output measurements and goals – especially broad-based output measurements that assess the functional capacity of ecosystems and goals that establish the desired functions of those ecosystems – raises the question of whether non-adaptive161 (or minimally adaptive162) input-focused regulation can achieve ecological sustainability, especially in the face of climate change. Indeed, this is the key issue for the next iteration of environmental and natural resources law. To again quote Adler:

The third, most recent modern environmental strategy . . . is to take affirmative steps to restore the health of ecosystems that have been altered to

of non-targeted species captured), and trip or bag limits for individual fishermen.”) [hereinafter AN OCEAN BLUEPRINT].

157 As one example, if the EPA regulates carbon dioxide under the Clean Air Act, the welfare effects of climate change are far more likely to set the NAAQS standards than the health health effects of atmospheric carbon dioxide.
158 33 U.S.C. § 1313(c); see also ADLER, supra note 12, at 177 (noting that Clean Water Act-based restoration efforts in the Chesapeake Bay, the San Francisco Bay delta, and the Everglades had to evolve beyond the Clean Water Act to “focus more broadly on a range of chemical, physical, and biological impairments, because eliminating individual sources of harm did not suffice in restoring the integrity of whole ecosystems.”).
160 See 16 U.S.C. § 1853(a) (addressing only the fishery being regulated in 14 out of 15 required components of a fishery management plan).
161 Most federal environmental and natural resources statutes, for example, work by imposing general or national requirements on the target sources – for example, the Clean Water Act’s technology-based effluent limitations, 33 U.S.C. § 1311(b); the Clean Air Act’s variety of technology-based emissions standards, 42 U.S.C. §§ 7411, 7412, 7473, 7503, 7521, 7571, 7651c, 7651d, 7661c; and the Endangered Species Act’s federal agency consultations and “take prohibitions.” 16 U.S.C. §§ 1536, 1538.
162 For example, the Clean Water Act contains several mechanisms, such as water quality-based effluent standards and total maximum daily loads, to ensure that regulators adjust national, industry-wide technology-based effluents to meet the water quality needs (as defined by the relevant state) of particular water bodies. 33 U.S.C. §§ 1312, 1313(d). Similarly, the Clean Air Act requires that, eventually, the EPA will adjust industry-wide technology-based national emissions standards for the hazardous air pollutants (NESHAPs) to address any residual health issues. 42 U.S.C. § 7412(f)(1), (2). Neither statute, however, requires comprehensive review of the technology-based standards to meet more general ecosystem goals.
damaged by our past actions. Restoration is the holistic medicine of environmental policy. Holistic medicine might help a patient to recover from and to prevent further illness through a combination of treatment, exercise, stress relief, diet, and other changes in lifestyle. It requires us to look at the whole patient rather than individual symptoms or body parts. In some cases, it requires the patient to choose between good health and cheeseburgers. To that extent, holistic medicine combines elements of prevention as part of a broader strategy of restoring and maintaining a patient’s health.

Similarly, environmental restoration requires us to look at all parts of the ecosystem’s anatomy and physiology . . . . It requires us to make hard choices about the value of a healthy environment compared to material wealth, such as the choice between water for off-stream economic use and the value of a free-flowing river. 163

However, this holistic, ecosystem-based strategy requires three major changes to the current system of fragmented regulation: (1) an assessment of both current and desired regulatory outputs – that is, the states of ecosystem function and health that currently exist and that are desired for the future; (2) regulatory mechanisms that can effectively address cross-media, multi-resource, and multi-jurisdictional problems that impair the relevant ecosystem functions; and, ultimately, (3) political decisions about what the priority goal(s) of environmental and natural resource regulation should be, both generally and for particular ecosystems, coupled with the political will to enforce those priorities.

D. Watersheds as a Regulatory Starting Point

Ecosystem-focused regulatory regimes may eventually become so comprehensive that they seek to address simultaneously all human activities affecting ecosystems and their interactions and effects on human and ecological welfare – a regulatory scope much along the lines of the study scope the Millennium Ecosystem Assessment. 164 This Article is not nearly so ambitious. Instead, this Article proposes to begin by focusing on watersheds and aquatic ecosystems, emphasizing the relatively simple need to recognize the connections between regulation of freshwater ecosystems and marine ecosystems.

The EPA has already turned its attention to watershed management, concluding that “[a] watershed approach is the most effective framework to address today’s water resources challenges.”165 In accord with this Article, the EPA has emphasized that the laws addressing water pollution, landscape modification, changes in water flow, overharvesting of fish, toxic pollution and bioaccumulation “have tended to focus on particular sources, pollutants, or water uses and have not resulted in an integrated environmental approach. Consequently, significant gaps exist in our efforts to protect watersheds from the cumulative impacts of a multitude of

163 ADLER, supra note 12, at 9.
activities. A watershed approach has several advantages, including allowing water resource managers to identify cumulative effects and priority problems and to establish output goals (“environmental indicators”) that can both guide regulatory efforts and measure success.

Structurally, therefore, the EPA’s watershed approach has much to commend it. Nevertheless, as a comprehensive approach to water resources management, it has several weaknesses. First, the EPA’s legal authority to implement a watershed program under the Clean Water Act is questionable, which helps to explain why the EPA has focused on encouraging state efforts rather than imposing federal requirements. Second, the EPA has grounded its watershed program in fresh (primarily surface) water, water quality goals, and, most specifically, nonpoint source pollution control. Habitat considerations, species protection, water flow issues, and marine issues (even marine pollution) have progressively fallen by the wayside. Substantively, therefore, this watershed approach could be improved.

My point here is both that the EPA hasn’t addressed watershed issues comprehensively enough and, more importantly, that it can’t – it lacks sufficient regulatory authority to address all of the relevant issues. Although water is an especially complex regulatory medium, the holistic nature of aquatic ecosystems is fairly obvious, providing a regulatory focus that can suggest transitions from environmental law’s current input-focused regulatory specificity to more comprehensive ecosystem restoration and output-focused management. Moreover, legal conflicts among the regulatory regimes that govern water have been increasing and are likely to continue to increase as a result of water stress and the effects of climate change, suggesting the need for a different approach. It is to those conflicts that this Article now turns.

II. EMERGING CONFLICTS IN THE REGULATION OF WATER AND INTERFERENCE WITH ECOSYSTEM-BASED OUTPUT GOALS


167 Office of Wetlands, Oceans, and Watersheds, Benefits Derived from Taking a Watershed Approach, http://www.epa.gov/owow/watershed/framework/ch5.html (last updated May 8, 2001); see also 2005 DRAFT WATERSHED HANDBOOK, supra note 24, at 4-8 to 4-17, 9-3 (emphasizing the need to develop watershed goals based on selected environmental indicators, to link those goals and indicators, and to translate watershed goals into management objectives).

168 See 2005 DRAFT WATERSHED HANDBOOK, supra note 146, at 2-2 (emphasizing nonpoint source pollution), 2-12 to 2-16 (proposing water quality standards as reasonable goals), 9-5 (focusing on pollutant reduction).


170 “[A]s functionally distinct hydrological units in which the water cycle is a key driver of ecosystem processes, catchments [watersheds] come reasonably close to what might be considered an idealized ecosystem. Also, their water bodies (i.e., streams, rivers, wetlands, and marine coastal zones) serve as pollution conduits or sinks, the proverbial miner’s canary, while their public appeal and appreciation of their values has increased dramatically in recent decades.” Bruce A. Wilcox, Ecosystem Health in Practice: Emerging Areas of Application in Environmental and Human Health, 7:4 ECOSYSTEM HEALTH 317, 319 (Dec. 2001).
A. Overview: Regulatory Fragmentation and Interference with Aquatic Ecosystem Restoration

As the discussion in Part I illustrates, a plethora of regulatory authorities are likely to have some kind of jurisdiction over water-related activities in any large watershed. At minimum, any large and interstate watershed will be subject to the regulatory claims of multiple state water quality agencies, multiple state water rights/allocation agencies, multiple state fish and wildlife agencies, the U.S. EPA\footnote{The EPA will be involved at least as a matter of its Clean Water Act regulatory authority, 33 U.S.C. §§ 1251(d), 1342(a), 1344(b), and perhaps with respect to other of its regulatory programs, as well, such as in connection with cleanups in connection with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). 42 U.S.C. §§ 9601-9675. The recent debate over dredging of the Hudson River to clean up toxic PCBs provides one example of CERCLA’s application in freshwater ecosystems. U.S. EPA, Hudson River PCBs, http://www.epa.gov/hudson/ (last updated July 16, 2007).} (and perhaps more than one EPA regional authority\footnote{U.S. EPA, About EPA, http://www.epa.gov/epahome/locate2.html (last updated Sept. 6, 2006). As one example, four EPA Regions have jurisdiction over the mainstem Mississippi River (Regions 4, 5, 6, 7) and seven have jurisdiction within the Mississippi River basin. \textit{Id}. Similarly, two EPA Regions have jurisdiction over the Colorado River, Regions 8 and 9, with Region 6 encompassing New Mexico. \textit{Id}.}, the U.S. Army Corps of Engineers\footnote{The Army Corps will be involved as a result of its Clean Water Act jurisdiction over the dredging and filling of waters of the United States. 33 U.S.C. § 1344(a). To the extent that the aquatic watershed also involves a navigable-in-fact waterway – as most interstate watersheds do – the Army Corps’ regulatory authority under the Rivers & Harbors Act will also be relevant.} (and perhaps more than one division and multiple district offices\footnote{The Army Corps has eight Civil Engineer Divisions. U.S. Army Corps of Engineers, \textit{Where We Are}, http://www.usace.army.mil/howdoi/civilmap.htm. Three divisions govern the Mississippi River: the Mississippi Valley, Great Lakes and Ohio River, and South Atlantic Divisions. \textit{Id}. However, the South Pacific Division has authority for the entire Colorado River. \textit{Id}. However, the Army Corps also has 38 district offices, whose regulatory jurisdictions do not match state boundaries. U.S. Army Corps of Engineers, \textit{Regulatory Program: District Offices}, http://www.usace.army.mil/cw/ceecw/req/district.htm.}), and the U.S. Fish & Wildlife Service.\footnote{Under the Clean Water Act, the U.S. Fish & Wildlife Service has the right to comment on any Army Corps permit. 33 U.S.C. § 1344(m). Moreover, any non-anadromous fresh water species listed for protection under the ESA that are present in the watershed – and almost all watersheds have at least one – will fall under the U.S. Fish & Wildlife Service’s ESA jurisdiction. Other Fish & Wildlife Service programs, such as the migratory bird programs, may also be relevant.} Interstate cooperation under the Clean Water Act may add an interstate regulatory authority such as the Tahoe Regional Planning Agency\footnote{Tahoe Regional Planning Agency, \textit{Home Page}, http://www.trpa.org/.; Ohio River Valley Water Sanitation Commission (ORSANCO), \textit{ORSANCO Home Page}, http://www.orsanco.org.} or the Ohio River Valley Water Sanitation Commission (ORSANCO).\footnote{Western Watersheds Project v. Matjeko, 456 F.3d 922, 925 (9th Cir. 2006) (challenging BLM’s allowance of diversions on public lands in the Upper Salmon River basin).} The presence of hydropower projects adds FERC and, depending on the region of the country, potentially other entities such as the Tennessee Valley Authority or the Bonneville Power Administration. Reclamation and irrigation projects can add any number of regulatory entities, including the federal Bureau of Reclamation,\footnote{Consejo de Desarrollo Economico de Mexicali, A.C. v. United States, 482 F.3d 1157, 1162 (9th Cir. 2007) (noting that the All-American Canal lining is a BOR project); Pacific Coast Federation of Fishermen’s Ass’ns v. Bureau of Reclamation, 2007 WL 901580, at *1 (9th Cir. March 26, 2007) (involving the BOR’s operation of the Klamath Reclamation Project); Central Delta Water Agency v. Bureau of Reclamation, 452 F.3d 1021, 1024 (9th Cir.} the federal Bureau of Land Management (BLM),\footnote{Western Watersheds Project v. Matjeko, 456 F.3d 922, 925 (9th Cir. 2006) (challenging BLM’s allowance of diversions on public lands in the Upper Salmon River basin).} and more state-specific
entities such as those associated with the Central Valley Project in California.  

The presence of anadromous species like salmon and sturgeon adds NMFS/NOAA Fisheries, particularly if those species are listed under the ESA. If Native American Tribes are present in the watershed, they at least potentially become additional regulatory presences and may assert claims to reserved water rights. Other federal lands within the watershed may confer regulatory authority or water rights on the Bureau of Land Management, the National Park Service, and/or the U.S. Forest Service. State parks and recreation areas may add state parks or state lands agencies. At the end of the line, when the fresh water flows into the ocean,
additional regulatory authorities become relevant: the state coastal management authorities\textsuperscript{189} (which may or may not be the same as any of the other relevant state agencies\textsuperscript{190}); NOAA and NMFS; and the relevant regional Fishery Management Council under the Magnuson-Stevens Act.\textsuperscript{191}

If this list of potentially regulatory authorities seems absurdly long, it is. Nevertheless, it is an accurate description of the regulatory fragmentation likely to occur in any large watershed. “For instance, the Delaware River Basin is divided among four states . . . . Responsibility for water resources alone in this basin is divided among at least 10 agencies in each of the four States and among more than 20 Federal agencies.”\textsuperscript{192} “The result of this jurisdictional fragmentation is often seen in conflicting efforts, high management costs, and foregone opportunities to provide better overall service.”\textsuperscript{193}

Each of the regulatory entities involved in managing water and water-related resources in a particular watershed will approach the aquatic ecosystem with a different set priorities, a different regulatory mission (and for some agencies like the EPA,\textsuperscript{194} the Army Corps,\textsuperscript{195} and NMFS/NOAA Fisheries,\textsuperscript{196} perhaps with multiple and potentially conflicting regulatory missions), and a different scope of regulatory jurisdiction. In other words, each regulatory authority is likely to view the aquatic ecosystem from a different normative perspective, in terms

\textsuperscript{189} State coastal zone management agencies become involved through the federal Coastal Zone Management Act, 16 U.S.C. §§ 1451-1465, which encouraged coastal states to enact Coastal Zone Management Plans. 16 U.S.C. §§ 1454, 1455. At the federal level, the EPA and NOAA jointly administer the Act. 16 U.S.C. §§ 1453(16), 1455.
\textsuperscript{190} In California, for example, the California Coastal Commission implements the CZMA, CAL. PUB. RESOURCES CODE §§ 30008, 30105, 30300, 30330, while the California Water Resources Board implements both the Clean Water Act and water rights permitting. CAL. PUB. RESOURCES CODE §§ 13191.3, 30412; CAL. GOV. CODE § 12812.
\textsuperscript{191} 16 U.S.C. § 1852.
\textsuperscript{193} Id.
\textsuperscript{194} The EPA may have jurisdiction within the aquatic watershed simultaneously through the Clean Water Act, the Coastal Zone Management Act, and CERCLA. Oil spills in fresh or salt water will trigger its regulatory authority under the Oil Pollution Act., 33 U.S.C. §§ 2701-2761, which applies to discharges of oil into the waters of the United States, onto adjoining shorelines, or into the Exclusive Economic Zone, which extends 200 miles out to sea. 33 U.S.C. §§ 2701(7), (8), (21), 2702(a). At the coast and in the ocean, moreover, its authority under Ocean Dumping Act, 33 U.S.C. §§ 1401-1445, may become relevant. Under this Act, the EPA issues most of the allowable permits for dumping of materials at sea. 33 U.S.C. § 1412(a).
\textsuperscript{195} The Army Corps may have jurisdiction within the aquatic watershed simultaneously through the Clean Water Act, the Rivers and Harbors Act, and specific congressional authorization. For example, the Army Corps has jurisdiction in Lake Okeechobee in Florida pursuant to the Rivers and Harbors Act of July 3, 1930, 46 Stat 918, 915, which specially established the Caloosahatchee River and Lake Okeechobee Drainage Areas Project; the Rivers and Harbors Act of 1899, see Sierra Club v. Flowers, 423 F. Supp. 2d 1273, 1355-56 (S.D. Fla. 2006); and Section 404 of the Clean Water Act. Coastal Petroleum Co. v. Secretary of the Army of the United States, 315 F. Supp. 845, 846-47 (S.D. Fla. 1970). At the coast and in the ocean, moreover, its authority under the Ocean Dumping Act, 33 U.S.C. §§ 1401-1445, may become relevant. Under this Act, the Army Corps issues permits for the dumping of dredged material into the ocean. 33 U.S.C. § 1413(a).
\textsuperscript{196} NMFS/NOAA Fisheries may have jurisdiction within the aquatic ecosystem simultaneously through the ESA, the Marine Mammal Protection Act, and the Magnuson-Stevens Fishery Conservation and Management Act. At the same time, NOAA more generally may have authority in the same watershed pursuant to the Coastal Zone Management Act.
both of what the relevant input considerations should and/or can be and of what output measurements and goals are desirable, preferable, and jurisdictionally cognizable.

Given this level of regulatory fragmentation, conflicts over jurisdiction and, more importantly, over the absolute and relative prioritization of regulatory goals and norms are inevitable. Indeed, they have been arising with increasing frequency in the courts.

B. Conflicts over Regulatory and Norm Priority in the Management of Water

1. Navigation and Hydropower

Some conflicts in water regulation are obvious and their resolution fairly well-established. For example, among the services that large rivers provide to humans, maintaining navigation and promoting hydropower present obvious implementation conflicts: the river-spanning dams required for hydropower can be fairly significant impediments to navigation. The Federal Power Act requires FERC (and previously the Federal power Commission) to consider navigation in its licensing decisions, and the agency can require navigation structures at any hydroelectric project. Thus, in waterways where navigations uses are significant, hydropower dams generally must yield to navigation interests by including navigational bypasses, such as locks and dams.

2. Hydropower and State Water Concerns

Hydropower dams can also impair water quality, water flow, and recreation. Although the Federal Power Act reserves authority to the states to allocate water rights, the U.S. Supreme Court held that the Federal Power Act nevertheless preempts state minimum stream flow requirements. Thus, in the conflict between federal power law and state water law, federal law won.

However, the Clean Water Act requires “[a]ny applicant for a Federal license or permit to conduct any activity including, but not limited to, the construction or operation of facilities, which may result in any discharge into the navigable waters” to “provide the licensing or permitting agency a certification from the State in which the discharge originates or will originate” that the discharge will comply with the Clean Water Act’s requirements. The federal permit cannot issue until the state certifies the discharge or waives its certification rights, and the state can impose conditions on the federal license or permit to ensure compliance with the Act and “any other appropriate requirement of State law . . . .” Nevertheless, it took two trips to the U.S. Supreme Court over 12 years (with the most recent

\[198\] 16 U.S.C. § 804(a), (b).
\[199\] Portland General Electric Co. v. Federal Power Comm’n, 328 F.2d 165, 174-75 (9th Cir. 1964).
\[203\] Id.
\[204\] 33 U.S.C. § 1341(d).
decision issuing in 2006)\textsuperscript{205} to confirm that state water quality concerns have priority over FERC’s mission to expand hydropower in the United States.

3. Water Quality and Endangered Species

The relationship between the Clean Water Act’s water quality goals and the ESA’s goals of species and habitat protection are less obviously in conflict than hydropower and navigation. Nevertheless, implementation of the Clean Water Act is not always optimal for species, leading to litigation, particularly when states want to set water quality standards for other uses\textsuperscript{206} and/or regulated entities want to dredge and fill waters that threatened and endangered species need.\textsuperscript{207}

More fundamental conflicts as to regulatory priority also occur. For example, when the EPA delegates Clean Water Act permit programs to states,\textsuperscript{208} future state-issued permits are not subject to the ESA’s requirements for federally issued permits – namely, that the federal agency ensure that the permitted activity will not jeopardize listed species or destroy critical habitat.\textsuperscript{209} Does the EPA itself have to take account of these regulatory implications for the ESA before it can delegate Clean Water Act permitting authority? While a few cases on this issue reached the lower federal courts,\textsuperscript{210} it wasn’t until Arizona sought Clean Water Act permitting authority in 2002 that the U.S. Supreme Court (after five years of lower court litigation) finally and narrowly resolved the regulatory priority issue in favor of the Clean Water Act.\textsuperscript{211}

4. State Water Law and the Clean Water Act

State water law and state permitting of consumptive uses of water also create conflicts with the Clean Water Act. In particular, the movement of water from one place to another can raise questions as to whether an “addition of pollutants” for Clean Water Act purposes occurs when that transported water enters another waterbody. In the eastern half of the United States, courts and states have nearly universally determined that the Clean Water Act applies to such


\textsuperscript{207} Defenders of Wildlife v. Flowers, 414 F.3d 1066, 1069-71 (9th Cir. 2005); Greater Yellowstone Coalition v. Flowers, 359 F.3d 1257, 1275-76 (10th Cir. 2004); town of Norfolk v. U.S. Army Corps of Engineers, 968 F.2d 1438, 1452-53 (1st Cir. 1992); Envtl. Coalition of Broward County, Inc. v. Myers, 831 F.2d 984, 987-88 (11th Cir. 1987); Riverside Irrigation Dist. v. Andrews, 758 F.2d 508, 511-13 (10th Cir. 1985) (all challenging Army Corps permits on ESA grounds).

\textsuperscript{208} See 33 U.S.C. §§ 1342(b), 1344(g).

\textsuperscript{209} 16 U.S.C. § 1536(a)(2).

\textsuperscript{210} American Forest & Paper Ass’n v. U.S. EPA, 137 F.3d 291, 297-98 (5th Cir. 1998); American Iron & Steel Inst. V. EPA, 115 F.3d 979, 1002-03 (D.C. Cir. 1997).


Interestingly, this regulatory showdown occurred not because of potential effects on aquatic species but because of the U.S. Fish & Wildlife Service’s concerns regarding the cumulative and indirect impacts on terrestrial ecosystems as a result of state water quality permitting and subsequent development. Id. at 2527.
water transfers. In contrast, western states that depend on the large-scale movement of water have resisted this interpretation, including, most recently, by intervening in eastern cases.

The Clean Water Act does at least partially address its relationship to state water law:

It is the policy of Congress that the authority of each State to allocate quantities of water within its jurisdiction shall not be superseded, abrogated or otherwise impaired by this chapter. It is further the policy of Congress that nothing in this chapter shall be construed to supersede or abrogate rights to quantities of water which have been established by any State. Federal agencies shall co-operate with State and local agencies to develop comprehensive solutions to prevent, reduce and eliminate pollution in concert with programs for managing water resources.

While this provision makes it clear that the EPA and the Army Corps are not in the business of establishing water rights, its applicability to water transfers (which do not directly “allocate quantities of water”) is less certain, and the courts have done little to explicate the analysis. Nevertheless, two juxtaposed sets of legal action suggest that the Supreme Court will soon be resolving this issue of regulatory priority: ongoing litigation over the Clean Water Act’s applicability to the Everglades has suggested that the Clean Water Act confers broad water quality regulatory authority over water transfers, while the EPA has proposed a regulation that would exempt such transfers from the statute’s coverage.

5. Water Consumption and the ESA

Litigation conflicts among the regulatory regimes governing water have thus been increasing over the last decade, raising not only questions about the proper interpretation of statutes and the proper role of federalism but also more fundamental questions about the

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212 Catskill Mountains Chapter of Trout Unlimited v. City of New York, 451 F.3d 77, 79-87 (2d Cir. 2006); Miccosukee Tribe of Indians v. South Florida Water Management District, 280 F.3d 1364, 1368-69 (11th Cir. 2002), reversed and remanded for factual determination sub nom South Florida Water Management District v. Miccosukee Tribe of Indians, 541 U.S. 95 (2004); Catskill Mountains Chapter of Trout Unlimited, Inc. v. City of New York, 273 F.3d 481, 492-93 (2d Cir. 2001); Dubois v. U.S. Dept. of Agriculture, 102 F.3d 1273, 1296-99 (1st Cir. 1996).


214 33 U.S.C. § 1251(g).


218 See, e.g. NATIONAL SYNTHESIS TEAM, U.S. GLOBAL CHANGE RESEARCH PROGRAM, CLIMATE CHANGE IMPACTS ON THE UNITED STATES: THE POTENTIAL CONSEQUENCES OF CLIMATE VARIABILITY AND CHANGE: OVERVIEW 98 (2000), available through http://www.usgcrp.gov/usgcrp/Library/nationalassessment/overview.htm (“In many rivers and streams in the US, there is not enough water to satisfy existing water rights and claims. Changing public values about preserving in-stream flows, protecting endangered species, and settling Indian water rights claims have made competition for water supplies increasingly intense.”).
priorities for the nation’s water resources. The heart of these increasingly frequent conflicts has
not, however, been the regulatory intermediary of the Clean Water Act. After all, in regulating
water quality through its cooperative federalism regime and through the dual mechanisms of
technology-based effluent limitations (focused on inputs) and ambient water quality standards
(focused on outputs), the Clean Water Act can accommodate a variety of potential regulatory
priorities and tailor them to individual waterbodies. While this approach does not
comprehensively address ecosystem-level outputs, it at least incorporates sufficient flexibility to
avoid most absolute conflicts in water resource use: Hydropower dams still operate, but in
accordance with water quality- and water function-preserving conditions. Similarly, while the
EPA may not have to consider the ESA in delegating state permitting authority, the ESA still
applies to activities that affect any listed species in states with delegated Clean Water Act
permitting authority and, potentially, even to the state permits themselves.219

Instead, the most prominent legal and ultimately irreconcilable real conflict between
regulatory priorities that has emerged is between water law – in particular, water law’s allowance
of ecosystem-damaging consumptive uses of water – and the ESA’s protections for endangered
and threatened species that depend on that water remaining in situ. In this context, it is worth
remembering that the first Supreme Court ESA decision involved the Tellico Dam, a
multipurpose impoundment that interfered with a fish’s habitat.220 The peaceful co-existence of
the ESA and water law requires regulators to presume that they can have their water and drink
(or store) it, too. This presumption increasingly unlikely to hold true, especially in light of
population growth and climate change.

The increasing number of conflicts between water consumers and the ESA attests to the
fundamental disconnect between the norms of water-based economic and social growth and of
aquatic habitat and ecosystem protection, particularly in areas where human uses already stress
limited water supplies. These conflicts have resulted in litigation to protect West Coast steelhead
in the Ventura River, California;221 delta smelt and winter-run Chinook salmon in Tulare Lake
and the Bay delta;222 Chinook salmon, coho salmon, and steelhead trout in the Trinity River in
California;223 Chinook salmon in the Central Valley Project and San Joaquin River in
California;224 coho salmon, shortnose suckerfish, and Lost River suckerfish in the Klamath River
basin on the California/Oregon border;225 various species of salmon and steelhead in the

219 See, e.g., Strahan v. Coxe, 127 F.3d 155, 163-66 (1st Cir. 1997) (holding that Massachusetts could violate
the ESA by issuing fishing permits).
221 Casitas Municipal Water Dist. v. United States, 76 Fed. Cl. 100, 102 (2007); Casitas Municipal Water Dist.
Fishermen’s Ass’ns/Inst. For Fisheries Resources v. Gutierrez, 2007 WL 1752289, at *2-*3 (E.D. Cal. 2007);
Natural Resources Defense Council v. Kempthorne, 2007 WL 1577896, at *4 (E.D. Cal. 2007); Natural Resources
224 Natural Resources Defense Council v. Houston, 146 F.3d 1118, 1124 (9th Cir. 1998).
225 Klamath Irrigation Dist. v. United States, 75 Fed. Cl. 677, 686-87 (2007); Oregon Trollers Ass’n v.
Gutierrez, 452 F.3d 1104, 1110-11 (9th Cir. 2006); Pacific Coast Federation of Fishermen’s Ass’ns v. U.S. Bureau of
Reclamation, 426 F.3d 1082, 1085-89 (9th Cir. 2005); Klamath Water Users Protective Ass’n v. Patterson, 191 F.3d
Columbia River, along the Oregon/Washington border\textsuperscript{226}; steelhead trout and Chinook salmon in the Chewuch River in Washington\textsuperscript{227}; cui-ui and Lahontan cutthroat trout in the Truckee River and Pyramid Lake in Nevada\textsuperscript{228}; bald eagle, willow flycatcher, and razorback sucker in the San Carlos Reservoir in Arizona\textsuperscript{229}; southwestern will flycatcher in Lake Mead and the Lower Colorado River in Arizona\textsuperscript{230}; silvery minnow in the Middle Rio Grande River in New Mexico\textsuperscript{231}; fountain darter, San Marcos gambusia, San Marcos salamander, Texas blind salamander, and Texas wild rice along the Edwards Aquifer in Texas\textsuperscript{232}; bull trout in the Upper Salmon River in Idaho\textsuperscript{233}; pallid sturgeon, least term, and piping plover in the Missouri River as it flows through Montana, North Dakota, South Dakota, Nebraska, Iowa, Kansas, and Missouri\textsuperscript{234}; and, most recently, the Gulf sturgeon, fat threeridge mussel, purple bankclimber mussel, and Chipola slabshell mussel in the Apalachicola River-Chattahoochee River-Flint River Basin in Alabama, Georgia, and Florida.\textsuperscript{235}

Of course, not all such conflicts manifest themselves through the ESA. For example, in California, a similar conflict between water use and an aquatic ecosystem resulted in public trust protection for Mono Lake.\textsuperscript{236} Nevertheless, the ESA has been the dominant regulatory regime for exposing underlying normative conflicts regarding priorities for water between consumption and more general aquatic ecosystem goals.

C. Adding the Chaos of Climate Change

Climate change is likely to generally increase conflicts over water resources in the United States. Most basically, climate change is expected to reduce water supplies in many parts of the United States. In addition, climate change will likely alter the demands made on water supplies and the dynamics among the users:
Irrigation water needs are likely to change, with decreases in some places and increases in others. It is very likely that demand for water associated with electric power generation will increase due to the increasing demand for air conditioning with higher temperatures, unless advances in technology make it possible for less water to be used for electrical generation. Climate change is likely to reduce water levels in the Great Lakes and summertime river levels in the central US, thereby affecting navigation and general water supplies.\textsuperscript{237}

As a result, as the effects of climate change begin to be felt in the United States, conflicts between claims for consumptive water use for human populations, agriculture, and development and other \textit{in situ} demands for water, including ecosystem demands, are only likely to escalate.\textsuperscript{238}

Within these conflicts, moreover, ESA litigation over water use is especially likely to increase. First, climate change is likely to increase the number of species that qualify for protection under the ESA as a result of climate-related loss of habitat and other effects.\textsuperscript{239} “The natural ecosystems of the Arctic, Great Lakes, Great Basin, Southeast, and the prairie potholes of the Great Plains appear highly vulnerable to the projected changes in climate,”\textsuperscript{240} suggesting that their species may become ESA candidates with increasing frequency. Indeed, NMFS/NOAA Fisheries has listed the \textit{Acropora} corals as threatened species in part because of climate change effects,\textsuperscript{241} and the U.S. Fish & Wildlife Service has proposed listing the polar bear almost entirely because of the effects climate change is having on the polar bear’s habitat.\textsuperscript{242}

Second, climate change is likely to place additional stress on species already listed, including and perhaps especially water-dependent species.\textsuperscript{243} “Surface water temperature fluctuates more rapidly with reduced volumes of water, likely affecting vital habitats,” and “[w]ater quality is also likely to be affected by climate change in a variety of ways.”\textsuperscript{244} Perhaps not coincidentally, courts’ demands that the relevant agencies consider the effects of climate

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\textsuperscript{238} \textit{Id.}

\textsuperscript{239} \textit{See, e.g.}, American Lands Alliance \textit{v.} Norton, 242 F. Supp. 2d 1, 6 (D.D.C. 2003) (noting that ecologists had identified climate change and global warming as factors that warranted listing of the Gunnison sage grouse under the ESA); Greenpeace \textit{v.} National Marine Fisheries Service, 237 F. Supp. 2d 1181, 1188 (W.D. Wash. 2002) (noting that NMFS’s Biological Opinion indicated that climate change was a factor in the population reduction of the Stellar sea lion); Friends of the Wild Swan, Inc. \textit{v.} U.S. Fish & Wildlife Service, 12 F. Supp. 2d 1121, 1128 (D. Or. 1997) (noting that the Jarbridge River population segment of the bull trout would be most susceptible to global warming).

\textsuperscript{240} U.S. Climate Change Consequences Overview, \textit{supra} note 237, at 101.

\textsuperscript{241} 71 Fed. Reg. 26,853, 26,855-57 (May 9. 2006) (listed elevated sea surface temperatures as a result of climate change as one of the three major threats to the staghorn and the elkhorn coral in the Caribbean, south Atlantic, and Gulf of Mexico; in addition, sea level rise as a result of climate change and ocean acidification as a result of elevated levels of carbon dioxide were also considered significant stressors to the coral).

\textsuperscript{242} 72 Fed. Reg. 1064, 1071-82 (Jan. 9, 2007).

\textsuperscript{243} U.S. Climate Change Consequences Overview, \textit{supra} note 237, at 99-100.

\textsuperscript{244} \textit{Id.} at 99.
change in their ESA decisions have been most insistent for aquatic and marine species. In May 2007, for example, the Eastern District of California determined that the U.S. Fish & Wildlife Service had not used the best scientific evidence in its Biological Opinion regarding the effects of the Central Valley Project and State Water Project in California on the delta smelt because the Service did not consider the effects of climate change. These two water supply projects draw water from the California Bay (Sacramento-San Joaquin) Delta pursuant to a Coordinated Operating Agreement (COA) with the Bureau of Reclamation and send it south to other parts of the state. According to the district court, the Service’s failure to think about climate change “is potentially significant because the [Biological Opinion’s] conclusions are based in part on the assumption that the hydrology of the waterbodies affected by the OCAP will follow historical patterns for the next 20 years.” The opinion thus emphasized that climate change is likely to alter relevant water conditions, and it explored those potential changes in some detail.

Third, climate change is likely to change water supplies, either in amount or timing or both, as a result of increased evaporation from higher temperatures, changes in rainfall patterns, reductions in snowpack, and/or changes in groundwater recharge rates. These changes are significant and most apparent during spring through autumn in the contiguous US. Despite the overall increase in precipitation, however, it is likely that many interior portions of the nation will experience more extremes related to drought due to increased air temperatures,” while “[r]ising temperatures are very likely to affect snowfall and increase snowmelt conditions in much of the western and northern portions of the US that depend on winter snowpack for runoff. This change in the timing of runoff will very likely have implications for water management, flood protection, irrigation, and planning.” Predictions are, nationwide, that summer surface water flows will generally decrease while the potential for flooding in winter and early spring will generally increase. “Groundwater supplies are less susceptible than surface water to short-term climate variability; they are more affected by long-term trends. Groundwater serves as the base flow for many streams and rivers. In many areas, groundwater levels are very likely to fall, thus reducing seasonal streamflows.” In 2001, the U.S. Global Change Research Program reached the following overall conclusions about climate change and water supplies in the United States:

- More pressure on surface water supplies is likely to come from population shifts and changes in water right allocations to accommodate endangered species and the water rights of Native Americans. Although wetter conditions in the Southwest may alleviate some of these stresses, stress is likely to increase in the

247 Id. at 79.
248 Id. at 80.
250 Id. at 98-99.
251 Id. at 100.
252 Id. at 99.
Northern Great Plains and in snowpack-dependent watersheds.

- Groundwater supplies are already over-drafted in many parts of the country, and pressure on groundwater supplies is likely to increase to offset changes in surface water supply availability. However, long-term increases in precipitation will possibly increase recharge rates in some areas.

- It is likely that aquatic and riparian ecosystems may be damaged even in the context of higher precipitation, due to higher air temperatures and reduced summer flows. It is also probable that changes in water temperature in lakes and streams will affect species composition.

- Water managers have multiple opportunities to reduce future risks by incorporating “no-regrets” changes into their operating strategies that are appropriate regardless of climate change.

- Institutions governing water rights are generally very inflexible, and are likely to prove to be obstacles to adaptation.

- Improvements are needed in monitoring efforts to identify key impacts related to water quantity and quality, biological conditions of key habitats, snowpack conditions, and groundwater supplies.²⁵³

Finally, changes in water supply may call into question the continued utility of existing water law rules and water consumption patterns in many areas of the country, unsettling rights and expectations long considered sacrosanct. On the one hand, to the extent common law allows courts or legislatures act, climate change may well prompt changes in the relevant water law. As noted above, water law is already more sensitive than many other kinds of law to the ecological conditions that dominate in an area – hence the divide in the United States between riparian and prior appropriation doctrine states.²⁵⁴ If water-stressed areas begin to receive greatly increased overall supplies of water, or if previously water-rich areas begin to experience continual shortages, their systems of water law may also begin to evolve, unsettling what were considered “settled” rights in water.

Indeed, such evolutions may already be occurring. In South Dakota, for example, several “unseasonably wet years” created three large lakes over what had previously been dry or marshy lands, prompting members of the public to use those lakes for recreation and fishing. When riparian landowners sued to exclude the public, claiming that the new lakes were privately owned, the South Dakota Supreme Court “clarified” (changed) the state’s public trust doctrine to allow public use. “We conclude that all water in South Dakota belongs to the people in accord


with the public trust doctrine and as declared by statute and precedent, and thus, although the lake beds are mostly privately owned, the water in the lakes is public and may be converted to public use, developed for public benefit, and appropriated . . . .”

On the other hand, water law and water management regimes may not change at all. “Most institutions related to water have not responded well to changing socioeconomic and environmental conditions.” Moribund legal systems could, ironically, be even more unsettling than evolving ones in areas where ecological realities no longer bear any relationship to legal rights. Either way, however, changes in water supply as a result of climate change are likely to become legally and politically uncomfortable in many parts of the country, inspiring even more conflict.

**D. Remembering What Gets Lost: Regulatory Fragmentation, Water Shortage, and Ecosystem Restoration**

As this Part thus suggests, the combination of water’s regulatory fragmentation and increasing shortages in water supply as a result of population growth, aquifer depletion, and climate change is likely to hamper efforts to achieve ecosystem-based restoration goals. The current regime of regulatory fragmentation means that achievement of such goals in large watersheds requires the cooperation of multiple states and multiple federal agencies, a difficult (if necessary) task under the best of circumstances. As Richard Lazarus has noted:

Fragmentation . . . makes it difficult to address issues in a comprehensive, holistic fashion. Ecological injury resists narrow redress; due to the highly interrelated nature of the ecosystem, it is almost always a mistake to suppose that one can isolate a single discrete cause as the source of an environmental problem. Not only is a broader overview needed, accounting for the full spatial and temporal dimensions of the matter, but failure to pursue such an overview is likely to result in an approach that is at best ineffective and at worst unwittingly destructive because of unanticipated consequences. When, however, government jurisdiction over the host of diverse activities affecting the ecosystem is divided between many entities, necessary coordination and overview are surprisingly difficult. “The environment, rather than being treated holistically, is thus subdivided according to the organized principles of social systems, not the natural world.”

As this Subpart will discuss, water’s regulatory fragmentation has already been “unwittingly destructive,” and actual or anticipated shortages of water will further undermine the political will to engage in the necessary cooperation, particularly when significant consumptive users are involved. One need only look at the decades-long battle over the Colorado River, or the growing conflict between Georgia and Florida over the Apalachicola-Chattahoochee-Flint River

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256 U.S. CLIMATE CHANGE CONSEQUENCES OVERVIEW, supra note 237, at 101.
257 LAZARUS, supra note 6, at 33 (quoting John W. Bennett & Kenneth A. Dahlberg, Institutions, Social Organization, and Cultural Values, in B.L. TURNER, ED., THE EARTH AS TRANSFORMED BY HUMAN ACTON: GLOBAL AND REGIONAL CHANGES IN THE BIOSPHERE OVER THE PAST 300 YEARS 73 (1990)).
258 ADLER, supra note 12, at 18-25.
Basin, or even one of the earliest water conflicts between New York and New Jersey over the Delaware River, to lose all sense of optimism about cooperative watershed-level management in times of water shortage.

Nevertheless, because some potential watershed-level goals fall outside any regulatory entity’s cognizance, failure to cooperate leads to de facto choices among potential output-based goals for the watershed as a whole, often without any comprehensive debate about those choices. As the example of atmospheric deposition of mercury demonstrates, regulatory fragmentation can cause certain ecological outputs, such as mercury-contaminated fish, to effectively become regulatory “orphans.” This regulatory orphaning, in turn, can lead to paradoxical regulatory results.

Again, atmospheric deposition of mercury provides an example. Structurally, the federal EPA has effectively taken the lead in addressing atmospheric deposition, suggesting that there is value to consolidation and centralization of regulatory authority. However, to date, the EPA has addressed atmospheric deposition as a fresh water water quality problem with human health implications. Thus, the EPA has established guidance water quality criteria for mercury based on the FDA’s assessments of the human health risk potential of methylmercury bioaccumulation, measured in terms of methylmercury concentrations in fish tissue. Moreover, the EPA and the FDA recently entered into a Memorandum of Understanding regarding fish tissue concentrations and fish consumption advisories. Once incorporated into state water quality standards, the new fish tissue criteria become the basis for categorizing the polluted waterway as water quality impaired, triggering the Clean Water Act’s total maximum daily load (TMDL) process, in which the air emitting sources of mercury are treated as nonpoint sources of water pollution. Presumably, states will then address these air emissions of mercury through their state implementation plans pursuant to the Clean Air Act.

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259 See generally Georgia v. U.S. Army Corps of Engineers, 302 F.3d 1242 (11th Cir. 2002) (addressing Florida’s motion to intervene in Georgia’s lawsuit seeking more water from the system); Southeastern Federal Power Customers, Inc. v. Harvey, 400 F.3d 1 (D.C. Cir. 2005) (addressing Alabama’s and Florida’s challenges to a settlement between Georgia and the Army Corps); Alabama & Florida v. U.S. Army Corps of Engineers, 424 F.3d 1117 (11th Cir. 2005) (addressing Florida’s and Alabama’s motions for preliminary injunction); J.B. Ruhl, supra note 39, at 48-50 (describing the conflict).


262 See, e.g., Office of Wetlands, Oceans, & Watersheds, U.S. EPA, Air Pollution and Water Quality, http://www.epa.gov/owow/airdeposition/ (last updated June 6, 2007) (listing the EPA’s efforts to address atmospheric deposition issues, including TMDLs for mercury).


266 See, e.g., Office of Wetlands, Oceans, & Watersheds, U.S. EPA, Air Pollution and Water Quality, http://www.epa.gov/owow/airdeposition/ (last updated June 6, 2007), and the TMDLs linked therefrom.

If human health is the most sensitive or most important regulatory priority, this choice of regulatory focus is rational, and implementation of the mercury TMDLs could eventually ensure protection of human health. However, an unexamined assumption that protection of human health is the highest priority can unwittingly and paradoxically foreclose the choice of other output goals and measurements that would better protect both human health and larger ecosystem functions and services. For example, it is becoming increasingly clear that humans are not the most sensitive users that methylmercury bioaccumulation affects. Instead, other species – like the Florida panther and downstream marine fish – are more likely than humans to suffer as a result of consuming the mercury-contaminated fish. In other words, the substantive choice to regulate for human health outputs – a choice forced, in part, by the existing fragmented regulatory frameworks and the scope of the EPA’s regulatory authority – is in fact a choice not to protect against other ecosystem effects or regulatory outputs.

Thus, in the case of atmospheric deposition, non-comprehensive evaluation, a narrowly focused prioritization of human health goals, and regulatory fragmentation have at least for now foreclosed better protections for non-human organisms, even though regulating to protect those other organisms, and the ecosystem in general, would also incidentally protect human health with a much wider margin of safety than current regulation provides. Moreover, given that scientific study has discovered human health effects at progressively more minute concentrations of mercury, it may well turn out that ecosystem-based, output-focused regulation is the only way to comprehensively protect human health from mercury pollution. A more holistic approach to the ecosystem that considers not only all sources of ecological problems (the regulatory inputs) but also all of the desired regulatory outputs – i.e., the overall desired ecosystem result, balancing ecosystem function, ecosystem services, and more commodified human uses of the entire ecosystem – would provide a more transparent and adaptive regulatory framework both for making and for implementing the legal and political choices regarding which of these ecological values and functions the regulatory scheme should protect and promote.

The regulatory issues that arise as a result of atmospheric deposition of mercury constitute only one aspect of ecosystem-based water management. Nevertheless, they suggest that reformation of fresh water regulation provides an interesting – and important – testing ground for the resolution of regulatory fragmentation and the incorporation of ecosystem goals and outputs, especially in times of increasing water stress and water shortage.

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268 See, e.g., U.S. EPA, MERCURY STUDY REPORT TO CONGRESS, VOL. VII: CHARACTERIZATION OF HUMAN HEALTH AND WILDLIFE RISKS FROM MERCURY EXPOSURE IN THE UNITED STATES, EPA-452/R-97-009, at 2-17, 3-7 (Dec. 1997), available at http://www.epa.gov/ttn/oarpgi3/reports/volume7.pdf (suggesting that the safe threshold concentration in humans is 0.1 ppm of mercury, while the safe threshold for loons and other animals that consume fish is 0.077 ppm); see also SOUTH FLORIDA WATER MANAGEMENT DISTRICT, 2004 EVERGLADES CONSOLIDATED REPORT 2B-4 (Jan. 1, 2004) (concluding that fish-eating birds are more sensitive to mercury than previously presumed).

269 See ADLER, supra note 12, at 9 (“In restoration we seek to redress the cumulative effects of human actions on ecosystems rather than focusing only on specific environmental media (e.g., air, water, land, wildlife) or on particular human activities (e.g., steel or power production, farming, hunting.”). In assessing the relative values of various ecosystem functions, the concept and valuation of ecosystem services could play a particularly helpful role. RUHL, KRAFT & LANT, supra note 148, at 249-96. Even so, the choice of regulatory priorities is ultimately a political choice, not one that either science or economics can establish.

270 Again, the focus of this Article is purposefully limited to one – hopefully graspable – aspect of a much larger ecosystem problem. As Robert Adler has rightly noted, “watersheds are not just bodies of water, but are
One can perhaps overstate the debilitative effects of water’s regulatory fragmentation. Nevertheless, studies of a variety of large aquatic ecosystems consistently conclude that regulatory fragmentation and the resulting inherent conflicts over turf and regulatory norms impede the attainment of desired ecological outputs — i.e., ecosystem restoration and maintenance. For example, with respect to the Florida Everglades, the Office of Technology Assessment (OTA) concluded in 1993 that:

One of the most vexing [problems], and one encountered many times in OTA’s study, is the lack of coordination among the responsible State and Federal agencies. Part of the problem is a result of the lack of shared values among agencies and among the constituencies they represent. Furthermore, each agency has a different mandate, and agencies’ jurisdictional boundaries seldom coincide with boundaries of natural systems. One might expect that the preservation mandate of the U.S. Fish & Wildlife Service and the Florida Department of Environmental Regulation would often clash with the flood-control mandate of the Corps of Engineers and with the interests of EAA [Everglades Agricultural Area] farmers, and such has been the case in South Florida. However, lack of coordination has extended even to agencies with similar mandates; a prominent example has been the difficulty of reconciling the National Park Service’s ecosystem-wide approach to restoring the Everglades with the Fish and Wildlife Service’s mandate under the Endangered Species Act . . . to focus on protection of individual species.\(^{271}\)

Similarly, regulatory fragmentation and norm conflict can impede restoration of large rivers. For example, “with respect to our management of the Colorado River, over time Congress legislated a set of conflicting, inconsistent directions in a maze of separate statutes. These inconsistencies continue to complicate restoration efforts.”\(^{272}\) Most dramatically, the complex allocation of Colorado River water among the states, known as the “Law of the River,” “provided the certainty by which states could forge long-term water policy with stable expectations,” but it also at least potentially conflicts with the ESA, which “established new requirements that could prevent the upper basin from using all of its allocations under the compact.”\(^{273}\)

connected intimately with the entire associated land mass. . . . Ecologists now conceptualize watersheds as not one but a collection of ‘ecosystems composed of a mosaic of terrestrial ‘patches’ that are connected (drained) by a network of streams.” Under this view, river ecosystems are not just two-dimensional (linear and lateral) but four dimensional in nature.” ADLER, supra note 12, at 77. Given the significant regulatory fragmentation that exists just with respect to the water, however, the proposals in this Article, limited in focus as they may be, already suggest a radical departure from the status quo. Moreover, a regulatory centralization of water with a priority focus on the oceans could relatively easily be expanded in the future to encompass terrestrial activities that can affect the quantity and quality of water than in turn affect the health of marine ecosystems.


\(^{272}\) ADLER, supra note 12, at 141.

\(^{273}\) Id. at 116. See also id. at 121 (“Under the ESA, the FWS must reject a project if no reasonable and prudent alternatives are identified that will avoid jeopardy to a listed species. Stopping projects altogether, however, would propel the ESA headlong into the well-entrenched Law of the River, under which upper basin users are allowed to continue to develop their water rights.”).
Finally, at the end of the watershed, issues of norm conflict and fragmented regulatory jurisdiction plague regulation of marine ecosystems. For example, in its 2004 report to Congress, the U.S. Commission on Ocean Policy recommended the creation of centralizing agencies at the federal level, emphasizing that:

At the federal level, eleven of fifteen cabinet-level departments and four independent agencies play important roles in the development of ocean and coastal policy. These agencies interact with one another and with state, territorial, tribal, and local authorities in sometimes haphazard ways. Improved communication and coordination would greatly enhance the effectiveness of the nation’s ocean policy.²⁷⁴

More bluntly, a parallel report by the Pew Oceans Commission concluded in 2003:

Not a system at all, U.S. ocean policy is a hodgepodge of individual laws that has grown by accretion over the years, often in response to crisis. More than 140 federal laws pertain to the oceans and coasts. Collectively, these statutes involve at least six departments of the federal government and dozens of federal agencies in the day-to-day management of our ocean and coastal resources.

Authority over marine resources is fragmented geographically as well. . . . This federal/state division of ocean jurisdiction makes it difficult to protect marine ecosystems because it divides their management into a nearshore and an offshore component with insufficient means or mandate to harmonize the two.²⁷⁵

The Pew Commission also recommended centralization to correct this regulatory fragmentation; specifically, it recommended that Congress “enact a National Ocean Policy Act requiring federal, state, and territorial agencies to protect, maintain, and restore marine and coastal ecosystems, and reorienting national and regional decision-making bodies to these ends.”²⁷⁶

The Pew Oceans Commission and U.S. Commission on Ocean Policy should be particularly provocative for fresh water resource management. Marine ecosystems are the ecological termini of freshwater watersheds, affected by both the water withdrawals and the water pollution that occur upstream. However, they are also some of the most significant regulatory orphans of fresh water’s regulatory fragmentation, suffering ecological outputs as a result of upstream activities that go far beyond mercury-contaminated marine fish. Incorporating marine ecosystem output measures into fresh water regulation could do much to harmonize and prioritize regulatory goals across the entire watershed.

²⁷⁴ AN OCEAN BLUEPRINT, supra note 155, at 5.
²⁷⁵ PEW OCEANS COMMISSION, AMERICA’S LIVING OCEANS: CHARTING A COURSE FOR SEA CHANGE 14 (May 2003) (emphasis added) [hereinafter AMERICA’S LIVING OCEANS].
²⁷⁶ Id. at 21 (emphasis added).
III. INCORPORATING MARINE ECOSYSTEM OUTPUT MEASURES INTO FRESH WATER REGULATION

In this era of water conflict and climate change, it is worth emphasizing – as two blue-ribbon Commissions have already done – that the existing regulatory fragmentation for fresh water resources largely ignores one of the most important sets of water-based ecosystems in the United States: the marine ecosystems off the nation’s coasts. Re-structuring regulatory priorities for water resources to actively incorporate and account for marine resources could accomplish two important improvements: (1) protecting the oceans themselves; and (2) providing a set of output measurements and goals that could begin to rationalize and prioritize holistic aquatic ecosystem management.

A. Focusing on Marine Outputs

1. Why Should the United States Protect and Restore Its Marine Ecosystems?

The United States has over 13,000 miles of coastline. Moreover, in parallel with the provisions of the Third United Nations Convention on the Law of the Sea, the United States asserts national jurisdiction over a 200-nautical-mile-wide Exclusive Economic Zone. As a result, the United States controls “more than 4 million square miles of ocean territory, the largest and richest in the world.” Indeed, the marine areas subject to the United States’ jurisdiction are “23 percent larger than the land area of the nation . . . .”

Marine ecosystems have immense value. Oceans cover more than 70% of our planet, support immense reserves of biodiversity (in all senses), produce at least half of the Earth’s atmospheric oxygen, drive the planet’s hydrological cycle, sequester carbon dioxide, and play a significant role in the Earth’s climate and weather. As such, oceans and estuaries are critical providers of ecosystem services – those “myriad of life support functions, the observable manifestations of ecosystem processes that ecosystems provide and without which human

281 PEW OCEANS COMMISSION, AMERICA’S LIVING OCEANS: CHARTING A COURSE FOR SEA CHANGE: SUMMARY REPORT 5 (May 2003) [hereinafter PEW SUMMARY REPORT].
283 PEW SUMMARY REPORT, supra note 281, at 5.
286 Id. at 77.
287 Id. at 78-86.
civilizations could not thrive . . . .”

According to a comprehensive study that appeared in *Nature* in 1997, “[a]bout 63% of the estimated value [of the world’s ecosystem services] is contributed by marine ecosystems,” especially coastal ecosystems. Specifically, “[c]oastal environments, including estuaries, coastal wetlands, beds of sea grass and algae, coral reefs, and continental shelves . . . cover only 6.3% of the world’s surface, but are responsible for 43% of the estimated value of the world’s ecosystem services.”

In the United States, economic calculation generally “distinguishes between the ocean economy, the portion of the economy that relies directly on ocean attributes, and the coastal economy, which includes all economic activity that takes place on or near the coast, whether or not that activity has a direct link to the sea.” Both, however, reveal that the oceans and coasts are substantial components of the nation’s economic well-being:

In 2000, the ocean economy contributed more than $117 billion to American prosperity and supported well over two million jobs. Roughly three quarters of the jobs and half the economic value were produced by ocean-related tourism and recreation . . . . For comparison, ocean-related employment was almost 1½ times larger than agricultural employment in 2000, and total economic output was 2½ times larger than that of the farm sector.

The level of overall economic activity within coastal areas is even higher . . . . More than $1 trillion, or one-tenth, or the nation’s annual gross domestic product (GDP) is generated within nearshore areas, the relatively narrow strip of land immediately adjacent to the coast. *Looking at all coastal watershed counties, the contribution swells to over $4.5 trillion, half of the nation’s GDP.*

Much coastal tourism in the United States – especially snorkeling and diving and recreational fishing – depends on healthy and sustainable marine ecosystems. Caribbean coral reefs provide fisheries, tourism, and shoreline protection benefits worth $3.1 to $4.6 billion per year, and degradation of these ecosystems will cost several hundred million dollars in yearly income by 2015. Hawaiian coral reefs provide “added value” of $364 million per year, most of which derives from net business revenues from snorkeling and diving; however, that “added value” also includes $40 million per year in increased property values.

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289 Robert Costanza, *et al., The value of the world’s ecosystem services and natural capital*, 387 NATURE 253, 259 (May 15, 1997).


291 AN OCEAN BLUEPRINT, supra note 155, at 31 (Sept. 2004).

292 Id. (emphasis added).

293 THE ROYAL SOCIETY, OCEAN ACIDIFICATION DUE TO INCREASING ATMOSPHERIC CARBON DIOXIDE 33 (June 2005), *available at* http://www.royalsoc.ac.uk/displaypagedoc.asp?id-13314.

294 Id.
Fishing also depends on sustainable marine ecosystems. Commercial fishing was worth $28 billion per year to the United States in 2004, recreational fishing was worth $30 billion, and trade in ornamental fish was worth $3 billion. Nor is the value of fish all in capture. In 2005, processed fisheries products were worth over $7.5 billion to the United States.

In light of these benefits, and in light of the fact that the nation’s marine ecosystems are currently inadequately protected, developing a sustainable, comprehensive, and integrated marine regulatory and management regime is critical to the United States’ continued wealth, quality of life, and national security – a fact that the two oceans Commissions have emphasized. The Pew Oceans Commission issued its report reviewing the nation’s oceans policies, America’s Living Oceans: Charting a Course for Sea Change, in May 2003. The U.S. Commission on Ocean Policy, which President George W. Bush appointed in response to the Oceans Act of 2000, issued its report, An Ocean Blueprint for the 21st Century, in September 2004. As Professor Donna Christie has emphasized, the two Commissions’ reports are “largely in agreement on some very fundamental issues,” including the need for an integrated, ecosystem-based approach to ocean management, including incorporation of upstream stressors.

Moreover, climate change only underscores the need for a comprehensive regulatory approach to protect marine ecosystems. Excess carbon dioxide levels have already acidified the oceans, and some of the more confidently predicted effects of climate change are increases in ocean temperatures and sea level rise. All of these effects can distress marine – especially coastal – ecosystems and hence already threaten a larger sector of the United States’ economic productivity. Considering the effects of upstream water resources decisions on coastal and marine ecosystems thus makes economic as well as ecological sense.

2. Marine Ecosystem Protection and Restoration and the Connection to Fresh Water Management

Ocean ecosystems are the “end of the line” for water, and comprehensive regulation to protect those ecosystems requires an examination of upstream inputs, particularly with regard to

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295 Id. at 2.
297 AMERICA’S LIVING OCEANS, supra note 275.
299 AN OCEAN BLUEPRINT, supra note 155.
300 Donna R. Christie, Implementing an Ecosystem Approach to Ocean Management: An Assessment of Current Regional Governance Models, 16 DUKE ENVTL. L. & POL’Y F. 117, 117-18 (Spring 2006); see also id. at 120-23 (discussing the Pew Oceans Commission Report), 123-29 (discussing the U.S. Commission on Ocean Policy’s Report). See also generally Josh Eagle, Regional Ocean Governance: The Perils of Multiple Use Management and the Promise of Agency Diversity, 16 DUKE ENVTL. L. & POL’Y F. 143 (Spring 2006); Andrew A. Rosenberg, Regional Ocean Governance and Ecosystem-Based Management of Ocean and Coastal Resources, 16 DUKE ENVTL. L. & POL’Y F. 179 (Spring 2006).
301 THE ROYAL SOCIETY, supra note 293, at 33 (June 2005).
water quality (pollution) and water quantity (freshwater influx, which determines salinity levels, especially in estuaries). The effects of upstream inputs on marine ecosystems are widely acknowledged, but a few specific examples are nevertheless appropriate.

In Florida, upstream/downstream effects are important to at least two coastal ecosystems. In the panhandle, oyster production at the mouth of the Apalachicola River, and the continued survival of endangered and threatened mussel species and Gulf sturgeon in the river, depend on the amount and quality of water released upstream in the Flint and Chattahoochee Rivers. However, Atlanta increasingly wants that water for its own municipal purposes, leading to a more-than-decade long conflict and failed attempts at resolution.

At the southern tip of the state, the health of Florida Bay and the Florida Keys coral reef ecosystem depend on the quantity and quality of water flowing in from the Everglades, and these marine ecosystems have suffered both from the loss of fresh water influx (and hence increased salinity) when the Everglades were drained and increased pollution as a result of agriculture, cities, and industries in the watershed. Specifically, Everglades drainage and flood control projects both diverted approximately 1.7 billion gallons of fresh water west and east, into the Gulf of Mexico and Atlantic Ocean, and allowed for the farming and development that are the source of much land-based pollution into the southern Florida marine waters. The drainage and other construction projects, such as Highway 1 and a southern Florida railroad, cut off most of the flow of relatively clean fresh water to Florida Bay and interfered with the natural circulation of water between the Bay and the Atlantic Ocean in and around the Florida Keys. Salinity in the Bay increased in conjunction with these projects, leading to a large region of hypersalinity, and those projects also have been linked to changes in the Atlantic/Florida Keys coral reef strands that occurred at the beginning of the 20th century. The Bay itself experienced a near ecological crash in the late 1980s, when more than 100,000 acres of seagrasses died and algal blooms – probably fed by nutrient pollution – clouded the Bay’s waters. Moreover, in combination with the added stressors of increasing ocean temperatures as a result of climate change and ocean acidification from increased carbon dioxide levels, these upstream stressors were sufficient to induce NOAA to list the elkhorn and staghorn corals for protection under the Endangered Species Act.

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304 See Andrew K. Jacoby, Water Pressure: The Eightieth Texas Legislature Attempts to Protect Instream Flows of Rivers and Streams, and Freshwater Inflows to Bays and Estuaries, 20 TULANE ENVTL. L.J. 381, 402-03 (Summer 2007), (describing Texas’ recent legislation to direct more water to estuaries).
305 Ruhl, supra note 39, at 48-49.
310 Id.
311 Id. at 2.
312 71 Fed. Reg. 26,852, 26,856-59 (May 9, 2006).
In the Gulf of Mexico, a hypoxic zone – an area lacking oxygen, often referred to as a “dead zone” – recurs every year off the coast of Louisiana. After the Mississippi River flood of 1993, the spatial extent of this zone more than doubled in size, to over 18,000 km$^2$, and has remained about the same size each year through midsummer 1997. In most years, the dead zone covers about 7000 square miles, with a record of 7728 square miles in 1999. In many years, this dead zone is the size of New Jersey, and it regularly interferes with commercial fishing in the Gulf. The hypoxic zone forms in the middle of the most important commercial and recreational fisheries in the coterminous United States and could threaten the economy of this region of the Gulf. The Dead Zone has become a serious threat to commercial fishing, shrimping, and recreation industries. The livelihoods of many thousands of people and their communities are at risk, as is the large marine ecosystem on which they depend. Gulf hypoxia is the product of nutrient (especially nitrogen) inputs, particularly from farms, from the entire Mississippi River watershed, a system of rivers and other waterways that drains 40 percent of the United States. As a result, reducing or eliminating Gulf hypoxia requires comprehensive examination of the entire watershed.

More progress has been made in restoring the Chesapeake Bay, another marine ecosystem damaged by upstream pollution and in-Bay overfishing. The watershed that drains to the Chesapeake Bay encompasses 64,000 square miles, including portions of six states – New York, Pennsylvania, Maryland, Delaware, Virginia, and West Virginia – and the District of Columbia. Efforts to restore the Bay began in the mid-1970s. Current restoration efforts are being guided by Bay-based, ecosystem-based output measurements and goals, namely: “Are the crabs, rockfish, underwater grasses and other living organism in the Bay restored?” To achieve those goals, however, the Chesapeake Bay restoration program has had to reach progressively farther upstream and to expand its regulatory scope. In 1987, Maryland, Virginia, Pennsylvania, and the District of Columbia agreed to reduce nitrogen and phosphorus loading to

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the Bay by 40 percent.\textsuperscript{324} In 1992, caps on nitrogen and phosphorus were allocated to each of the ten sub-basins in the watershed, but these were modified in 2000 to meet a 2010 Clean Water Act-driven TMDL deadline (a TMDL goes into effect in 2011 if the states do not meet the water quality goals for the Bay).\textsuperscript{325} In addition, agreements in 2000 formally brought New York, Delaware, and West Virginia into the program.\textsuperscript{326} Finally, to meet the ecosystem-based output goals, the program has expanded beyond nutrients to include dissolved oxygen, water clarity, and chlorophyll (a measure of algae growth).\textsuperscript{327} The latest 2006 Bay Health and Restoration Assessment indicates that progress is being made for most goals and most parameters, although the Bay remains degraded and more intensive control of agricultural pollution is required.\textsuperscript{328}

In the West, consumption of water by the Colorado River states – Colorado, New Mexico, Wyoming, Utah, Arizona, Nevada, and California – has left the Gulf of California and the Sea of Cortez parched and stressed, reflecting “the Progressive Era philosophy that water allowed to reach the sea wasted a precious resource.”\textsuperscript{329} The reduction in flow to the Gulf of California has been significant, from approximately 24-25 million acre feet of water (maf)\textsuperscript{330} per year to, at best, the 1.5 maf per year currently mandated by treaty.\textsuperscript{331} Moreover, the water that reaches the sea “consists of salty, polluted return flows from thousands of acres of irrigated agriculture on both sides of the border.”\textsuperscript{332} As a result, “[s]everal largely marine species in the lower river, including machete, striped mullet, spotted sleeper, and roundfin, were extirpated before 1900; roundtail chub and pikeminnow followed shortly thereafter,”\textsuperscript{333} and in the delta itself, the prior complex of two million acres of wetlands, ranging from freshwater to brackish to tidal, have been reduced to 150,000 acres.\textsuperscript{334} In turn, these “[w]etland losses and other changes in the river dramatically altered the ecosystem of the delta, the estuary, and the upper Sea of Cortéz,”\textsuperscript{335} increasing salinity, changing water circulation patterns, and affecting species such as shrimp, fish,
and the vaquita porpoise. Nevertheless, the Gulf of California and the Sea of Cortéz have largely been ignored in Colorado River restoration discussions. As Robert Adler has noted, “existing analytical approaches to Colorado River restoration have been confined just as much as the water held behind the dams. We approach restoration decisions in the wrong order by allowing legal and institutional decisions made long ago to constrain choices about our goals for the river for future generations, and about the best means to achieve those goals.”

B. Marine Ecosystems as Regulatory Commons

William Buzbee, in his theory of the “regulatory commons,” has detailed why regulatory inattention might occur regarding ecosystem-level – that is, multi-jurisdictional – environmental problems such as watersheds, and especially their marine endpoints. Buzbee posits “that when social ills match no particular political-legal regime or jurisdiction, but instead encounter fragmented political-legal structures, predictable incentives arise for potential regulators to opt against investing in such regulatory opportunities.” These incentives, in turn, create a “regulatory commons,” which Buzbee analogizes to Garrett Hardin’s “tragedy of the commons”: “where a social ill does not fall squarely within any particular political-legal regime’s turf,” potential regulators lack “incentives to invest in efforts to gather information about the resource harms, lead collective efforts to devise curative strategies, or design a responsive strategy,” because: (1) “regulators are not likely accurately to perceive the aggregate interest in the underlying ill” (2) regulatory fragmentation is likely “to lead to competing credit claims”; (3) information costs are high, leading to free rider problems, and payoffs uncertain for any regulator who chooses to act; and (4) numerous incentives exist for regulators to preserve the status quo.

Aquatic ecosystem management, especially when such management seeks to incorporate marine ecosystems, is almost a textbook example of the regulatory fragmentation that should produce regulatory gaps under Buzbee’s theory. First, as already discussed, “a single government regulator seldom exists” in any given watershed, and “[i]n settings of regulatory fragmentation, mismatch, and overlap, regulatory commons dynamics will exist.” Second, large watersheds suffer as a result of almost all of Buzbee’s “jurisdictional mismatches” – that is, the “lack of a regulator with primacy over an activity and its effects . . . .” These jurisdictional mismatches include the regulatory fragmentation resulting from federalism, which divides regulatory authority between the federal government and the states, the problem of

336 Id. (footnoted omitted).
337 Id. at 266.
339 Id. at 6.
340 Id. at 27.
341 Id. at 28.
342 Id. at 31.
343 Buzbee, supra note 338, at 32.
344 Id. at 33
345 Id. at 33-36.
346 Id. at 21-22.
347 Id. at 23.
348 Buzbee, supra note 338, at 23.
interjurisdictional harms, especially as pollution and other effects upstream flow downstream; the mismatch between the scope of the resource and the scope of governmental regulatory authority, leaving no single regulator with the authority to address the entire problem; and social ills that “arise[] out of dynamics, incentives or actors outside of a government’s jurisdiction,” such as the interstate and international atmospheric deposition of mercury. Indeed, Buzbee himself offers aquaculture as a predictable regulatory orphan, because “no primary regulator exists or has reason to step forward,” given that “[t]he broad potential harms of aquaculture are unlikely to befall any one jurisdiction.” More specifically, “aquaculture operations . . . are a geographically identifiable and ostensibly confined activity that arises out of market demands that are global in nature, pollution implications that are far from confined, and ecosystem risks that are global. The mixed-media nature of aquaculture and its risks, coupled with the lack of any one prime regulator, has to date left aquaculture subject to incomplete and arguably ineffective regulation.

Buzbee’s theory thus predicts a lack of adequate regulatory attention to problems such as atmospheric deposition of mercury and other watershed-level environmental problems. Nevertheless, outputs from atmospheric deposition of mercury are recognized environmental and public health problems that pose a fundamental regulatory question: How do we get past the problems of regulatory fragmentation and the regulatory commons? Quite logically, Buzbee suggests that regulatory fragmentation be reduced and that regulatory hierarchies be created. Moreover, “[i]n the regulatory commons setting, recourse to federal authority will generally be a constitutionally palatable option,” although some decentralization is generally also advisable.

C. Marine Ecosystem Health as an Output Measure for Upstream Regulation

As noted, the health of coastal marine ecosystems depends, at least in part, upon the quantity and quality of fresh water that reaches those ecosystems – two factors that upstream use and withdrawals already alter. In addition, “[c]limate change may decrease or increase precipitation, thereby altering coastal ecosystems. Decreased precipitation and delivery of fresh water alters food webs in estuaries and affects the amount of time required to flush nutrients and contaminants from the system.” These facts explains why coastal and ocean regulators – like those involved in the Chesapeake Bay program – must look upstream if they want to ensure that the United States’ marine ecosystems can continue to provide the wealth inherent in sustainable marine biodiversity, especially as climate change increasingly affects the nation’s coasts.

349 Id. at 23-24.
350 Id. at 25.
351 Id.
352 Id. at 9.
353 Id.
354 Buzbee, supra note 338, at 49-51.
355 Id. at 53.
356 Id. at 56-63.
357 Pew Center on Global Climate Change, Coastal and Marine Ecosystems and Global Climate Change, http://www.pewclimate.org/globalwarming-in-depth/all_reports/coastal_and_marine_ecosystems/marine_execsumm.cfm.
358 Id.
Nevertheless, as the examples in Subpart A suggest, marine ecosystems also suggest relevant output measures that could provide regulatory focus and coherence for upstream fresh water resource management. For example, asking what water quality goals in the Mississippi River watershed “should” be is close to a meaningless question. Because of the Clean Water Act’s cooperative federalism, states set water quality goals for particular water segments, a state-local focus that almost never takes account of cumulative watershed effects or large aquatic ecosystems. Focusing on the Mississippi itself, in other words, quickly devolves into a focus on state and local interests and priorities.

However, if instead one asks how water resources in the Mississippi River should be managed to both promote both local-state priorities and restore the Gulf of Mexico by reducing or eliminating hypoxia, priority regulatory issues come immediately into focus – namely, controlling nutrient pollution, which in turn requires a focus on agriculture. As such, focusing on marine outputs in this watershed immediately underscores two of the Clean Water Act’s gaping regulatory “holes”: agriculture and nonpoint source pollution. Such a focus also reveals – in stark contrast to the Colorado River basin and in some contrast to the Apalachicola-Chattahoochee-Flint River basin – that water regulation is not as important an issue.

In other words, a marine output-based focus reveals that priority ecosystem-based issues can vary considerably from watershed to watershed. “Protecting the oceans” is thus not a univalent regulatory goal, and incorporation of marine ecosystem goals into fresh water management is as likely to reveal differences in watershed prioritization choices as it is to reveal similarities. This recognition of difference, in turn, is important for at least two reasons. First, and most basically, the types of sources that need to be addressed, and the types of regulatory refinements that need to be made, in order to protect marine ecosystems will vary from watershed to watershed. Second, in times of decreased water supply and water shortage, regulating to protect marine resources will be far more politically and economically viable in some watersheds than in others. Thus, incorporating marine ecosystem considerations into fresh water management would make it less likely that marine ecosystems will be “unwittingly destroyed” through unconscious triage in those watersheds where, if marine ecosystems were in fact consciously considered, economics, cultural values, and/or the availability of relatively minor regulatory accommodations would accord marine ecosystem protection higher regulatory priority than it currently receives.

An ecosystem-based, marine-inclusive approach to water management would certainly be better for the oceans, but incorporation of marine-focused output goals is also likely to better protect upstream ecosystems and many upstream uses. For example, reductions in atmospheric deposition of mercury sufficient to prevent contamination of marine fish would also address mercury bioaccumulation in freshwater fish, adverse effects on protected species such as the Florida panther, and potential human health impairments. Similarly, reductions in other types of land-based water pollution to protect ocean water quality would almost certainly simultaneously better protect fresh water quality. Ensuring that enough water flows through the fresh waterways to support the estuaries and other coastal ecosystems at the end of the line would simultaneously help to ensure that sufficient water remained in those waterways to support the fresh water

359 33 U.S.C. § 1313(c).
ecosystems and protected species within them, support efforts to improve water quality, would improve navigation, and support hydropower generation.

In terms of water quantity, therefore, incorporating marine ecosystem goals into fresh water management lends additional weight to arguments in favor of preserving certain levels of in situ flows, aligning marine ecosystem output goals with other in situ use goals, including species and biodiversity preservation. As a result, the addition of marine considerations inevitably raises issues of private property rights in water. However, water rights are not an insurmountable (or even necessarily expensive) barrier to the ocean-focused reform of fresh water regulation. As was discussed in Part I, in the eastern half of the United States, riparian rights have always been correlative and subject to adjustment to accommodate new future users; moreover, while the riparian doctrine has evolved from a natural flow to a reasonable use theory, reasonable use still generally prohibits the destruction or material impairment of downstream values as a result of upstream consumption of water. Many states, regardless of whether they follow the riparian or the prior appropriation doctrine, require water rights to comply with water quality requirements. As states are often less explicit about conditioning water rights to protect species or ecosystems, but the public interest review requirement in many state water permitting statutes generally does consider impacts on fish and wildlife. In addition, many states have robust state public trust doctrines that limit the extent of property rights in water.

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Incorporating marine ecosystem considerations into the water regulatory calculus also does not mean that the oceans always win – simply that regulators actively consider marine ecosystem output goals when making choices about upstream water resources. Like NEPA’s environmental impact requirements, such active consideration could prevent unintended and unnecessary adverse marine impacts. For example, one gaff in the massive Everglades restoration project was the failure to manage for both phosphorus and nitrogen pollution. The Everglades are sensitive to the former, but corals in the Florida Keys are sensitive to the latter. Everglades restoration efforts have focused on measures that would remove phosphorus from the water flowing downstream, but those measures removed only 30 to 50 percent of the nitrogen. Between 1996 and 1998, water flows into Florida Bay increased as part of early Everglades restoration efforts. Although these increased flows coincided with the implementation of the agricultural Best Management Practices requirements, and hence reflected a decrease in phosphorus levels in the water, “38 percent of the living coral in the Keys died off, a problem . . . credited to ‘nitrogen overloading.’ Other pollutants were clearly in the water, but . . . nitrogen caused an explosion in algae blooms, which led to the reef’s demise.” When officials decreased the water flow in 1998, corals in the Florida Keys began to recover. Thoroughly considering the Florida Keys in the Everglades restoration planning process could have avoided further damaging the Keys as a result of these mis-matched nutrient sensitivities.

**CONCLUSION**

The regulatory fragmentation that characterizes water resource management in the United States in effect presumes that aquatic resources are abundant enough that the nation can tolerate their inefficient management and the incidental effects of upstream management on downstream resources. The evidence is increasingly all to the contrary – litigation indicates that conflicts among the fragmented regulatory regimes governing water are becoming more frequent, requiring the piecemeal prioritization of uses and goals.

Fresh water is already in short supply in many parts of the United States. Factors such as population growth and groundwater aquifer depletion are already exacerbating existing shortages or creating new shortages in states, like Florida, that traditionally have been viewed as “water rich.” Even when sufficient supply exists for consumptive human uses, moreover, those consumptive uses may interfere with in situ uses, including aquatic habitat and biodiversity maintenance, and both complicate and create water quality problems.

In coming decades, and especially in combination with population growth and other existing stressors, climate change is likely to underscore the problems of water’s regulatory fragmentation by creating or worsening water shortages and water stress in many parts of the country. Specifically, climate change is likely to increase water shortages and the number of conflicts that such shortages generate. In many areas of the country, as has already been seen in the Colorado River, the likely result will be some form of de facto water triage – the unconscious

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364 *Id.*

365 *Id.*
sacrificing of some uses and some ecosystems, especially downstream marine ecosystems, in pursuit of “more pressing” local needs.

If ecosystem restoration is the equivalent of holistic medicine in environmental law, “establishing restoration goals requires some sense of what is possible and what is not, given the magnitude of existing environmental change,” and climate change is likely to alter – perhaps repeatedly – what “restoration” is actually possible, especially in combination with existing water stressors. Moreover, increasing water shortages and conflicts over water in an era of climate change may in fact eventually require the ecological equivalent of medical triage: an ability to make quick decisions among competing demands on water resources in the face of system stresses and shocks, with a goal of saving as much as possible. Both of these potential problems counsel for comprehensive, deliberative, public, and conscious decisionmaking regarding water resource priorities, including an explicit recognition that the use priorities and regulatory capabilities are likely to vary from watershed to watershed.

As the country enters this potential regulatory chaos that climate change may bring, moreover, it should also ensure that no water-dependent resources remain unattended regulatory orphans. Two Commissions have concluded that significant legal reforms, both structural and substantive, are needed to protect the nation’s valuable marine resources, including the incorporation of upstream effects. Examples across the country demonstrate that coastal marine ecosystems in particular have often suffered from decisions made under the current reality of water’s regulatory fragmentation, in terms of both reductions in flow and increased pollution. These salt water ecosystems are already the regulatory orphans of fresh water regulatory regimes, and increasing water shortages and water conflict are an unpromising context in which to generate spontaneous improvements in watershed-wide cooperation and marine-inclusive management.

Nevertheless, viewing an entire watershed from the perspective of its terminal marine ecosystems can suggest at least some regulatory output priorities, measurements, and goals that better protect the entire system. Restoration of water and sediment flow in the Colorado River system to increase productivity in the Gulf of California and Sea of Cortéz would simultaneously help to restore the function and productivity of the River itself. Nutrient control in the Mississippi River Basin to reduce or eliminate the “dead zone” in the Gulf of Mexico would also improve water quality throughout that Basin and encourage more comprehensive and improved nonpoint source regulation. Increased attention to nitrogen in the Everglades restoration efforts to protect (or at least reduce the stresses on) the Florida Keys coral reef ecosystem would also contribute to overall Everglades restoration efforts. And, as was noted above, elimination of atmospheric deposition of mercury to protect top-level marine predators simultaneously protects endangered species, fresh water species, and human health.

Many regulatory reformations, ranging from relatively minor “tweaking” of existing regimes to comprehensive federalization of water resource management, could work to better incorporate marine ecosystem goals and output-based management measures into fresh water resource management, and full discussion of those possibilities will be the topic of a future paper. For now, it is sufficient to note that both marine ecosystem preservation and the potential chaos

366 Adler, supra note 12, at 90.
of climate change are likely to require “fundamental choices . . . about conflicting values and trade-offs”\textsuperscript{367} in watersheds. Unconsciously sacrificing the oceans to fresh water’s regulatory fragmentation should not be considered either an ecologically or an economically viable option.

“Forcing people to answer the most difficult questions often generates the most useful results.”\textsuperscript{368} However, before regulators provide “definitive” answers, they should be able to take cognizance of the entire problem so that they can understand all of the stakes involved in their decisions. Seeing the entire system — for purposes of this Article, the fresh water and the salt water — already suggests some of the desirable output goals and measures that in turn can suggest ways to modify input-based regulation, to the overall improvement of human use values, economic productivity, ecosystem stability, biodiversity preservation, and human health.

\textsuperscript{367} Id. at xxii.

\textsuperscript{368} Id. xxi.