Nos. 04-1034; 04-1384

In The Supreme Court of the United States

JOHN A. RAPANOS, *et ux.*, *et al.*,

Petitioners,

v.

UNITED STATES OF AMERICA,

Respondent.

JUNE CARABELL, *et al.*,

Petitioners,

v.

UNITED STATES ARMY CORPS OF ENGINEERS; UNITED STATES ENVIRONMENTAL PROTECTION AGENCY,

Respondents.

On Writs Of Certiorari To The United States Court Of Appeals For The Sixth Circuit

BRIEF OF JARED M. DIAMOND, PAUL R. EHRLICH, HAROLD A. MOONEY, GORDON H. ORIANS, STUART L. PIMM, SONDRA POSTEL, PETER H. RAVEN, JOHN W. TERBORGH, DAVID S. WILCOVE, AND EDWARD O. WILSON AS *AMICI CURIAE* IN SUPPORT OF RESPONDENTS

JASON C. RYLANDER
DEFENDERS OF WILDLIFE
1130 17th Street, N.W.
Washington, D.C. 20036
(202) 682-9400

Counsel for Amici Curiae

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INTEREST OF THE *AMICI CURIAE*

Amici are prominent scientists in the fields of biology, botany, zoology, entomology, and ecology.[1] They have special knowledge of the important nexus of tributaries and adjacent wetlands to downstream water bodies and aquatic ecosystems, and other issues before this Court. Their scientific expertise enables them to explain the economic and ecological consequences of polluting or filling wetlands and tributaries, including the resulting loss of ecosystem functions, wildlife habitat, and biodiversity. Understanding these impacts is necessary to appreciate fully the substantial effects of altering wetlands and tributaries on interstate commerce, and why, under the Court's jurisprudence, Congress is empowered to regulate such activities.

Amici include, in alphabetical order:

Jared M. Diamond is Professor and Vice Chair, Department of Physiology, UCLA Medical School. Dr. Diamond is an explorer of New Guinea bird fauna, and inventor of the concept of assembly rules in community organization. Although his formal training was in physiology and membrane biophysics, Dr. Diamond has pursued a parallel career in ecology and evolutionary biology. Since 1977, he has devoted much of his time to popular science writing including the bestselling books *Guns, Germs and Steel: The Fates of Human Societies*, for which he was

[1] This brief was not authored in whole or in part by counsel for a party, and no person or entity other than the *amici* and their counsel made a monetary contribution to the preparation or submission of this brief. The parties have consented to the filing of *amicus* briefs and have filed letters of consent with the Clerk of the Court.

awarded the Pulitzer Prize, and *Collapse: How Societies Choose to Fail or Survive*.

Paul R. Ehrlich is President, Center for Conservation Biology and Bing Professor of Population Studies at Stanford University. Dr. Ehrlich is a fellow of the American Association for the Advancement of Science, the American Academy of Arts and Sciences, and the American Philosophical Society, and a member of the National Academy of Sciences. He is a recipient of the First AAAS/Scientific American Prize for Science in the Service of Humanity and the Royal Swedish Academy of Sciences, Crafoord Prize in Population Biology and the Conservation of Biological Diversity (an explicit replacement for the Nobel Prize for areas where the Nobel is not given).

Harold A. Mooney is the Paul S. Achilles Professor of Environmental Biology at Stanford. Dr. Mooney is a member of the National Academy of Sciences, the American Academy of Arts and Sciences, a Fellow of the American Association for the Advancement of Science, and past president of the Ecological Society of America and the American Institute of Biological Sciences. His research has earned him the Ecological Society's Mercer Award and Eminent Ecologist Award, Germany's Max Planck Research Award and Humboldt Senior Distinguished Scientist Award.

Gordon H. Orians is Professor Emeritus of Biology, University of Washington. Dr. Orians is a member of the National Academy of Sciences, the American Academy of Arts and Sciences, and a past president of the Ecological Society of America. His publications are focused on behavioral ecology, plant-herbivore interactions, community ecology, the ecology of rare plants, and human ecology.

Stuart L. Pimm is the Doris Duke Professor of Conservation Ecology, Duke University. Dr. Pimm is a conservation biologist and ecologist, 1993 Pew Scholar in Conservation and the Environment, and author of *The Balance of Nature? Ecological Issues in the Conservation of Species and Communities* and *The World According to Pimm: A Scientist Audits the Earth.* Dr. Pimm's expertise lies in species extinctions and what can be done to prevent them. He also studies the loss of tropical forests and its consequences to biodiversity. He has conducted research in the Florida Everglades for fifteen years.

Sandra Postel is Director of the Global Water Policy Project in Amherst, Massachusetts, a Visiting Senior Lecturer in Environmental Studies at Mount Holyoke College, and a senior fellow with the Worldwatch Institute. A leading authority on international freshwater issues, Postel has authored several books and more than 100 articles for popular and scholarly publications on the nature of global water challenges and constructive solutions to them. Her short book, *Liquid Assets: The Critical Need to Safeguard Freshwater Ecosystems*, was released in 2005. Postel is a 1995 Pew Scholar in Conservation and the Environment and in 2002 was named one of the "Scientific American 50," by *Scientific American* magazine.

Peter H. Raven is Director of the Missouri Botanical Garden and the George Engelmann Professor of Botany at Washington University in St. Louis. Dr. Raven is past Chair of the Division of Earth and Life Studies, U.S. National Research Council. A MacArthur Fellow and member of the National Academy of Sciences and American Academy of Arts and Sciences, he is a world leader in the fields of plant evolution and systematics.

John W. Terborgh is the James B. Duke Professor of Environmental Science and Co-Director of the Center for Tropical Conservation at Duke University. An authority on avian and mammalian ecology in neotropical forests, Dr. Terborgh is a member of the National Academy of Sciences. He is a MacArthur Fellow and was awarded the National Academy of Sciences Daniel Giraud Elliot medal for his research and his book *Diversity and the Tropical Rainforest*.

David S. Wilcove is Professor of Public Affairs and Ecology and Evolutionary Biology at the Woodrow Wilson School, Princeton University. Dr. Wilcove previously served as Senior Ecologist at Environmental Defense, Senior Ecologist for The Wilderness Society, and Research Scientist in Zoology for The Nature Conservancy. A recipient of the Distinguished Service Award of the Society for Conservation Biology, he has authored numerous publications, including *The Condor's Shadow: The Loss and Recovery of Wildlife in America* (1999).

Edward O. Wilson is Curator of Entomology at the Museum of Comparative Zoology, and Pellegrino University Professor Emeritus, Harvard University. Dr. Wilson's research interests include evolutionary sociobiology, biogeography, and ethical philosophy. A recipient of the National Medal of Science, the International Prize for Biology, the Distinguished Humanist Award from the American Humanist Association, and the Crafoord Prize from the Swedish Academy of Sciences, he has written over a dozen books, including *On Human Nature* and *The Ants* for which he was awarded Pulitzer Prizes in 1979 and 1991, respectively. His book, *The Diversity of Life*, has been described as the sequel to Darwin's *Origin of Species*.

SUMMARY OF THE ARGUMENT

As scientists who have devoted their lives to the study of nature and the conservation of ecosystems and biodiversity, *Amici* come to this case with great concern for the future of freshwater ecosystems and the laws that protect them. In this submission, *Amici* will explain the importance of tributaries and wetlands to achieving the goals of the Clean Water Act. 33 U.S.C. §§ 1251 *et seq*. *Amici* will further demonstrate how the loss of wetlands and degradation of aquatic ecosystems substantially affects interstate commerce and warrants a comprehensive federal response.

Petitioners seek an interpretation of the Clean Water Act that would largely limit its reach to navigable-in-fact waters. From the perspective of scientists, legal "navigability" is irrelevant to the ecological and economic values aquatic ecosystems provide and should not be a practical or constitutional barrier to Congress's ability to protect and maintain the health of the nation's waters. Limiting the reach of the Act in this manner would seriously undermine Congress's stated purpose "to restore and maintain the chemical, physical, and biological integrity of the Nation's waters." 33 U.S.C. § 1251(a).

Likewise, the Court should not adopt a reading of the Commerce Clause that would strip Congress of its power to regulate tributaries, adjacent wetlands, and other similar environmental resources.[2] Such an unprecedented

[2] Congress is empowered by the Commerce Clause to regulate three "broad categories of activity" – the channels of interstate commerce; the instruments of interstate commerce, and persons or things in interstate commerce; and activities that substantially affect interstate commerce. *United States v. Lopez*, 514 U.S. 549, 558-59 (1995). As the government and other *amici* will address Congress's authority to

(Continued on following page)

holding could have far-reaching effects, and, importantly from *Amici*'s perspective, would reflect a profound misunderstanding of ecosystem functions and their relation to interstate commerce. Considered in the aggregate, degradation of wetlands and tributaries impairs ecosystem functions that are vital for human well-being and biodiversity. Indeed, this Court recently reaffirmed that the commerce power extends even to purely intrastate, noncommercial acts, provided the acts are part of a comprehensive statutory scheme to address activities that in the aggregate substantially affect interstate commerce. *Gonzales v. Raich*, 125 S. Ct. 2195 (2005). As the noted environmental law professor Richard Lazarus has recognized, "Environmental laws inevitably regulate and affect commerce because the nation's natural resources supply, after all, what are literally the basic ingredients of commercial life." Richard J. Lazarus, *The Making of Environmental Law* 205 (2005).

Natural resources are the building blocks of commerce, with none more important than water – a valuable and increasingly scarce commodity in itself.[3] In the last century, federal water policy rarely worked in concert with nature; water projects from the Everglades to the

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regulate the degradation of tributaries and wetlands as channels of commerce, this brief focuses on the substantial effects of these activities on interstate commerce.

[3] It has been said that "if the world fought for oil in the 20th Century, the war will be about water in the 21st Century." *Water: Is it the 'Oil' of the 21st Century? Hearing Before the Subcomm. on Water Res. and the Env't of the House Comm. on Transp. and Infrastructure*, 107th Cong., May 22, 2003. The quote is attributed to Ismail Serageldin, former World Bank Vice President and Chairman of the Global Water Partnership.

Mississippi Delta to the Colorado River fundamentally altered intact ecosystems. To be sure, these dams, levees, river diversions, and other engineering projects provide much of the nation's drinking water, food, electricity, and flood control. But intact aquatic ecosystems provide significant economic services of their own. More than a source of water and fish, the nation's rivers, lakes, and wetlands store flood waters and reduce economic devastation due to flooding. They recharge groundwater, filter pollutants, and purify drinking water. And they provide the habitats that sustain a diversity of species, which themselves perform important ecological functions. These ecosystem services – and their potential loss – profoundly affect interstate commerce and warrant comprehensive federal protection.

Reasonable people can disagree over language, and it is for the Court to decide questions of law. But when it comes to the connection of tributaries, streams, and wetlands to navigable waters and interstate commerce, there is no ecological ambiguity. In the opinion of *Amici*, if the Clean Water Act does not protect these resources, then it does not protect navigable waters from pollution, and it cannot achieve its goals.

A ruling for Petitioners would elevate the short-term interests of a few over the long-term economic and ecological health of the nation. It would deny indisputable ecological connections and compromise a generation of environmental progress.

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ARGUMENT

I. FROM A SCIENTIFIC PERSPECTIVE, PROTECTION OF TRIBUTARIES AND ADJACENT WETLANDS IS ESSENTIAL TO ACHIEVING CONGRESS'S GOAL OF RESTORING AND MAINTAINING THE CHEMICAL, PHYSICAL, AND BIOLOGICAL INTEGRITY OF THE NATION'S WATERS.

Section 301 of the Clean Water Act, 33 U.S.C. § 1311, prohibits discharges of pollutants into navigable waters unless authorized by permits granted under other sections of the Act. Principle authorizing sections include Section 402, which governs the discharge of waste, 33 U.S.C. § 1342, and Section 404, which authorizes the U.S. Army Corps of Engineers ("the Corps") to issue permits "for the discharge of dredged or fill material into the navigable waters at specified disposal sites." 33 U.S.C. § 1344. Although the statute's reach is linked to the term "navigable waters," Congress broadened the traditional definition to include "the waters of the United States, including the territorial seas." 33 U.S.C. § 1362(7). Moreover, Congress made clear that the purpose of the Act is "to restore and maintain the chemical, physical, and biological integrity of the Nation's waters." 33 U.S.C. § 1251(a). These goals extend beyond traditional notions of navigability and manifest Congress's farsighted desire to achieve through comprehensive national policies "water quality which provides for the protection and propagation of fish,

shellfish, and wildlife and provides for recreation in and on the water." 33 U.S.C. § 1251(a)(2).[4]

Aquatic ecology makes clear the complex interdependencies of freshwater ecosystems and the many valuable benefits they provide. Rivers, lakes, streams, wetlands, and aquifers – in concert with forests, grasslands and other terrestrial ecosystems – provide water supplies for irrigation, industry, cities, and homes; purification and filtration of pollutants; flood mitigation; drought mitigation; groundwater recharge; water storage; wildlife habitat and nursery grounds; soil fertility maintenance; nutrient delivery to deltas and estuaries; freshwater flows to maintain estuarine salinity balances; recreational opportunities; and conservation of biodiversity, which provides resilience and options for the future. Sandra Postel, Worldwatch Institute, *Liquid Assets: The Critical Need to Safeguard Freshwater Ecosystems* 12 (2005); Millennium Ecosystem Assessment, World Resources Institute, *Ecosystem and Human Well-Being: Biodiversity Synthesis* 15 (2005).

These functions and relationships are important national interests protected directly and indirectly by the Clean Water Act. As the term "navigable waters" applies to the entire Act, not merely section 404, a restrictive interpretation of that term would seriously undermine Congress's ability to protect and maintain the integrity of the Nation's waters and the services they provide. Indeed, such a ruling would limit Congress's reach over wetlands

[4] Indeed, protection of navigation is not even a stated purpose of the Act (presumably because the Rivers and Harbors Act of 1899, 33 U.S.C. § 401 *et seq*., already does so). 33 U.S.C. § 1251.

and point sources alike.[5] Lance D. Wood, *Don't Be Misled: CWA Jurisdiction Extends to All Non-navigable Tributaries of the Traditional Navigable Waters and to Their Adjacent Wetlands*, 34 Envtl. L. Rep. 10187, 10187 (2004).

As this brief demonstrates, wetlands and tributaries are inexorably bound up with navigable waters and are a critical part of riverine ecosystems. Traditional navigability may be relevant to waters that serve literally as channels of commerce, but the national interest in clean water is much more extensive and its protection substantially affects interstate commerce. "Whether or not a specific water body is 'navigable,' 'nonnavigable,' or physically 'adjacent' to another navigable body is generally irrelevant [to protecting aquatic ecosystem functions] and is certainly not dispositive of the question of whether national regulation is needed or appropriate." Lazarus, *supra*, at 205. To effectuate Congress's intent in passing the Clean Water Act – to protect and restore the waters of the United States – federal protections must extend beyond merely traditional navigable waters.

A. Wetlands and tributaries have a significant nexus to navigable waters based on hydrological and other connections.

Wetlands are complex ecosystems that are seasonally or permanently covered with shallow water, or lands in which the water table is near enough to the surface to

[5] The wetlands provisions of section 404, like sections 402 (discharge of waste) and 311 (governing oil facilities), are not themselves prohibitive. 33 U.S.C. §§ 1321, 1342, 1344. Taken together, each provides for exceptions to section 301, which prohibits discharges into waters of the United States. 33 U.S.C. § 1311. A definitional ruling affecting section 404 thus also impacts all discharges regulated by section 301.

cause the formation of hydric soils and growth of hydrophilic plants. Despite the myriad benefits wetlands provide humans and animals alike, until the mid-1970s federal policy specifically encouraged draining and filling of wetlands for mosquito control and to promote agricultural, commercial, and residential development. By the mid-1980s, approximately fifty-three percent of the nation's original wetlands were lost. National Research Council, *Compensating for Wetland Losses Under the Clean Water Act* 1 (2001). Although wetland loss has slowed in the past decade, the U.S. Fish and Wildlife Service estimates an average of 58,545 acres of wetlands were lost each year from 1986 to 1997. *Id.* at 3.

Many wetlands, like marshes that border lakes and streams, have obvious connections to surface waters. Others may appear to be isolated, but wetlands are almost always linked to stream networks and other wetlands through groundwater. Although freshwater ecosystems are diverse, depending on type, location, climate, and other factors, their structure and functions are intricately linked to the watershed of which they are a part. Through the hydrological cycle – the sun-fueled movement of water among the sea, air, and land – water moves through a landscape in three dimensions. Water connects upstream to downstream ecosystems, stream channels to floodplains and wetlands, and surface waters to ground water. This process also delivers natural materials – and man-made pollutants – into rivers, lakes, and estuaries.

Ecologists frequently refer to "aquatic and related terrestrial ecosystems" in recognition of the difficulty of analyzing aquatic environments without considering linkages to adjacent terrestrial environments. National Research Council, *Valuing Ecosystem Services: Toward*

Better Environmental Decision-Making 59 (2005). The connection between rivers and their floodplains is readily apparent, but what happens on land equally impacts these systems.

For example, the amount of nitrogen carried by major U.S. rivers has increased dramatically in recent decades as a result of terrestrial activities and wetland loss. Nitrogen levels in the Mississippi River, which drains forty percent of the coterminous United States, have tripled since the 1950s. Nitrogen causes excess algae growth, reduces recreational and aesthetic values, and contributes to low dissolved oxygen conditions that can kill aquatic organisms. The Heinz Center, *The State of the Nation's Ecosystems: Measuring the Lands, Waters, and Living Resources of the United States* 21, 36 (2002). As a result, wetlands lost in the Mississippi watershed far upstream from the Gulf of Mexico can nonetheless contribute to the formation of "dead zones" that threatens the Gulf's fisheries and aquatic resources.[6]

Additionally, some 20% of groundwater wells and 10% of streams in farmland areas exceed drinking water standards for nitrate, while more than half of America's larger rivers, three-quarters of farmland streams, and two-thirds of urban/suburban streams contained phosphorous levels at or above Environmental Protection Agency ("EPA") recommended levels for avoiding excess algae. *Id.* at 21. Three-quarters of stream samples and half of stream

[6] "Dead zones" form when fertilizers and other pollutants high in nitrogen and phosphorus are washed by rain into rivers, bays, and estuaries. The compounds feed an explosive growth of algae, which, in turn, die and rot. Bacteria devouring such decaying matter consume oxygen, suffocating marine life.

sediments tested were found to contain one or more chemical compounds exceeding guidelines for protection of aquatic life, and 60% of estuary sediments exceeded levels that indicate negative effects on aquatic life. *Id.* at 37.

Tributaries, streams, and adjacent wetlands have important connections that affect the ecological and economic functions of navigable waters. Surface and subsurface hydrological connections include overbank flow and flood connections, groundwater and drainage connections, and man-made conveyances such as ditches, culverts, dams, canals, and channels. Waste discharged into streams and tributaries can thus have significant deleterious downstream impacts. As Judge Posner correctly noted, "A ditch can carry as much water as a stream; many streams are tiny. It wouldn't make much sense to interpret the regulation as distinguishing between a stream and its manmade counterpart." *United States v. Gerke Excavating, Inc.*, 412 F.3d 804, 805-06 (7th Cir. 2005).

Biological connections include the use of streams, ponds, and wetlands by fish, waterfowl and wetland-dependent birds, amphibians, reptiles, insects, and plants. Many aquatic and semi-aquatic animals move between land-locked wetlands, streamside wetlands, and stream channels. Animals, including many spawning fish, often use different parts of the aquatic environment at different points in their life cycles; thus wildlife and food webs also link wetlands to larger waterways. *See generally* Judy L. Meyer *et al.*, American Rivers, *Where Rivers Are Born: The Scientific Imperative for Protecting Small Streams and Wetlands* (2003). Finally, as discussed in greater detail *infra* tributaries and wetlands are connected economically to navigable waters through tourism, recreation, and the municipal, commercial, and industrial uses of the waters they provide.

Notably, neither the text of the Clean Water Act, the implementing regulations, nor this Court currently conditions federal jurisdiction over wetlands and tributaries on the presence of hydrological or ecological connections to navigable waters. *Baccarat Fremont Developers, LLC v. United States*, 425 F.3d 1150, 1154 (9th Cir. 2005). Indeed, in *United States v. Riverside Bayview Homes, Inc.*, 474 U.S. 121 (1985), this Court did not require such a connection, noting "[t]hat the definition may include some wetlands that are not significantly intertwined with the ecosystem of adjacent waterways is of little moment" because the Corps can always grant a permit in such cases. *Id.* at 135 n.9. The *Riverside* Court correctly recognized the reasonableness of the Corps' determination that "in the majority of cases, adjacent wetlands have significant effects on water quality and the aquatic ecosystem." *Id.* Yet even if this Court were to impose a hydrological or ecological connection standard, such a test is easily met.[7]

B. Intact freshwater ecosystems provide valuable services that sustain human life and biodiversity.

Ecosystem services are "the conditions and processes through which natural ecosystems, and the species that make them up, sustain and fulfill human life." Gretchen C. Daily, *Introduction: What are Ecosystem Services? in Nature's*

[7] In *Baccarat*, the Ninth Circuit found such a connection based on the wetlands' proximity to flood control channels; functions that contribute to the aquatic environment, particularly in light of wetland loss in the San Francisco Bay area; location within a 100-year flood plain; and inclusion in a hydric soil unit contiguous with an area covered by tidal waters. *Baccarat,* 425 F.3d at 1157-58.

Services: Societal Dependence on Natural Ecosystems 3 (Daily, Gretchen C. ed., 1997). These include provisioning services such as water and food; regulating services such as regulation of floods, drought, land degradation, and disease; supporting services like soil formation and nutrient cycling; and cultural services such as recreational, spiritual, religious, and other nonmaterial benefits. *See generally* Millennium Ecosystem Assessment, World Resources Institute, *Ecosystem and Human Well-Being: Biodiversity Synthesis* (2005). As *Amicus* Edward O. Wilson has written:

> It is also easy to overlook the services that ecosystems provide humanity. They enrich the soil and create the very air we breathe. Without these amenities, the remaining tenure of the human race would be nasty and brief. The life-sustaining matrix is built of legions of microorganisms and mostly small, obscure animals, in other words, weeds and bugs. . . .They run the world precisely as we would wish it to be run.

Edward O. Wilson, *The Diversity of Life* 347 (1992).

Streams, tributaries, and wetlands, even those without obvious surface water connections, are integral parts of broader watersheds, and perform essential functions that affect the health of these systems. They are nature's filters and are essential to clean water. Abundant scientific evidence proves that pollution entering these upstream waters not only damages these waters and the creatures that inhabit them but will harm lakes, rivers, and waters further downstream as well. Simply put, the more wetlands and streams are destroyed, the more contaminants turn up in drinking water.

Many communities are beginning to recognize the water purification values of watersheds and are turning to

natural solutions to avoid construction of expensive water treatment facilities. New York City depends on the reservoirs and forested wetlands of the Catskill region – two-thirds of which is privately owned – for ninety percent of its water. Faced with capital costs of more than $6 billion and annual maintenance costs of $300 million for water treatment, New York City entered into an agreement in 1997 with state and federal officials, seventy towns and villages, and environmental organizations to invest $1.5 billion to restore and protect the Catskill watershed. The investment has had the desired effect; despite population pressures water quality is maintained naturally without the need for expensive filtration. New York City's program is perhaps most remarkable, but similar efforts are underway in Boston, Seattle, and other cities, with a savings of hundreds of millions of dollars in expenditures for water purification. Postel, *supra*, at 27-29.

Flood control and storm water retention are other critical ecosystem functions wetlands and tributaries provide, and the loss of these functions can contribute to the magnitude of natural events like storms and floods. The tsunami that claimed at least 227,000 lives in coastal Asia in 2004 cast a spotlight on the storm and wave protection afforded by mangrove swamps and coral reefs. *Id*. Similarly, the devastating impact of Hurricanes Katrina and Rita in the Gulf of Mexico highlighted what happens when water channelization fails and coastal wetlands lose their buffering abilities. *See* Virginia R. Burkett *et al*., *Sea-Level Rise and Subsidence: Implications for Flooding in New Orleans, Louisiana, in U.S. Geological Survey Subsidence Interest Group Conference, Proceeding of the Technical Meeting, Galveston, Texas* 63-73 (K. R. Prince & D. L. Galloway eds., 2003). Clearing trees, filling wetlands, and engineering rivers fray

the natural safety nets that healthy ecosystems provide, at a tremendous economic cost. Indeed, economic losses from natural disasters in the last ten years (not including the devastating hurricanes of 2005) totaled $566.8 billion, topping the combined losses from 1950 to 1989. Postel, *supra*, at 48.

After the Great Midwest Floods of 1993, when the upper Mississippi and Missouri Rivers reached record heights and floodwaters breached miles of levees, researchers turned to natural solutions for flood management. They concluded that an investment of $2-3 billion to restore 5.3 million hectares of water-absorbing wetlands in the Upper Mississippi watershed would have substantially reduced flood damage, which totaled $16-19 billion. Ed Rykiel, *Ecosystem Science for the Twenty-First Century*, Bio Science, October 1997, at 705-08; Janet Abramovitz, Worldwatch Institute, *Unnatural Disasters* 158 (2001).

Even the Corps of Engineers, which is responsible for most of the nation's flood control dams and levees, has found that wetlands and floodplains can often provide the same services at less cost, with important side benefits. Purchasing development rights to 3,440 hectares of floodplain wetlands in the headwaters of the Charles River in Massachusetts for $10 million provided storage for sixty-two million cubic meters of water, negating the necessity of a proposed $100 million dam and levee project. This natural wetlands flood control system helped contain large floods in 1979 and 1982 that would otherwise have caused considerable damage. National Research Council, *Valuing Ecosystem Services: Toward Better Environmental Decision-Making* 170 (2005). In Napa Valley, California, the Corps is relocating homes, roads and businesses to restore the Napa River's natural floodplain. The $155 million

project cost is one-tenth the amount that would be needed to repair flood damage over the next century if the floodplain were not restored. *Id.* Napa Valley residents supported a sales tax increase to pay for the project, recognizing that in addition to flood control, the project would lower flood insurance rates, provide parks and trails for recreation and wildlife watching, increase tourism revenues, and revitalize town centers. Postel, *supra*, at 51.

Headwaters systems trap sediment, which moves downstream in runoff from rain, snow, and floods. Too much sediment can fill reservoirs and navigation channels, impede transportation, damage commercial and recreational fisheries, harm aquatic habitats, and increase water filtration costs. Suspended sediment turns water murky, blocking light to underwater plants and reducing the spawning productivity of fish. As it settles, sediment can smother fish eggs and fill the gravel homes of small but important organisms at the bottom of the food chain. For municipalities, sediment poses significant financial costs. Dredging and removing sediment from the Patapsco River to keep Baltimore Harbor navigable costs more than $10 million each year. Meyer *et al.*, *supra*, at 12.

Tributaries, streams, and wetlands also provide habitat for diverse flora and fauna, including numerous threatened and endangered species. Unfortunately, many species are now at risk due to alteration of freshwater ecosystems. At least 123 species of freshwater fish, mollusks, crayfish, and amphibians have gone extinct since 1900 and the extinction rate for such species is expected to be five times greater than that of terrestrial species. Anthony Ricciardi & Joseph B. Rasmussen, *Extinction Rates of North American Freshwater Fauna*, 13 Conservation Biology 1220, 1220-22 (1999). Freshwater mussels are called "living filters"

because of their skill at purifying water. The United States has more known species of freshwater mussels than any other country with 292; yet sixty-nine percent are at risk of extinction or have already gone extinct. Postel, *supra*, at 22.

Wetlands contribute significantly to the nation's ecological diversity and provide habitat for wildlife and plants. According to a new study, 274 at-risk plant and animal species are supported by wetlands. Patrick Comer *et al.*, NatureServe, *Biodiversity Values of Geographically Isolated Wetlands in the United States* 1 (2005). A total of eighty-six plants and animals listed as threatened, endangered or candidates for listing under the Endangered Species Act ("ESA"), 33 U.S.C. §§ 1531 *et seq.* – roughly six percent of all listed and candidate species in the United States – are supported by isolated wetlands. Nearly half of the wetland types studied are known to support at least one ESA listed species. *Id.* Loss of wetland habitats could seriously impact the survival of these species. The Clean Water Act plays an indirect yet critical role in protecting these biodiversity values.

C. Alteration of stream and wetland ecosystems has spillover effects on terrestrial and downstream ecosystems.

Human-caused disruptions to the hydrological cycle, over time, diminish these and other ecosystem benefits and can even lead to societal collapse – what *Amicus* Jared Diamond calls "self-inflicted ecological suicides." Jared Diamond, *Collapse: How Societies Choose to Fail or Survive* (2004). Although collapse may seem far fetched in our modern, technologically-advanced world, the fact is human society is intrinsically dependent on the water cycle. Alterations to that cycle – including loss of wetland functions – have serious implications. As *Amicus* Stuart Pimm

has noted, "wetlands provide unusually high ecosystem services and once destroyed are almost impossible to restore." Stuart Pimm, *The Value of Everything,* Nature, May 15, 1997, at 231-32.

Although human manipulation of water through irrigation, dams, canals, deep pumps, and levees – provides the skeleton upon which the world's $55 trillion annual economic output depends, these advances have come at a cost that society is only beginning to appreciate. The signs of ecosystems in peril include disappearing species, falling water tables, plunging fish populations, shrinking lakes, diminished river flows, loss of wetlands, declining water quality, and pollution-induced "dead zones." Last summer, thirty-six percent of the Chesapeake Bay – formerly one of the world's most productive and economically valuable estuaries – had less than five milligrams per liter of dissolved oxygen, the minimum level needed by aquatic life. UPI, *Large Part of Chesapeake Bay is Dead Zone*, July 26, 2005.

The Missouri River – the longest in the continental United States – is another example of a failing ecosystem. Highly dammed and channelized for barge traffic, the river's modified flow patterns have dramatically affected habitat. The loss of natural floodplains, sandbars, and shallow-water habitats on the Missouri have led to steep declines in fish and bird species and riparian vegetation. State and federal agencies list as endangered, threatened or rare sixteen species of fish, fourteen birds, three mammals, and two mussels in that watershed. Populations of caddis flies, mayflies and other invertebrates have declined seventy percent, even in the unchannelized portions of the river. Postel, *supra*, at 21.

According to *Amicus* Sandra Postel, "This syndrome of flow modification, habitat destruction, and species imperilment is playing out in river systems all over the world. Although biodiversity loss does not necessarily equate with the loss of ecosystem services, it offers a rough proxy for impacts on ecosystem health and resilience." *Id.* at 21-22. There is substantial overlap, for instance, between lands protected for their biodiversity and conservation values (such as national parks and nature reserves) and lands that supply cities with drinking water. *Id.* at 29; *see also PUD No. 1 of Jefferson Co. v. Washington Dept. of Ecology*, 511 U.S. 700, 719 (1994) ("[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, as here, a fishery.").

The pervasiveness of chemical contaminants in river systems and groundwater further illustrates the spillover effects of upstream discharges. In Great Britain, scientists discovered traces of the anti-depressant Prozac in rivers and groundwater used for drinking. Kevin Hurley, *Prozac Seeping into Water Supplies*, The Scotsman, August 9, 2004. Closer to home, the U.S. Geological Survey tested 139 streams in thirty states and found that eighty percent contained traces of at least one drug, endocrine-disrupting hormone, insecticide, or other chemical – some at levels that are known to harm fish and aquatic life. Dana W. Kolpin *et al.*, *Pharmaceuticals, Hormones, and Other Organic Wastewater Contaminants in the U.S. Streams, 1999-2000; A National Reconnaissance*, Envtl. Sci. & Tech., March 15, 2002, at 1202-11; Postel, *supra* at 37. Indeed, "no ecosystem on the earth's surface is free of pervasive human influence." Peter M. Vitousek *et al.*, *Human Domination of the Earth's Ecosystems*, 277 Science 494, 494 (1997).

D. Small impacts to ecosystems can have sudden, exponential, or irreversible effects.

The pace of human-induced change raises the very real possibility of irreversible consequences. Ecosystems have a threshold character that does not always allow for predictable analyses of cause and effect. At a certain point, ecosystem alteration – be it by filling of wetlands or chemical contamination of streams – will reach what Malcolm Gladwell has popularized as a "tipping point" and result in sudden, exponential, or irreversible change.[8] A small amount of additional pollution or habitat disturbance could lead to catastrophic consequences. Millennium Ecosystem Assessment, World Resources Institute, *Living Beyond Our Means: Natural Assets and Human Well-Being* 15 (2005); D. J. Rappaport *et al*., *Ecosystem Behavior under Stress*, 125 Am. Naturalist 617, 626, 635 (1985). Coral reefs, for example, will collapse ecologically in response to incremental increases in contaminant concentrations or maximum water temperature. Coral Reef Information System, *Hazards to Coral Reefs*, http://www.coris.noaa.gov/about/hazards (visited January 9, 2006).

The waste assimilation and transport services of lakes, rivers, and estuaries are particularly relevant. Increases in nutrients from runoff and upstream tributaries can increase biotic productivity to the point of harmful eutrophication. That can accumulate organic matter, deplete oxygen in the water, and alter levels of nourishment – the trophic structure – in the system. But at a certain point, even if nutrient loads are reduced, these changes may persist. "From the perspective of ecosystem service assessment, waste

[8] Malcolm Gladwell, *The Tipping Point: How Little Things Can Make a Big Difference* (2002).

assimilation may still be occurring, but habitat services, recreational services, and maintenance of biodiversity may all be significantly changed. The point at which this abrupt shift in services occurs may be controversial and unpredictable." NRC, *Valuing Ecosystem Services*, *supra*, at 86-87. Wetland loss can dramatically impact nutrient storage.

The dynamic complexity of ecosystems and the nature of ecological injury is the context for any law or policy that would seek to manage human impacts on the environment, and ecology has shattered tidy notions of a bounded domain. Joseph Sax aptly frames the consequential dilemma for courts and policymakers: "Many things that a short time ago were thought entirely the business of a landowner within the confines of his or her own land are now revealed to be intimately interconnected with other lands and with public resources that have never been thought to belong to the owner of a given tract." Joseph Sax, *The Constitutional Dimensions of Property*, 26 Loy. L. Rev. 23, 33 (1992). Understanding ecosystem functions and values – and the downstream impacts of human activities – is thus essential to properly reconciling conflicts in environmental regulation.

II. DEGRADATION OF WETLANDS AND TRIBUTARIES SUBSTANTIALLY AND ADVERSELY AFFECTS INTERSTATE COMMERCE AND WARRANTS A COMPREHENSIVE FEDERAL RESPONSE.

A. Freshwater ecosystems provide economic services that directly affect interstate commerce.

Throughout this brief, *Amici* have illustrated the many ways that freshwater ecosystems affect human life

and contribute to the nation's prosperity. Tributaries, streams, and wetlands are a pivotal part of these aquatic systems, and their alteration has demonstrable downstream consequences that compromise water quality and quantity. Loss of wetlands and degradation of tributaries diminishes the entire system's services in water storage, water purification, sediment control, habitat for game and non-game species, and recreation.

Economic valuation can help assess the total contribution that particular ecosystems make to human well-being. *See* Millennium Ecosystem Assessment, World Resources Institute, *Ecosystem and Human Well-Being: A Framework for Assessment* (2005). Knowledge of the value of ecosystems services, in turn, can influence governments and industry alike to evaluate the consequences of alternative actions that may affect those services. In the last few decades, the field of environmental economics has made significant progress developing new approaches and methodologies to quantify the value of natural services. The total value of a wetland – taking into account water and habitat functions, as well as agricultural, industrial, and recreational values – often greatly exceeds the direct value of the wetland property for development.

For example, wetlands and floodplains benefit the public through wastewater reclamation and reuse, pollution abatement, aquifer recharge, and recreation. One recent study attempted to quantify the values of a range of ecosystem services provided by the Salt Creek Greenway in Illinois. The sum of the natural values of floodplain land, other than for flood control, was estimated at $8,177 per acre, while the estimated value of regional floodwater storage was $52,340 per acre. Combined, the total estimated value of preserved floodplain land in the greenway

was $60,517 per acre. NRC, *Valuing Ecosystem Services*, *supra*, at 170.

Biodiversity, which of course depends on water, has tremendous economic value as commodities traded in interstate commerce. Of the top 150 prescription drugs used in the United States, 118 are derived in whole or in part from natural sources: 74% from plants, 18% from fungi, 5% from bacteria, and 3% from one vertebrate snake species. Nine of the top ten drugs are based on natural plant products. Ecological Society of America, *Ecosystem Services: Benefits Supplied to Human Societies by Natural Ecosystems*, Issues in Ecology (1997), at 6; *see also* Norman Myers, *Biodiversity's Genetic Library*, *in Nature's Services*, *supra*, at 263. The commercial value of plant-derived drugs to developed nations alone during the 1990s amounted to some $500 billion. *Id*. at 264.[9]

Additionally, wetlands and tributaries contribute tremendous value for recreational pursuits. The value of the freshwater sport fishery in the U.S. as of 1991 was $16 billion. When aggregated with the employment value generated by sportfishing activities, the total reaches $46 billion. Ecological Society of America, *supra,* at 4. Nearly 2 million people participated in waterfowl hunting in 2001, spending $495 million on trip expenditures and $440 million on equipment in that year alone. U.S. Fish & Wildlife Service,

[9] *Amicus* Edward O. Wilson's words reinforce the point. "It is fashionable in some quarters to wave aside the small and obscure, bugs and weeds, forgetting that an obscure moth from Latin America saved Australia's pastureland from overgrowth by cactus, that the rosy periwinkle provided the cure for Hodgkin's disease and childhood lymphocytic leukemia, that the bark of the Pacific yew offers hope for victims of ovarian and breast cancer, that a chemical from the saliva of leeches dissolves blood clots during surgery . . . " Wilson, *supra*, at 347.

Economic Impact of Waterfowl Hunting in the United States, at 3 (2005), http://library.fws.gov/nat_survey2001_waterfowlhunting.pdf (visited January 9, 2006). In total, people engaged in wildlife watching, fishing, and hunting activities contributed more than $108 billion in revenue in 2001 to local communities across the country.

These numbers demonstrate a significant impact on the economy, but they still do not capture the full contribution of wetlands and freshwater ecosystems to interstate commerce. *Amicus* Edward O. Wilson explains:

> The traditional econometric approach, weighing market price and tourist dollars, will always underestimate the true value of wild species. None has been totally assayed for all of the commercial profit, scientific knowledge, and aesthetic pleasure it can yield. Furthermore, none exists in the wild all by itself. Every species is part of an ecosystem, an expert specialist of its kind, tested relentlessly as it spreads its influence through the food web. To remove it is to entrain changes in other species, raising the populations of some, reducing or even extinguishing others, risking a downward spiral of the larger assemblage.

Wilson, *supra*, at 308; *National Assoc. of Home Builders v. Babbitt,* 130 F.3d 1041, 1053 n.19 (D.C. Cir. 1997) (same). The more scientists and economists are able to translate these ecosystem services into monetary terms, the more readily grasped is their substantial impact on commerce.

Courts have long considered the regulation of activities affecting the nation's waters to be within the ambit of

the Commerce Clause.[10] *United States v. Deaton*, 332 F.3d 698, 707 (4th Cir. 2003) ("[T]he principle that Congress has the authority to regulate discharges into nonnavigable tributaries in order to protect navigable waters has long been applied to the Clean Water Act."). Indeed, the Corps and EPA regulations defining the term "waters of the United States" are premised on the fact that, because "[w]ater moves in hydrological cycles," pollution of waters that do not themselves meet traditional tests of navigability "will affect the water quality of the other waters within that aquatic system," *Riverside Bayview*, 474 U.S. at 134 (quoting 42 Fed. Reg. 37,128 (1977)). It follows that, to achieve its statutory aims, Congress can aggregate the effects of individual discharges to tributaries or fillings of wetlands to justify regulating each of them. *See Wickard v. Filburn*, 317 U.S. 111 (1942).

As Judge Posner aptly notes, filling a single upstream wetland "is not going to have a measurable effect on the depth of the Wisconsin or Mississippi Rivers. But that cannot be the test. The sum of many small interferences with commerce can be large, and so to protect commerce Congress must be able to regulate an entire class of acts if the class affects commerce, even if no individual act has a

[10] Professor Akhil Amar notes that " 'commerce' also had in 1787, and retains even now, a broader meaning referring to all forms of intercourse in the affairs of life." So read, Congress's power to act would hinge not on the question of whether an activity had a potential economic effect but whether "a given problem genuinely spilled across state or national lines." Akhil Reed Amar, *The Constitution: A Biography* 107-08 (2005). In our view, the loss of wetlands and its consequences for biodiversity, water quality, and aquatic ecosystems generally, is a national problem with implications that transcend state boundaries. Even isolated wetlands and species contribute significantly to ecosystem health and their impact cannot be arbitrarily delimited to state lines.

perceptible effect." *Gerke*, 412 F.3d at 806 (citing *Gonzales v. Raich*, 125 S. Ct. 2195, 2205-07 (2005); *Wickard*, 317 U.S. at 118-29).

B. Maintenance of a comprehensive national scheme for protecting waters of the United States is critical to achieving the goals of the Clean Water Act and federal environmental policy.

Alteration of tributaries, streams, and wetlands implicates both the "use of the channels of interstate commerce" and "those activities having a substantial relation to interstate commerce." *United States v. Morrison*, 529 U.S. 598, 609 (2000). But even if this Court decides there is no rational basis for concluding that these resources substantially affect interstate commerce – a highly dubious proposition from a scientific perspective – it should permit their regulation as a necessary part of a broader statutory scheme to protect and enhance our nation's waters.

In *United States v. Lopez*, this Court suggested that federal regulation of noncommercial, intrastate activity is constitutionally permissible under the Commerce Clause if the regulation was an "essential part of a larger regulation of economic activity, in which the regulatory scheme could be undercut unless the intrastate activity were regulated." *United States v. Lopez*, 514 U.S. 549, 561 (1995). Lower courts have employed this rationale to uphold the Endangered Species Act, which is a comprehensive regulatory scheme aimed at preserving the economic benefits of biodiversity and mitigating the negative effects of interstate economic competition. *GDF Realty Invs., Ltd. v. Norton*, 326 F.3d 622 (5th Cir. 2003); *Gibbs v. Babbitt*, 214

F.3d 483 (4th Cir. 2000).[11] The same rationale applies here; the "major purpose" of the Clean Water Act was "to establish a *comprehensive* long-range policy for the elimination of water pollution." S. Rep. No. 92-414, at 95 (1971) (emphasis added).

Last term, in *Gonzales v. Raich*, this Court affirmed this principle's validity in Commerce Clause jurisprudence. If a class of activities is properly regulated within the ambit of the Commerce Clause, the local character of a particular activity that falls within the class is immaterial. *Raich*, 125 S. Ct. at 2209; *id.* at 2217 (Scalia, J. concurring) ("Congress may regulate even non-economic local activity if that regulation is a necessary part of a more general regulation of interstate commerce."); *Maryland v. Wirtz*, 391 U.S. 183, 196 n.27 (1968) ("[W]here a general regulatory statute bears a substantial relation to commerce, the *de minimis* character of individual instances arising under the statute is of no consequence."). Moreover, both the *Raich* majority and Justice Scalia in concurrence recognized that the comprehensive scheme principle flows equally from Congress's authority to " 'make all Laws

[11] At least three circuits have upheld the ESA as a valid economic regulatory scheme. *GDF Realty Invs., Ltd. v. Norton*, 326 F.3d 622, 640 (5th Cir. 2003); *Gibbs v. Babbitt*, 214 F.3d 483, 494 n.3 (4th Cir. 2000); *Rancho Viejo, LLC v. Norton*, 323 F.3d 1062, 1073-74 (D.C. Cir. 2003); *see also National Ass'n of Homebuilders v. Babbitt*, 130 F.3d 1041 (D.C. Cir. 1997). In those cases, as here, an economic regulatory statute passed constitutional muster because Congress could rationally conclude that regulation of a broad class of activities is essential to its functionality. "The court must defer to a congressional finding that a regulated activity affects interstate commerce, if there is any rational basis for such a finding." *Hodel v. Virginia Surface Mining & Reclamation Assoc.*, 452 U.S. 264, 276 (1981). As *Amici* have demonstrated, such a conclusion is not only rational but firmly grounded in science.

which shall be necessary and proper' to 'regulate Commerce . . . among the several States.'" *Raich*, 125 S. Ct. at 2209 (quoting U.S. Const., Art. I. § 8). Not only is a ruling for the United States in the present cases consistent with the Commerce Clause, it is also supported by the Necessary and Proper Clause because regulation of upstream tributaries and adjacent wetlands is essential to the statutory scheme. *GDF Realty*, 236 F.3d at 641-42 (Dennis, J. concurring) (noting that the Necessary and Proper Clause supports the constitutionality of the ESA).

The Clean Water Act establishes a comprehensive scheme to eliminate water pollution and preserve aquatic ecosystems. Congress's intent to restore and maintain the chemical, physical, and biological integrity of the nation's waters will be seriously undercut if the modification of tributaries, streams, and adjacent wetlands "were excepted from its general scheme of regulation." *Raich,* 125 S. Ct. at 2220.

CONCLUSION

The judgments of the U.S. Court of Appeals for the Sixth Circuit in *Rapanos* and *Carabell* should be affirmed.

Respectfully submitted,

JASON C. RYLANDER*
DEFENDERS OF WILDLIFE
1130 17th Street, NW
Washington, D.C. 20036
(202) 682-9400

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Counsel for Amici Curiae