

Spring 3-1-2010

Climate Change Comes to the Clean Water Act: Now What?

Robin Kundis Craig

Follow this and additional works at: <https://scholarlycommons.law.wlu.edu/jece>



Part of the [Environmental Law Commons](#)

Recommended Citation

Robin Kundis Craig, *Climate Change Comes to the Clean Water Act: Now What?*, 1 Wash. & Lee J. Energy, Climate & Env't. 9 (2010), <https://scholarlycommons.law.wlu.edu/jece/vol1/iss1/4>

This Article is brought to you for free and open access by the Journal of Energy, Climate, and the Environment at Washington & Lee University School of Law Scholarly Commons. It has been accepted for inclusion in Washington and Lee Journal of Energy, Climate, and the Environment by an authorized editor of Washington & Lee University School of Law Scholarly Commons. For more information, please contact lawref@wlu.edu.

Climate Change Comes to the Clean Water Act: Now What?

Robin Kundis Craig*

Abstract

In January 2009, the EPA agreed to respond to the Center for Biological Diversity's (CBD's) petition requesting it to modify its marine pH water quality criteria to reflect ocean acidification. Ocean acidification, however, is a by-product of increasing concentrations of carbon dioxide in the atmosphere. Thus, climate change has come to the Clean Water Act—and in May 2009, the CBD filed suit in the U.S. District Court for the District of Washington to bring this point home.

The question, of course, is what the Clean Water Act can actually contribute to efforts to deal with climate change. After reviewing the Act's basic provisions (Part I) and the various kinds of impacts that climate change is likely to have on water quality in the United States (Part II), this Article systematically evaluates the contributions that the Clean Water Act can (Part III) and cannot (Part IV) make to efforts to respond to climate change. It argues that the EPA and the states could use the Act to: (1) make valuable contributions to the nation's efforts to gather information about actual climate change impacts on water resources and to promote more effective modeling of future impacts; (2) generate expert recommendations about potential responses to those impacts; and (3) encourage and require states and the EPA to implement water quality standards, permitting requirements, best management practices, and other measures to blunt the worst water quality impacts from climate change, increase protections for particularly sensitive areas, and increase the resilience of aquatic species, aquatic ecosystems, and the socio-ecological systems dependent upon them.

However, the Article also argues that the Obama Administration and Congress could implement several changes to the Act and its regulations that would increase its effectiveness as a climate change adaptation tool.

* Attorneys' Title Professor of Law, Florida State University College of Law, Tallahassee, Florida. My thanks to Professor Hari Osofsky for inviting me to participate in the Washington & Lee School of Law's Symposium on "Climate Policy for the Obama Administration." Comments on this Article may be directed to me at rcraig@law.fsu.edu.

Finally, the Article concludes that even though the total maximum daily load (TMDL) provisions could be interpreted to reach greenhouse gas emissions, such an interpretation would lead to costly and ultimately ineffective efforts to make the Clean Water Act a climate change mitigation tool—a role for which the Act is not at all suited.

Table of Contents

I.	Introduction	11
II.	The Clean Water Act's Regulatory Regime.....	13
III.	Climate Change-Driven Impacts on Water Quality	18
IV.	What Can the Clean Water Act Do to Help Respond to Climate Change Problems?.....	23
	A. The EPA Can Use the Clean Water Act to Increase Knowledge about System Changes and Tolerances, Giving Governments Valuable Information for Climate Change Planning and Possible Revisions to State Water Quality Standards	24
	B. The Clean Water Act Can Increase Species, Ecosystem, and Human Resilience by Reducing Pollutant Stressors	28
	1. Water Quality Criteria and Standards in a Climate Change Era.....	30
	2. Climate Change-Reflective NPDES Permitting	30
	3. The EPA's Authority over Toxic Water Pollutants.....	31
	4. Best Management Practices for Nonpoint Sources.....	33
	5. Protecting Particular Waters from Pollution.....	35
	C. Nevertheless, the Obama Administration Could Make Several Changes to the Clean Water Act to Improve Its Ability to Deal with Climate Change.....	37
	1. Increasing Reductions in Water Pollution	37
	a. EPA: The Clean Water Act should effectively regulate pollutants that currently largely escape effective control.....	37
	b. EPA and States: Regulate synergistic sources of pollution more stringently and effectively.....	38
	c. EPA: Toxic effluent standards and other regulations should become more common.	38

d.	The EPA should develop more biocriteria like the ones it intends to propose for coral reefs.	39
e.	Congress: Fix the Rapanos problem and clarify that jurisdiction extends to the limits of the Commerce Clause.	40
f.	Congress: The Clean Water Act should extend enforceable regulation at the federal level to sources that have largely escaped control, such as agricultural sources and nonpoint sources.	41
g.	Congress: Should the Clean Water Act require something more than BAT?	42
2.	Increasing Flexibility in the Face of Climate Change Impacts.....	42
V.	What Can't the Clean Water Act do about Climate Change?	44
A.	The Clean Water Act Cannot Stop Climate Change Impacts	44
B.	The Clean Water Act Cannot Generate a Rational or Effective Regulatory Program for Reducing GHG Emissions, Despite the Potential Applicability of the TMDL Requirement to GHG Emitters	45
VI.	Conclusion: So What Should President Obama's Administration do about Climate Change Pursuant to the Clean Water Act?.....	47

I. Introduction

On January 16, 2009, the U.S. Environmental Protection Agency (EPA) agreed to address the Center for Biological Diversity's (CBD's) December 2007 petition requesting that the EPA revise its water quality criteria for marine pH pursuant to the federal Clean Water Act¹ to reflect current knowledge about ocean acidification.² Ocean acidification is a by-product of increasing carbon dioxide concentrations in the atmosphere. Climate change has come to the Clean Water Act.

1. 33 U.S.C. §§ 1251–1387 (2006).

2. Letter from Benjamin H. Grumbles, Assistant Adm'r, U.S. Env'tl. Prot. Agency, to Ms. Miyoko Sakashita, Attorney, Center for Biological Diversity (Jan.16, 2009), at 1, available at http://www.biologicaldiversity.org/campaigns/ocean_acidification/pdfs/EPA_Response_to_CBD_Ocean_Acidification_Petition.pdf.

Although the EPA acted on the CBD's petition in part by issuing a Notice of Data Availability with respect to ocean acidification in April 2009,³ less than a month thereafter, the CBD filed a lawsuit against the EPA in the U.S. District Court for the District of Washington.⁴ While this lawsuit addresses neither the petition nor climate change directly, it does offer a warning to coastal states that climate change can spur Clean Water Act violations. In this lawsuit, CBD challenges the EPA's January 2009 approval of Washington's impaired waters list. According to the CBD, Washington's list did not include its coastal waters, even though the pH of those waters had dropped by 0.2 pH units, violating Washington's water quality standards.⁵

Climate change will impact water resources in a variety of ways, including by increasing water temperatures in both fresh and marine waters, decreasing overall water supplies in some parts of the country, and increasing flood events almost everywhere. All of these impacts will make it increasingly difficult for states and the EPA to meet the Clean Water Act's overall goal of "restor[ing] and maintain[ing] 'the chemical, physical, and biological integrity of the Nation's waters.'"⁶ In particular, increasing temperatures, increased pollution from runoff, and/or more concentrated pollution in shrinking rivers and lakes are all likely to lead to violations of water quality standards, prompting lawsuits similar to the one the CBD has filed.

The question, of course, is what the Clean Water Act can actually contribute to efforts to deal with global climate change. Part I of this Article reviews the Act's basic provisions, including its goals and regulatory scope. Part II reviews in greater detail the effects that climate change is already having on water resources and water quality, which are expected to worsen over time. Part III looks at what the Clean Water Act *can* do to address climate change, while Part IV examines what it *cannot* do.

Positing that the Act's total maximum daily load (TMDL) provisions⁷ are likely to become the focus of debates over its "proper" use in addressing

3. Notice of Data Availability, 74 Fed.Reg.17,484 (April 15, 2009).

4. Center for Biological Diversity v. Env'tl. Prot. Agency (D. Wash., filed May 14, 2009).

5. Center for Biological Diversity, Press Release: *Lawsuit Filed Against Environmental Protection Agency for Failure to Combat Ocean Acidification*, CENTER FOR BIOLOGICAL DIVERSITY (May 14, 2009), http://www.biologicaldiversity.org/news/press_releases/2009/ocean-acidification-05-14-2009.html.

6. 33 U.S.C. § 1251(a).

7. 33 U.S.C. § 1313(d).

climate change, this Article argues that those provisions, and the Clean Water Act as a whole, are a poor tool for climate change *mitigation*—that is, efforts to reduce greenhouse gas (GHG) emissions and the concentration of GHGs, especially carbon dioxide, in the atmosphere. Instead, the Clean Water Act much more suitably aids climate change *adaptation* efforts—the steps humans can take to help themselves, species, ecosystems, and socio-ecological systems to adjust to climate change impacts.

II. *The Clean Water Act's Regulatory Regime*

It is perhaps an obvious point but, in the context of the CBD's ocean acidification petition and lawsuit, one worth making: the Clean Water Act regulates discharges of pollutants into waters, not emissions of air pollutants. Specifically, the Act's regulatory programs derive from its declaration that, except as in compliance with the Act itself, “the discharge of any pollutant by any person shall be unlawful.”⁸ This seemingly simple phrase is a defined term under the Act: a “discharge of a pollutant” is “(A) any addition of any pollutant to navigable waters from any point source, [and] (B) any addition of any pollutant to the waters of the contiguous zone or the ocean from any point source other than a vessel or other floating craft.”⁹ Thus, for Clean Water Act jurisdiction to exist there must be: (1) an addition; (2) of a pollutant; (3) to jurisdictional waters; (4) from a point source.

According to the Act, “navigable waters” are the “waters of the United States, including the territorial seas,”¹⁰ a zone encompassing the first three miles of ocean.¹¹ The Act's references to the territorial seas, the contiguous zone, and the ocean make it clear that the Clean Water Act applies to discharges of pollutants to the seas. This forms one basis for the CBD's ocean acidification petition. In contrast, the exact contours of the non-marine “navigable waters” under the Act is currently ambiguous,¹² but those waters include at a minimum the traditionally “navigable in fact” waters,

8. 33 U.S.C. § 1311(a).

9. 33 U.S.C. § 1362(12).

10. 33 U.S.C. § 1362(7).

11. 33 U.S.C. § 1362(8).

12. *See Rapanos v. United States*, 547 U.S. 715 (2006) (presenting a 4-1-4 non-decision on the meaning of “navigable waters” and “waters of the United States”). Other courts have interpreted the *Rapanos* split. *See, e.g., United States v. Robison*, 505 F.3d 1208 (11th Cir. 2007); *N. California River Watch v. City of Healdsburg*, 496 F.3d 993, 999-1000 (9th Cir. 2007); *United States v. Johnson*, 467 F.3d 56, 64 (1st Cir. 2006); *United States v. Gerke Excavating, Inc.*, 464 F.3d 723, 724-25 (7th Cir. 2006).

adjacent wetlands, and smaller tributaries and wetlands linked to the traditional navigable waters that can influence water quality in those navigable waters.¹³

Federal jurisdiction under the Act also requires the addition of a pollutant from a point source. A “point source” is “any discernible, confined, and discrete conveyance,” like a pipe,¹⁴ but the phrase has also been interpreted to apply to almost any human-controlled conveyance of pollutants.¹⁵ Other sources of water pollution, such as runoff, are nonpoint sources, which the various states are supposed to regulate by other means.¹⁶

The Clean Water Act defines “pollutant” broadly to include “dredged spoil, solid waste, incinerator residue, sewage, garbage, sewage sludge, munitions, chemical wastes, biological materials, radioactive materials, heat, wrecked or discarded equipment, rock, sand, cellar dirt, and industrial, municipal, and agricultural waste discharged into water.”¹⁷ Notably for the climate change era, this definition explicitly includes “heat” as a pollutant.

Finally, the Act does not define “addition.” Nevertheless, case law has defined this term to include most non-natural conveyances of pollutants to a water body.¹⁸

If federal jurisdiction exists, the most common way of complying with the Clean Water Act is to get a permit. Persons discharging “dredged” or “fill” material¹⁹ into the navigable waters must obtain a Section 404 “dredge

13. See 33 C.F.R. § 323.2 (listing regulated waters); see also *United States v. Riverside Bayview Homes, Inc.*, 474 U.S. 121, 132-33 (1985) (concluding that the Act applies to adjacent wetlands); *Rapanos*, 547 U.S. at 730-31 (noting that “navigable waters” under the Act are broader than traditional navigable waters).

14. 33 U.S.C. § 1362(14).

15. See *Parker v. Scrap Metal Processors, Inc.*, 386 F.3d 993, 1009 (11th Cir. 2004) (interpreting “point source” broadly); see also *Dague v. City of Burlington*, 935 F.2d 1343, 1354-55 (2d Cir. 1991) (same).

16. 33 U.S.C. § 1329.

17. 33 U.S.C. § 1362(6). However, the Act also specifies that “pollutant” does not mean “(A) ‘sewage from vessels or a discharge incidental to the normal operation of a vessel of the Armed Forces’... or (B) water, gas, or other material which is injected into a well, if the well used either to facilitate production or for disposal purposes is approved by authority of the State in which the well is located, and if such State determines that such injection or disposal will not result in the degradation of ground or surface water resources.” *Id.*

18. See generally, *Micosukee Tribe of Indians of Florida v. S. Florida Water Mgmt. Dist.*, 280 F.3d 1364 (11th Cir. 2002) (establishing a “but for” test to determine whether an addition of pollutants has occurred); *Catskill Mountains Chapter of Trout Unlimited, Inc. v. City of New York*, 273 F.3d 481, 491-93 (2d Cir. 2001) (invoking a “natural flow” test for whether an addition of pollutants has occurred); *Dubois v. U.S. Dept. of Agriculture*, 102 F.3d 1273 (1st Cir. 1996) (holding that waters that flow non-naturally from a more polluted to a less polluted water body “add” pollutants for purposes of the Act).

19. “Dredged material” is “material that is excavated or dredged from waters of the United States.” 33 C.F.R. § 323.2(c). “Fill material,” in turn, is “material placed in waters of

and fill” permit from the U.S. Army Corps of Engineers²⁰ or, in limited circumstances, from the state.²¹ Persons discharging any other kind of pollutant into navigable waters or the ocean must generally obtain a Section 402 National Pollutant Discharge Elimination System (NPDES) permit from the EPA²² or the relevant state.²³

The terms used in each type of permit derive from different sources. For example, for Section 404 permits, the EPA has issued the Section 404(b)(1) Guidelines under the Act.²⁴ These Guidelines specify that “dredged or fill material should not be discharged into the aquatic ecosystem, unless it can be demonstrated that such a discharge will not have an unacceptable adverse impact either individually or in combination with known and/or probable impacts of other activities affecting the ecosystem of concern.”²⁵ Moreover, the Guidelines explicitly prohibit discharges of dredged or fill material that cause or contribute to violations of state water quality standards, violate toxic effluent standards, jeopardize endangered or threatened species, or violate requirements relating to National Marine Sanctuaries.²⁶

Otherwise, the Guidelines seek to prevent “significant degradation of the waters of the United States.”²⁷ To achieve this goal the Army Corps and, much more rarely, the EPA, can impose conditions on Section 404 permits that require the reduction or mitigation of the impacts of the discharge, most famously through wetlands mitigation banking and other forms of replacing wetlands.²⁸ Similarly, the Army Corps’ public interest review can lead to

the United States where the material has the effect of: (i) Replacing any portion of a water of the United States with dry land; or (ii) Changing the bottom elevation of any portion of a water of the United States.” 33 C.F.R. § 323.2(e).

20. 33 U.S.C. § 1344(a), (d).

21. 33 U.S.C. § 1344(g). While the Act allows the state to acquire Section 404 permitting authority, that authority does not extend to the traditionally navigable waters. *Id.* § 1344(g)(1). Moreover, only two states, Michigan and New Jersey, have acquired Section 404 permitting authority. See EPA, *State or Tribal Assumption of the Section 404 Permit Program*, EPA.GOV (Jan. 12, 2009), <http://www.epa.gov/owow/wetlands/facts/fact23.html>. As a result, the Army Corps issues almost all § 404 permits.

22. 33 U.S.C. § 1342(a).

23. 33 U.S.C. § 1342(b). Unlike for Section 404 permits, most states have acquired at least partial NPDES permitting authority. See EPA, *National Pollutant Discharge Elimination System (NPDES): State Program Status*, EPA.GOV (last updated Apr. 14, 2003), <http://cfpub.epa.gov/npdes/statestats.cfm>. Therefore, states issue most NPDES permits.

24. 33 U.S.C. § 1344(b)(1); 40 C.F.R. Part 230.

25. 40 C.F.R. § 230.1(c).

26. 40 C.F.R. § 230.10(b).

27. 40 C.F.R. § 230.10(c).

28. 40 C.F.R. § 230.10(d).

other requirements to reduce the detrimental impact on a variety of potential benefits from waters, including fish and wildlife, water quality, navigation, scenic and recreational values, energy conservation, and coastal zone protections.²⁹

In contrast, the terms of NPDES permits generally derive from the Act's various technology-based effluent limitations.³⁰ An effluent limitation under the Act is "any restriction established by a State or the Administrator on quantities, rates, and concentrations of chemical, physical, biological, and other constituents which are discharge from point sources into navigable waters, the waters of the contiguous zone, or the ocean, including schedules of compliance."³¹ Technology-based effluent limitations are generally numeric limitations on the concentration of a specific pollutant that can be discharged from a point source, depending on the technology available to control that discharge.

The Act initially subjected pollutant discharges from existing point sources other than sewage treatment plants ("publicly owned treatment works," or POTWs) to effluent limitations based on the "best practicable control technology currently available" (BPT).³² It provides limitations based on "best conventional pollutant control technology" (BCT) for the conventional pollutants such as grease and pH³³ and "best available technology economically achievable" (BAT) for all other pollutants, including toxics.³⁴ POTWs are subject to effluent limitations based on secondary treatment of sewage,³⁵ while new point sources are subject to new source performance standards (NSPS) that "reflect[] the greatest degree of effluent reduction which the Administrator determines to be achievable through application of the best available demonstrated control technology . . . including, where practicable, a standard permitting no discharge of pollutants."³⁶

Nevertheless, NPDES permits occasionally include terms that are more stringent than the applicable technology-based effluent limitations, because the Clean Water Act ultimately requires compliance with water quality standards set by states. To aid states in setting these standards, the Act first

29. See 33 C.F.R. § 320.4 (outlining the Army Corps' public interest review).

30. See 33 U.S.C. § 1311(b).

31. 33 U.S.C. § 1362(11).

32. 33 U.S.C. § 1311(b)(1)(A).

33. 33 U.S.C. § 1311(b)(2)(E).

34. 33 U.S.C. §§ 1311(b)(2)(A), 1317(a)(2).

35. 33 U.S.C. § 1311(b)(1)(B).

36. 33 U.S.C. §§ 1316(a)(1), (b)(1)(B).

requires the EPA to establish reference water quality criteria.³⁷ The CBD's ocean acidification petition, for example, asks the EPA to amend its reference water quality criteria for marine pH.³⁸ These criteria must reflect:

[T]he latest scientific knowledge (A) on the kind and extent of all identifiable effects on health and welfare, including, but not limited to, plankton, fish, shellfish, wildlife, plant life, shorelines, beaches, esthetics, and recreation which may be expected from the presence of pollutants in any body of water, including ground water, (B) on the concentration and dispersal of pollutants, or their byproducts, through biological, physical, and chemical processes, and (C) on the effects of pollutants on biological community diversity, productivity, and stability, including information on the factors affecting rates of eutrophication and rates of organic and inorganic sedimentation for varying types of receiving waters.³⁹

In addition, the EPA is required to “develop and publish” information on how to restore and maintain water quality, protect shellfish, fish, and wildlife in various kinds of waters, measure water quality, and set TMDLs.⁴⁰

Relying on the EPA's reference criteria, states set water quality standards for all their navigable waters, including the first three miles of ocean.⁴¹ Water quality standards have two components: (1) designated uses: the uses that the state wants the waters to support, usually including all existing uses; and (2) water quality criteria: the numeric and narrative standards for various pollutants—pH, toxics, temperature, nutrients, and so on—necessary to support the designated uses.⁴²

Water quality standards can directly influence the terms of NPDES permits. If the standard industry-wide technology-based effluent limitations are not stringent enough to ensure that the specific water body in question meets its water quality standards, the state or the EPA must adjust the permit limitations with water-quality-based effluent limitations.⁴³ The state's water quality criteria and the EPA's reference water quality criteria usually help to determine what the permit's water-quality-based effluent limitations will be.

Less directly, water quality standards can influence NPDES permits through the TMDL program. The Clean Water Act's TMDL provisions require each state to identify all waters within the state's borders that do not

37. 33 U.S.C. § 1314.

38. See Letter from Benjamin H. Grumbles to Miyoko Sakashita, *supra* note 2.

39. 33 U.S.C. § 1314(a)(1).

40. 33 U.S.C. § 1314(a)(2).

41. 33 U.S.C. §§ 1313(a), (c).

42. 40 C.F.R. §§ 131.3(b), (f).

43. 33 U.S.C. § 1312(a).

meet their water quality standards and to rank those waters in terms of priority.⁴⁴ The state then sets a TMDL for each pollutant contributing to the water quality standard violation.⁴⁵ A TMDL is the total amount of a specific pollutant that can be added to the water body on a daily basis *without* violating the relevant water quality standard.

Setting a TMDL can be time-consuming and expensive,⁴⁶ and most states and the EPA set them only in response to litigation.⁴⁷ However, setting the TMDL is only the first step in the process. Once the TMDL exists, the state must divvy up this pollutant allowance among the point sources (the waste load allocation, or WLA), and nonpoint sources and natural background sources (collectively, the load allocation or LA).⁴⁸ Thus, a TMDL can lead both to amendments of NPDES permits to impose more stringent discharge requirements and to revisions in state nonpoint source regulation.

III. Climate Change-Driven Impacts on Water Quality

The goal of the Clean Water Act, as noted, is “to restore and maintain the chemical, physical, and biological integrity of the Nation’s waters.”⁴⁹ Climate change, however, is already making this goal more difficult to achieve.

Since the Industrial Revolution, concentrations of carbon dioxide in the atmosphere have been increasing, causing the now widely accepted phenomenon of global climate change.⁵⁰ There is no question but that climate

44. 33 U.S.C. § 1313(d)(1).

45. *Id.*

46. See EPA, TMDL DEVELOPMENT COST ESTIMATES: CASE STUDIES OF 14 TMDLS 13 (May 1996) (reporting that 8 out of 14 TMDLs studied in the 1990s cost between \$100,000 and over \$1 million each just to develop). Virginia expects to spend over \$10.7 million over the course of 10 years to develop and implement TMDLs required by litigation. VIRGINIA DEPARTMENT OF ENVIRONMENTAL QUALITY, GET THE FACTS: TMDL PROGRAM FIVE YEAR PROGRESS REPORT 2 (Feb. 2005), available at <http://www.deq.state.va.us/export/sites/default/tmdl/pdf/04rptfs.pdf>.

47. See EPA, *Litigation Status: TMDL Litigation by State*, EPA.GOV (March 2009) <http://www.epa.gov/owow/tmdl/lawsuit.html> (summarizing litigation on TMDL establishment).

48. 40 C.F.R. § 130.2(g)–(i).

49. 33 U.S.C. § 1251(a).

50. INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE, CLIMATE CHANGE 2007: SYNTHESIS REPORT: SUMMARY FOR POLICYMAKERS 5 (Nov. 2007) [hereinafter 2007 IPCC SYNTHESIS REPORT].

change will impact water resources and water quality. Indeed, these are among the most accepted of climate change impacts.⁵¹

Moreover, climate change is affecting and will continue to affect water quality in a variety of ways. First, climate change is expected to reduce overall water supplies in many parts of the country, especially the already water-strapped West, and hence increase demand for water withdrawals.⁵² For example, in 2000 the U.S. Global Change Research Team concluded that decreasing rainfall in the United States would increase demands for irrigation water for agriculture and other 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 U.S., thereby affecting navigation and general water supplies.⁵³

Both the decreased precipitation and increased withdrawals of water will reduce the total amount of water present in lakes, streams, and rivers, concentrating any pollutants present and lowering water quality.⁵⁴

Second, climate change is already changing the timing of water supplies in many parts of the country, especially those that rely on snow melt for late spring, summer, and early fall flows. Increasing temperatures both will reduce the amount of snowpack and cause it to melt faster, more extensively, and earlier.⁵⁵ As a result, flows will be reduced, again concentrating pollutants and degrading water quality. As the U.S. Global Change Research Team

51. *See id.* at 8–10.

52. *See* 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 11, 98 (2000) [hereinafter 2000 USGCRP OVERVIEW REPORT], available at <http://www.usgcrp.gov/usgcrp/Library/nationalassessment/overview.htm> (“Reduced summer runoff, increased winter runoff, and increased demands are likely to compound current stresses on water supplies and flood management, especially in the western US.”).

53. *Id.* at 98.

54. *See id.* at 7 (noting that climate change impacts are likely to compound water pollution problems in the United States).

55. *See id.* at 96 (“Snowpack serves as natural water storage in mountainous regions and northern portions of the US, gradually releasing its water in spring and summer. Snowpack is very likely to decrease as the climate warms, despite increasing precipitation, for two reasons. It is very likely that more precipitation will fall as rain, and that snowpack will develop later and melt earlier.”).

recognized, “[i]ncreases in water temperature and changes in seasonal patterns of runoff will very likely disturb fish habitat and affect recreational uses of lakes, streams, and wetlands.”⁵⁶

Third, changing rainfall patterns in many parts of the country may produce increased flooding.⁵⁷ Flooding produces large amounts of runoff flowing over land, fields, parking lots, roads, and other surfaces. As Congress recognized when it added storm water discharge permitting requirements to the Clean Water Act,⁵⁸ this runoff generally contains numerous pollutants that impair water quality, including sediments, nutrients, pesticides, oil, grease, gasoline, and litter.⁵⁹ Moreover, as the U.S. Global Change Research Team noted, “Flooding can cause overloading of storm and wastewater systems, and damage water and sewage treatment facilities, mine tailing impoundments, and landfills, thereby increasing the risks of contamination.”⁶⁰

Fourth, increasing air temperatures are already raising water temperatures in many streams, lakes, and rivers. As noted, heat is itself a pollutant under the Clean Water Act,⁶¹ and increasing water temperatures may also render waters incapable of supporting existing uses. As the U.S. Global Change Research Team has noted generally:

Rising water temperatures and changes in ice cover are of particular importance to the ecology of lakes, streams, and their biological communities. Such changes are likely to affect how ecosystems function, especially in combination with chemical pollution. For example, when warmer lake water combines with excess nutrients from agricultural fertilizers (washed into the lake by heavy rains), algae blooms on the lake surface, depleting the ecosystem of oxygen and harming the other organisms in the system.⁶²

56. *Id.* at 11.

57. *See id.* at 96 (“Precipitation is very likely to continue to increase on average, especially in middle and high latitudes, with much of the increase coming in the form of heavy downpours. Changes in the amount, timing, and distribution of rain, snowfall, and runoff are very probable, leading to changes in water availability as well as in competition for water resources. Changes are also likely in the timing, intensity, and duration of both floods and droughts, with related changes in water quality.”).

58. 33 U.S.C. § 1342(p).

59. *See* 2000 USGCRP OVERVIEW REPORT, *supra* note 52, at 99 (“For example, more frequent heavy precipitation events will very likely flush more contaminants and sediments into lakes and rivers, degrading water quality. Thus, it is likely that pollution from agricultural chemicals and other non-point sources will be exacerbated.”).

60. *Id.*

61. *See* 33 U.S.C. § 1362(6) (defining “pollutant” to include heat).

62. 2000 USGCRP OVERVIEW REPORT, *supra* note 52, at 99.

Temperature is already impacting existing uses in waters of the United States. For example, trout streams in Montana have in the past supported a \$300 million recreational fishery.⁶³ However, increasing average air temperatures and less snowmelt have decreased summer flows and increased water temperatures—and trout begin to die when water temperatures reach 78°F.⁶⁴

Fifth, increasing water temperatures also change the chemical reactivity of water and its components, and the resulting effects on water quality can cause water bodies to violate their water quality standards. For example, as water warms, its capacity to hold dissolved oxygen decreases, reducing the water body's ability to support animal life.⁶⁵ In January 2009, researchers at the University of Copenhagen, Denmark, reported that their modeling of the world's oceans predicted significant losses of dissolved oxygen in the surface ocean waters over the next two centuries because of rising temperatures caused by climate change, with a related expansion of ocean "dead zones" (hypoxic zones) that support little to no life.⁶⁶

Sixth, as the ocean acidification problem demonstrates, the build-up of greenhouse gases like carbon dioxide in the atmosphere can promote chemical interactions between air and water that change water quality. Ocean acidification begins when carbon dioxide in the atmosphere dissolves into seawater.⁶⁷ Once dissolved, carbon dioxide reacts with the seawater to form carbonic acid⁶⁸—the same reaction that gives sodas their fizz and their ability to dissolve tooth enamel. The oceans are naturally basic, with a pH of about 8.16, and that pH level has been remarkably stable over geological time.⁶⁹

63. Climate Central, *Montana: Drought and Trout*, CLIMATECENTRAL.ORG <http://www.climatecentral.org/video/montana-trout-drought> (last visited Jan. 26, 2010).

64. *Id.* See also 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 100 (2000), available at <http://www.usgcrp.gov/usgcrp/Library/nationalassessment/overview.htm> ("Rising temperatures in surface waters are likely to force out some cold water fish species such as salmon and trout that are already near the threshold of their viable habitat.").

65. 2000 USGCRP OVERVIEW REPORT, *supra* note 52, at 100.

66. Gary Shaffer, Steffen Malskaer Olsen, & Jens Olaf Pepke Pedersen, *Long-term ocean oxygen depletion in response to carbon dioxide emissions from fossil fuels*, 2 NATURE GEOSCIENCE 105, 105–109 (Jan. 25, 2009).

67. Ocean Acidification Network, *How is Ocean Acidity Changing?*, OCEAN ACIDIFICATION NETWORK, <http://www.ocean-acidification.net/FAQacidity.html> (last visited June 6, 2010).

68. *Id.*

69. Science Daily, *Ocean Acidification: Another Undesired Side Effect of Fossil Fuel-burning*, SCIENCE DAILY (May 24, 2008)

However, since the Industrial Revolution, the average ocean surface water pH has dropped by 0.1 units.⁷⁰ While this change may seem small, the pH scale is logarithmic, so that a pH decrease of 0.1 units means that the oceans have become 30% more acidic in the last 250 years.⁷¹ Moreover, the ocean's pH is expected to drop another 0.3 to 0.4 units by the end of the century as a result of the increasing carbon dioxide concentrations in the atmosphere.⁷²

Like temperature, pH is a basic measure of water quality that the Clean Water Act incorporates broadly. Moreover, changes in pH can affect existing uses. In the oceans, for example, decreasing pH is projected to reduce the availability of calcium carbonate by about 60% by the end of the century.⁷³ A number of marine organisms such as corals, mussels, snails, sea urchins, and certain types of microscopic plants and animals (calcareous phytoplankton and zooplankton, respectively) use calcium carbonate to build their shells, and lab testing has demonstrated that many species cannot survive well in water at pH levels equal to the projected decreases.⁷⁴ Moreover, ocean acidification can cause acidosis, the buildup of carbonic acid in organisms' bodily fluids, which in turn can cause "lowered immune response, metabolic depression, behavioral depression, affecting physical activity and reproduction, and asphyxiation."⁷⁵

Finally, interactions between salt water and fresh water systems are likely to change the water quality of both in response to climate change. Most notably, average global sea level is rising in response to climate change.⁷⁶ As salt water rises along the nation's coasts, it will invade coastal streams, rivers, lakes, and aquifers, a process known as saltwater intrusion.⁷⁷ Such changes in salinity are likely to violate applicable water quality standards as well as render coastal fresh water unusable for many human needs. At the same time, however, increased rainfall and flooding in the eastern United States may alter the delicate salinity balance in many estuaries, those ecosystems where freshwater streams and rivers flow into the oceans.

<http://www.sciencedaily.com/releases/2008/05/080521105251.htm> (last visited June 6, 2010).

70. *How is Ocean Acidity Changing?*, *supra* note 67.

71. *Id.*

72. *Id.*

73. *Id.*

74. Ocean Acidification Network, *How Will Ecosystems Be Affected?*, OCEAN ACIDIFICATION NETWORK, <http://www.ocean-acidification.net/FAQeco.html> (last visited Jan. 26, 2010).

75. *Id.*

76. 2007 IPCC SYNTHESIS REPORT, *supra* note 50, at 7–8.

77. *Id.* at 13.

Estuaries are more sensitive than many aquatic ecosystems to changes in salinity and thus are likely to experience water quality problems and loss of ecosystem productivity as a result of climate change.

Thus, climate change is causing and will continue to cause water quality problems that are relevant to the Clean Water Act, including increased pollution, changes to water chemistry, and changes to aquatic ecosystems. What such impacts mean for Clean Water Act regulation—and what the Clean Water Act might contribute to responses to these climate change issues—is the subject of the next Part of this Article.

IV. What Can the Clean Water Act Do to Help Respond to Climate Change Problems?

Prior to the CBD's petition and lawsuit, connections between the Clean Water Act and climate change have been few. Notably, the EPA commented in 1993 that land spreading of biosolids—sewage sludge—could avoid some of the climate change problems associated with other methods of disposal: “Some methods of sewage sludge disposal, such as incineration and uncovered landfills, may contribute to global warming (i.e., the “greenhouse effect”) by releasing carbon dioxide and methane.”⁷⁸ At least two federal courts have also noted this connection.⁷⁹ Pollution can have a direct impact on energy production, connecting water quality to greenhouse gas emissions.⁸⁰ Moreover, the Clean Water Act imposes special requirements on cooling water intake structures, and the EPA's regulations implementing these provisions for power plants—major greenhouse gas emitters—were the subject of a recent opinion in the U.S. Supreme Court.⁸¹ Finally, the U.S.

78. Standards for the Use and Disposal of Sewage Sludge, 58 Fed. Reg. 9248, 9249 (Feb. 19, 1993).

79. *City of Los Angeles v. County of Kern*, 2006 WL 3073173, at *11 (C.D. Cal. 2006) (noting that land application of biosolids is preferable, climate-change-wise, to burying or burning the sludge); *Welch v. Bd. of Supervisors of Rappahannock County, Va.*, 888 F. Supp. 754, 756 (W.D. Va. 1995) (quoting the EPA's language).

80. ELECTRIC POWER RESEARCH INSTITUTE, PROGRAM ON TECHNOLOGY INNOVATION: POWER GENERATION AND WATER SUSTAINABILITY 3 (2007), available at <http://mydocs.epri.com/docs/public/00000000001015444.pdf> (noting that power plants using degraded water must treat that water first); see also ARGONNE NATIONAL LABORATORY, U.S. DEPT. OF ENERGY, USE OF RECLAIMED WATER FOR POWER PLANT COOLING 17-18 (Aug. 2007), available at <http://www.netl.doe.gov/technologies/coalpower/ewr/pubs/reclaimed%20water.pdf> (listing the problematic chemicals in reclaimed water and describing the need for water treatment).

81. See *Entergy Corp. v. Riverkeeper, Inc.*, 129 S. Ct. 1498, 1502-05 (2009) (discussing § 316(b) of the Clean Water Act and the EPA's regulations regarding cooling water intake

Court of Appeals for the Fifth Circuit recently accepted, without much analysis, the proposition that the Clean Water Act does not preempt state law “with respect to global warming.”⁸²

In combination with the CBD’s petition and lawsuit, however, these acknowledged connections between water quality regulation and climate change indicate that a more comprehensive assessment of the Clean Water Act’s potential roles in mitigating and adapting to climate change is in order. Examining the Act’s structure, moreover, reveals that the Act is a much stronger and more appropriate adaptation tool than a means of addressing greenhouse gas emissions.

A. The EPA Can Use the Clean Water Act to Increase Knowledge about System Changes and Tolerances, Giving Governments Valuable Information for Climate Change Planning and Possible Revisions to State Water Quality Standards

As the Intergovernmental Panel on Climate Change (IPCC) has recently recognized, current information about climate change impacts is fairly limited, especially with regard to detailed information about local impacts.⁸³ Similarly, researchers at the World Bank have noted that “[t]here is a great deal of uncertainty about when, where, and how much predicted climate change will manifest. Few problems confronted by social scientists and policy makers entail such complex long-term implications and this much uncertainty.”⁸⁴ Acknowledging this dearth of data, the U.S. Climate Change Science Program has recently called for increased monitoring and research to keep track of climate-change-induced changes to ecosystems.⁸⁵

Thus, one way that the Clean Water Act can help to address climate change issues is by generating information about how climate change is

requirements for power plants).

82. *Comer v. Murphy Oil of USA*, 585 F.3d 855, 878-79 (5th Cir. 2009).

83. INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE, CLIMATE CHANGE 2007: IMPACTS, ADAPTATION, AND VULNERABILITY 20, 719, 724 (2007) [hereinafter 2007 IPCC ADAPTATION REPORT].

84. RASMUS HELTBERG, PAUL BENNETT SIEGEL, & STEEN LAU JORGENSEN, *Addressing Human Vulnerability to Climate Change: Toward a “No Regrets” Approach*, in GLOBAL ENVIRONMENTAL CHANGE, manuscript dated 21 November 2008 (forthcoming), abstract available at <http://ssrn.com/abstract=1158177>.

85. U.S. CLIMATE CHANGE SCIENCE PROGRAM, SYNTHESIS & ASSESSMENT PRODUCT 4.2: THRESHOLDS OF CLIMATE CHANGE IN ECOSYSTEMS 5–6 (2009) [hereinafter 2009 USCCSP ECOSYSTEM THRESHOLDS REPORT].

actually and specifically affecting the nation's waters.⁸⁶ Moreover, the Act gives the EPA a variety of mechanisms for generating such information, all of which could contribute not only to state and federal water quality regulation but also more generally to federal, state, regional, and local planning efforts to deal with climate change impacts. In other words, the informational provisions of the Clean Water Act can make helpful contributions to climate change adaptation measures.

In general, the EPA has plenary authority to implement the Act,⁸⁷ and Congress recognized that such authority would require the power to investigate and gather information about water quality and aquatic ecosystem function. Thus, the Act specifically charges the EPA Administrator with:

prepar[ing] or develop[ing] comprehensive programs for preventing, reducing, or eliminating the pollution of the navigable waters and ground waters and improving the sanitary condition of surface and underground waters,” and in so doing he or she may “make joint investigations with any [state or federal] agencies of the condition of any waters in any State or States, and of the discharges of any sewage,⁸⁸ industrial wastes, or substance which may adversely affect such waters.⁸⁸

Similarly, the EPA must “establish national programs for the prevention, reduction, and elimination of pollution,” and in so doing, it may work with federal, state, and local agencies to “conduct and promote the coordination and acceleration of, research, investigations, experiments, training, demonstrations, surveys, and studies relating to the causes, effects, extent, prevention, reduction, and elimination of pollution”⁸⁹ Dissemination of this information is equally important, and the Clean Water Act explicitly empowers the EPA Administrator to “collect and make available, through publications and other appropriate means, the results of and other information, including appropriate recommendations by him in connection therewith,” relating to the studies and research that the EPA has promoted relating to water pollution.⁹⁰

As quoted, the EPA's investigatory and research functions relate to the “pollution” of waters. The Clean Water Act defines “pollution” to be “the

86. See Robin Kundis Craig, “Stationarity Is Dead”—*Long Live Transformation: Five Principles for Climate Change Adaptation Law*, 34 Harv. Envtl. L. Rev. 29 (forthcoming), available at <http://ssrn.com/abstract=1357766>, (arguing that the first principle of climate change adaptation law should be to increase knowledge about climate change impacts).

87. 33 U.S.C. § 1251(d) (2006).

88. 33 U.S.C. § 1252(a).

89. 33 U.S.C. § 1254(a)(1).

90. 33 U.S.C. § 1254(b)(1).

man-made or man-induced alteration of the chemical, physical, biological, and radiological integrity of water.”⁹¹ Because climate change has been fairly conclusively linked to anthropogenic emissions of carbon dioxide and other greenhouse gas emissions,⁹² and because, as discussed above, climate change will affect the “chemical, physical, and biological . . . integrity” of the nation’s waters in a variety of ways, climate change impacts to water resources qualify as “pollution” under the Act.⁹³

Thus, the EPA and the states can use the Clean Water Act to contribute to efforts to generate information regarding climate change impacts on water resources and potential responses to those impacts. Indeed, in its response to the CBD’s petition, the EPA stressed this need for additional information about ocean acidification and its effects on marine ecosystems such as coral reefs. The EPA’s Notice of Data Availability (NODA), published on April 15, 2009, both summarizes the data about ocean acidification that the EPA has and requests additional information from scientists and other interested persons.⁹⁴ More specifically:

EPA is notifying the public of its intent to review the current aquatic life criterion for marine pH to determine if a revision is warranted to protect the marine designated uses of States and Territories pursuant to Section 304(a)(1) of the Clean Water Act. The NODA also solicits additional scientific information and data, as well as ideas for effective strategies for Federal, State, and local officials to address the impacts of ocean acidification. This information can then be used as the basis for a broader discussion of ocean acidification and marine impacts. EPA also requests information pertaining to monitoring marine pH and implementation of pH water quality standards.⁹⁵

The EPA made clear, however, that it is not yet convinced that changes to the marine pH water quality criteria are warranted. As it explained:

EPA’s current CWA 304(a) recommended criterion for marine pH states: “pH range of 6.5 to 8.5 for marine aquatic life (but not varying more than 0.2 units outside of the normally occurring range).” This criterion applies to open-ocean waters within 3 miles of a State or Territory’s shoreline where the depth is substantially greater than the euphotic zone.

91. 33 U.S.C. § 1362(19).

92. 2007 IPCC SYNTHESIS REPORT, *supra* note 50, at 5.

93. *See, e.g.*, *N. Plains Res. Council v. Fidelity Exploration & Dev. Co.*, 325 F.3d 1155, 1161–62 (9th Cir. 2003) (interpreting “pollution” broadly to include non-traditional sources of impacts on water quality).

94. Ocean Acidification and Marine pH Water Quality Criteria, 74 Fed. Reg. 17484, 17484–85 (April 15, 2009).

95. *Id.* at 17,484.

On December 17, 2007, EPA received a petition from the Center for Biological Diversity asking EPA to revise its recommended national marine pH water quality criterion for the protection of aquatic life and also asked EPA to publish information and provide guidance on ocean acidification.

Following careful consideration of the petitioner's request and supporting information, EPA is issuing this notice to solicit additional scientific information and data to fill data gaps to inform EPA's next steps and determine whether changes in existing criteria are warranted.

In this NODA, EPA is only requesting information and data relevant to addressing ocean acidification under the CWA. After the comment period closes on this NODA, EPA plans to evaluate the information received in considering whether the revision of the recommended marine pH criterion is warranted at this time. EPA intends to make final its decision regarding the evaluation of the information received within one year. If necessary, additional public review and comment will be requested during revision of the pH criterion.⁹⁶

Comments were due to the EPA on June 15, 2009;⁹⁷ therefore, the EPA should be issuing its next statement on ocean acidification in June 2010.

Nevertheless, even if the EPA chooses not to revise the marine pH criteria, the NODA aptly demonstrates that the EPA's reference water quality criteria, set pursuant to Section 1314 of the Act, can serve as a means of gathering and publicizing information about climate change impacts on the nation's water. Moreover, establishment of such criteria also serve to distribute and publicize valuable information. As noted above, the EPA must set these criteria based on "the latest scientific knowledge."⁹⁸

Given this language, the Clean Water Act arguably *requires* the EPA to investigate how climate change is affecting and will continue to impact the nation's waters and to respond with new recommendations for water quality managers. At the very least, the EPA has clear *authority* to gather and generate scientific data regarding climate change's actual and potential effects on basic water quality, particular species, and aquatic ecosystems, and this information could prove invaluable in planning for and coping with those impacts.

In the case of the ocean acidification petition, for example, if the EPA *does* revise the marine pH water quality criteria in response to the NODA, the resulting criteria would incorporate an impressive compilation of

96. *Id.* at 17,486.

97. *Id.* at 17,484.

98. 33 U.S.C. § 1314(a)(1).

information about ocean acidification and its effects on ocean chemistry, marine species, marine ecosystems, and the ecosystem services that those ecosystems provide to human communities. At a minimum, the new marine pH water quality criteria should reflect: (1) observed changes in ocean pH in various marine environments, including estuaries, and projected changes for the future under a range of global carbon dioxide emissions scenarios; (2) various estuarine and marine species' tolerances for decreasing pH, including an identification of most sensitive and least sensitive species; (3) the effects of decreasing pH on biological and other chemical processes in the oceans; and (4) the potential larger-scale impacts to various estuarine and marine ecosystems, such as coral reefs or kelp forests, and the services that they provide.

Thus, the EPA's investigatory, research, reporting, and Section 1314 water quality criteria authorities can all combine to generate and disseminate information about climate change impacts on water quality and aquatic species and ecosystems. These Clean Water Act authorities are likely to be particularly valuable—especially when supplemented by state monitoring and reporting⁹⁹—in providing progressive information and specific data regarding climate change dynamism (the changes that are occurring) in various kinds of water bodies and aquatic ecosystems.

B. The Clean Water Act Can Increase Species, Ecosystem, and Human Resilience by Reducing Pollutant Stressors

As the IPCC noted in 2007, species', ecosystems', and socio-ecological systems' "vulnerability to climate change can be exacerbated by other stresses."¹⁰⁰ In other words, aquatic ecosystems that are already coping with problems such as pollution are more vulnerable to climate change impacts.¹⁰¹

For example, coral reefs already suffer from a number of non-climate-change stressors—such as overfishing, marine pollution, and nutrient (fertilizer) and pesticide runoff from agriculture and coastal development—that “have been the major drivers of massive and accelerating decreases in abundance of coral reef species, causing widespread changes in reef ecosystems over the past two

99. See, e.g., 33 U.S.C. § 1313(e) (requiring states to engage in a continuing planning process); 33 U.S.C. § 1315(b)(1) (requiring states to submit biennial reports on water quality to the EPA).

100. 2007 IPCC SYNTHESIS REPORT, *supra* note 50, at 14.

101. 2007 IPCC ADAPTATION REPORT, *supra* note 75, at 19.

centuries.”¹⁰² These ecosystems are thus already weakened and hence more vulnerable to climate change impacts.

In contrast, as the U.S. Climate Change Science Program has recently emphasized, reducing non-climate-change stresses on ecosystems, such as pollution, can “make ecosystems healthier and more resilient as climate changes.”¹⁰³ “Resilience” refers to the ability of a species, ecosystem, or socio-ecological system to cope with change—or, more scientifically, “the degree to which a complex adaptive system is capable of self-organization . . . and the degree to which the system can build capacity for learning and adaptation.”¹⁰⁴ I have argued elsewhere that one of the important principles for climate change adaptation law should be to generally increase resilience in the face of climate change impacts, in part by reducing the pollutant stressors on species, ecosystems, and socio-ecological systems.¹⁰⁵

The Clean Water Act already largely pursues this goal, making it a useful and ready-made tool for climate change adaptation efforts. Indeed, the Clean Water Act has already prompted considerable progress in reducing pollution in the nation’s waters. As the Sierra Club summarized this progress as of the Act’s 30th anniversary in 2002:

Thirty years ago, only 30 to 40 percent of the nation’s rivers, lakes, and coastal waters were considered safe for swimming and fishing. Today, nearly 60 percent of our waters are estimated to be safe for these uses.

On June 22, 1969, a train passing over the Cuyahoga River in Cleveland kicked up sparks that fell into the polluted water below, setting the river ablaze. Flames soaring up to five stories high were captured on film and reported in the national media, prompting public outrage that led to the creation of the Clean Water Act three years later.

The law stopped industries and municipalities from discharging untreated wastes, provided generous financing for sewage treatment plants, and slowed the rapid loss of wetlands by limiting commercial and residential development.¹⁰⁶

102. T.P. Hughes *et al.*, *Climate Change, Human Impacts, and the Resilience of Coral Reefs*, 301 *SCIENCE* 929, 929 (2003); *see also* 2007 IPCC ADAPTATION REPORT, *supra* note 75, at 19 (presenting coral reefs as an example of ecosystems already over-stressed from non-climate-change stressors and hence more vulnerable to climate change impacts).

103. 2009 USCCSP ECOSYSTEM THRESHOLDS REPORT, *supra* note 77, at 7.

104. W. Neil Adger *et al.*, *Socio-Ecological Resilience to Coastal Disasters*, 309 *SCIENCE* 1036, 1036 (2005).

105. Craig, *supra* note 78, at 32–36.

106. Tom Valtin, *Clean Water Act Turns Thirty*, THE PLANET NEWSLETTER,

Nevertheless, as the Sierra Club recognized, the Clean Water Act has not yet fulfilled all of its goals with regard to water quality.¹⁰⁷ Moreover, more comprehensive and explicit consideration of climate change impacts on water quality could improve both the Act's general ability to reduce pollution stressors (and hence increase resilience) and its more particular relevance as a tool for responding to climate change. Discussions of several of the more important aspects of the Clean Water Act for a climate change era follow.

1. Water Quality Criteria and Standards in a Climate Change Era

As discussed, the EPA's reference water quality criteria serve as guidelines for the states in setting water quality standards. Thus, if the EPA incorporates information about climate change impacts into its reference water quality criteria, those criteria should inspire states to amend their relevant water quality standards to similarly reflect climate change impacts, increasing the recognition of climate change effects and, to the extent possible, protecting affected water resources against those impacts. For example, if the EPA amends its marine pH water quality criteria to reflect ocean acidification problems, states should follow up by amending or setting marine water quality standards that reflect the fact of ocean acidification in coastal waters.

2. Climate Change-Reflective NPDES Permitting

More stringent water quality standards that reflect climate change considerations could also influence NPDES permitting and the regulation of point source discharges of pollutants that are synergistic with climate change impacts. Suppose, for example, that technology-based limitations would allow a sewage treatment plant or other discharger to discharge effluent with a pH below 8.16 into the oceans—and, notably, distilled fresh water with a neutral pH of 7 would meet that condition. Cognizance of ocean acidification and actual or impending violations of the climate-change-based marine pH water quality standards should therefore compel states and the EPA to use water-quality-based effluent limitations more frequently in NPDES permits, subjecting point sources that are discharging relevant pollutants into coastal waters to increasingly stringent effluent limitations.

http://www.sierraclub.org/planet/200210/clean_water.asp (2002).

107. *Id.*

Increased use of water-quality-based effluent limitations could thus become an effective climate change adaptation measure, particularly where the receiving water is experiencing synergistic stresses from both climate change impacts and point source discharges. As noted, revised water quality standards to reflect climate change impacts may make it obvious that point source discharges of lower pH than marine waters—or discharges that promote pH-reducing chemical reactions in marine waters—have to be re-evaluated in light of ocean acidification. Thus, if a coral reef ecosystem experiencing ocean acidification is also receiving low-pH discharges from point sources, reducing those point source impacts could reduce the overall stresses to the reefs. Similarly, if waters are warming because of *both* climate change impacts and discharges of heated effluent, reducing the point source discharges may forestall the worst effects of increasing temperatures and hence increase the resilience of the species and ecosystems in those waters.

The EPA's authority under the Act to deal with synergistic thermal discharges is even clearer than the water-quality-based effluent limitation provisions indicate. Suppose, for example, that a point source proposes to discharge heat into a water body, such as Montana's trout streams, that is already experiencing increasing temperatures because of climate change. Section 1326 of the Clean Water Act states that if the point source is otherwise subject to effluent limitations under the Act, the EPA or the state "may impose effluent limitations . . . with respect to the thermal component of such discharge (taking into account the interaction of such thermal component with other pollutants), that will assure the protection of propagation of a balanced, indigenous population of shellfish, fish, and wildlife in and on that body of water."¹⁰⁸ Thus, while the Clean Water Act may not be able to prevent the temperature impacts that arise directly from climate change, it certainly provides both the states and the EPA with clear authority to reduce synergistic temperature stressors on aquatic ecosystems.

3. The EPA's Authority over Toxic Water Pollutants

Toxic pollutants, because they directly and indirectly affect basic life processes and/or cause disease, impose substantial stresses on aquatic ecosystems that can reduce the resilience of those ecosystems as they become subject climate change impacts. Under the Act, "toxic pollutants" are:

108. 33 U.S.C. § 1326(a).

[T]hose pollutants, or combinations of pollutants, including disease-causing agent, which after discharge and upon exposure, ingestion, inhalation or assimilation into any organism, either directly from the environment or indirectly by ingestion through food chains, will, on the basis of information available to the Administrator, cause death, disease, behavioral abnormalities, cancer, genetic mutations, physiological malfunctions (including malfunctions in reproduction) or physical deformations, in such organisms or their offspring.¹⁰⁹

For example, two of the most famous (or infamous) toxic pollutants that affect aquatic ecosystems are mercury and polychlorinated biphenyls (PCBs), both of which bioaccumulate up the food chain, to the point where fish and other aquatic organisms can become more toxic than the water they live in.¹¹⁰ Mercury is a neurotoxin, and mercury concentrations in fish can pose problems for human health. Mercury is also a widespread toxic contaminant in the nation's waters.¹¹¹ As the U.S. Geological Survey observed in 2005, "[m]ercury is currently the leading cause of impairment in the Nation's estuaries and lakes and was cited in nearly 80 percent of fish-consumption advisories (2,242 of 2,838) reported by states in 2000. The geographic extent of mercury advisories covers more than 10 million acres of lakes and more than 400,000 stream miles"¹¹² PCBs, in turn, cause numerous short- and long-term health problems for humans, including acne-like eruptions, skin pigmentation, hearing and vision problems, spasms, changes in liver function, and perhaps cancer.¹¹³ In addition, they can concentrate in ecosystems, where accumulation in bird eggs, for example, can cause developmental problems for chicks.¹¹⁴

109. 33 U.S.C. § 1362(13).

110. U.S. Department of the Interior & U.S. Geological Survey, *Mercury Contamination in Water*, Fact Sheet FS-216-95 1 (1995), available at <http://pubs.usgs.gov/fs/1995/fs216-95/>; Natural Resources Defense Council, *Mercury Contamination in Fish*, NATURAL RESOURCES DEFENSE COUNCIL, <http://www.nrdc.org/health/effects/mercury/effects.asp> (last visited Mar. 19, 2009); EPA, *Technical Fact Sheet on Polychlorinated Biphenyls*, EPA.GOV <http://www.epa.gov/safewater/pdfs/factsheets/soc/tech/pcbs.pdf> (2006).

111. Mark E. Brigham, David P. Krabbenhoft, & Pixie A. Hamilton, *Mercury in Stream Ecosystems—New Studies Initiated by the U.S. Geological Survey*, Fact Sheet 016-03 at 1 (Mar. 2003), available at <http://pubs.usgs.gov/fs/fs-016-03/pdf/fs-016-03.pdf>.

112. *Id.*

113. U.S. Environmental Protection Agency, *Technical Fact Sheet on Polychlorinated Biphenyls*, NATIONAL PRIMARY DRINKING WATER REGULATIONS (2006), <http://www.epa.gov/safewater/pdfs/factsheets/soc/tech/pcbs.pdf>.

114. Environment Canada, *Toxins in Great Blue Heron Eggs*, http://www.ecoinfo.ec.gc.ca/env_ind/region/gbhtoxin/gbhtoxin_e.cfm (last updated June 15, 2005).

The Clean Water Act regulates toxic pollutants fairly stringently, a fact that is already helping to reduce and prevent pollution stressors in aquatic ecosystems. For example, the Act itself prohibits all discharges of “any radiological, chemical, or biological warfare agent, any high-level radioactive waste, or any medical waste, into the navigable waters.”¹¹⁵ Moreover, unlike for most effluent limitations, the EPA has limited authority to modify BAT-based effluent limitations for toxic pollutants to make them less stringent.¹¹⁶

In contrast, the EPA has considerable authority to reduce discharges of toxic pollutants *beyond* what the basic BAT-based effluent limitations would require. Perhaps most recognized is the EPA’s authority to set toxic effluent standards under Section 1317 of the Act. The EPA Administrator sets such standards in his or her discretion and must take into account the toxicity of the pollutant, its persistence, degradability, the usual or potential presence of the affected organisms in any waters, the importance of the affected organisms and the nature and extent of the effect of the toxic pollutant on such organisms, and the extent to which effective control is being or may be achieved under other regulatory authority.¹¹⁷

However, if these factors so warrant, the EPA may set a very stringent toxic effluent standard, up to and including a complete prohibition on all discharges of that pollutant.¹¹⁸

Less well known is the EPA’s authority to supplement effluent limitations for toxic and hazardous pollutants with regulations for point sources “to control plant site runoff, spillage or leaks, sludge or waste disposal, and drainage from raw material storage” that “are associated with or ancillary to the industrial manufacturing or treatment process” and which “may contribute significant amounts of such pollutants to navigable waters.”¹¹⁹ This supplemental regulatory authority can thus address industrial processes that contribute to toxic water pollution beyond just point source discharges.

4. *Best Management Practices for Nonpoint Sources*

Although the EPA cannot regulate nonpoint sources directly, the Administrator nevertheless has the authority under Section 1314 to identify “processes, procedures, and methods to control pollution resulting from”:

115. 33 U.S.C. § 1311(f) (2000).

116. 33 U.S.C. § 1311(l).

117. 33 U.S.C. § 1317(a)(2).

118. *Id.*

119. 33 U.S.C. § 1314(e).

(A) agricultural and silvicultural activities, including runoff from fields and crop and forest lands;

(B) mining activities, including runoff and siltation from new, currently operating, and abandoned surface and underground mines;

(C) all construction activity, including runoff from the facilities resulting from such destruction;

(D) the disposal of pollutants in wells or subsurface excavations;

(E) *salt water intrusion resulting from reductions of fresh water flow from any cause*, including extraction of ground water, irrigation, obstruction, and diversion; and

(F) *changes in the movement, flow, or circulation of any navigable waters or ground waters*, including changes caused by the construction of dams, levees, channels, causeways, or flow diversion facilities.¹²⁰

Thus, the EPA can generate considerable information about how to control water quality impacts from nonpoint sources. Moreover, while many of the sources listed above are “standard” nonpoint sources, those italicized may take on additional importance in the climate change era, as rising seas increase the occurrence of salt water intrusion and changing precipitation and hydrological patterns alter flows in the nation’s waters.

States, in turn, *do* have the authority to directly regulate nonpoint sources of pollution. Under Section 1329, Congress bribed the states into preparing nonpoint source management plans. First, Congress asked that states to prepare reports identifying “those navigable waters within the State which, without additional action to control nonpoint sources of pollution, cannot reasonably be expected to attain or maintain applicable water quality standards”¹²¹ Second, states were to submit to the EPA a nonpoint source management program to control nonpoint source water pollution.¹²² If the EPA approved the state program, then the state became eligible for technical assistance and federal grants.¹²³

As with water quality criteria, therefore, the information that the EPA generates regarding the control of nonpoint source pollution provides valuable help to states seeking to implement nonpoint source management plans.

120. 33 U.S.C. § 1314(f) (emphasis added).

121. 33 U.S.C. § 1329(a)(1).

122. 33 U.S.C. § 1329(b)(1).

123. 33 U.S.C. §§ 1329(f), (h).

Moreover, increased use of more effective best management practices could help to reduce water quality impacts from flooding, potentially mitigating the increased burdens on storm water systems that will occur if climate change projections regarding heavy precipitation events and flooding are accurate. Finally, in a climate change era, this information may also prove invaluable more generally to state, local, and regional adaptation plans and strategies.

5. Protecting Particular Waters from Pollution

Under the Clean Water Act, both the states and the EPA have clear authority to protect particular waters from pollution, beyond mere permitting requirements. For example, when discharges of sewage from vessels can interfere with a state's water quality goals for particular waters, or if the area is used as a drinking water intake zone, the state can establish a "no discharge zone" where all such discharges are prohibited.¹²⁴

In addition, any state governor may nominate for protection an "estuary of national significance." If the EPA approves the nomination, the estuary becomes protected through a comprehensive conservation and management plan that recommends priority corrective actions and compliance schedules addressing point and nonpoint sources of pollution to restore and maintain the chemical, physical, and biological integrity of the estuary, including restoration and maintenance of water quality, a balanced indigenous population of shellfish, fish, and wildlife, and recreational activities in the estuary, and assure that the designated uses of the estuary are protected . . .¹²⁵ Grants are available under the Act to implement the plan.¹²⁶

At the federal level, the EPA must establish special protections, known as ocean discharge criteria, for point source discharges into the territorial sea, the contiguous zone, or the ocean,¹²⁷ and the Act specifies that those criteria "may not be waived for discharges into the territorial sea,"¹²⁸ the first three miles of ocean. In establishing the ocean discharge criteria, the EPA must determine, among other things: "the effect of disposal of pollutants on human health or welfare, including but not limited to plankton, fish, shellfish, wildlife, shorelines, and beaches"; "the effect of disposal of pollutants on marine life," including "changes in marine ecosystem diversity, productivity,

124. 33 U.S.C. §§ 1322(f)(3), (4).

125. 33 U.S.C. §§ 1330(a), (b)(4), (f).

126. 33 U.S.C. § 1330(g).

127. 33 U.S.C. § 1343(a).

128. 33 U.S.C. § 1343(b).

and stability”]; and “the persistence and permanence of the effects of disposal of pollutants.”¹²⁹

In addition, as part of the Section 404 permit program, the Army Corps of Engineers “may issue permits . . . for the discharge of dredged or fill material into the navigable waters at specified disposal sites.”¹³⁰ In general, as discussed, the Army Corps’ authority to allow such discharges at specified sites is limited by the EPA’s Section 404(b)(1) Guidelines, which are based on criteria similar to the ocean discharge criteria.¹³¹ In addition, however, the EPA Administrator can prohibit the use of certain sites as disposal sites if he or she determines “that the discharge of such materials into such area will have an unacceptable adverse effect on municipal water supplies, shellfish beds and fishery areas (including spawning and breeding areas), wildlife, or recreational areas.”¹³²

The EPA has most obviously exercised this Section 404 authority to protect particular places through its delineation of “special aquatic sites.” Special aquatic sites “are geographic areas, large or small, possessing special ecological characteristics of productivity, habitat, wildlife protection, or other important and easily disrupted ecological values. These areas are generally recognized as significantly influencing or positively contributing to the general overall environmental health or vitality of the entire ecosystem of a region.”¹³³ Currently, for example, special aquatic sites include (among other important aquatic places) sanctuaries and refuges,¹³⁴ wetlands,¹³⁵ and coral reefs.¹³⁶

The EPA’s Guidelines make it more difficult for a person to receive a Section 404 permit to discharge dredged or fill material into a special aquatic site by presuming that some other alternative is available to the permittee.¹³⁷

All of these provisions allow states and the EPA to increase protections for areas deemed especially important or sensitive to pollutant discharges. Moreover, all of these provisions focus on the health of the relevant aquatic ecosystem and the species that comprise those ecosystems. Therefore, use of these more site-specific provisions in an era of climate change would

129. 33 U.S.C. § 1343(d)(1).

130. 33 U.S.C. § 1344(a).

131. *See* 33 U.S.C. § 1344(b)(1).

132. 33 U.S.C. § 1344(c).

133. 40 C.F.R. § 230.3(q-1).

134. 40 C.F.R. § 230.40(a).

135. 40 C.F.R. § 230.41(a).

136. 40 C.F.R. § 230.44(a).

137. 40 C.F.R. § 230.10(a)(3).

increase the Clean Water Act's ability to shield aquatic ecosystems from pollution impacts, reducing non-climate-change stressors and hence increasing species' and ecosystems' resilience.

C. Nevertheless, the Obama Administration Could Make Several Changes to the Clean Water Act to Improve Its Ability to Deal with Climate Change

Two general aspects of the Clean Water Act could be improved to make the Act even more useful in a climate change era. First, seven changes would increase the Act's capacity for reducing water pollution, thereby reducing pollution stresses on aquatic species and ecosystems and helping to increase resilience in the face of climate change impacts. Second, amendments to the Act's water quality standards and TMDL provisions would allow for increased flexibility in the face of climate change impacts that are not amenable to mitigation through the Act's normal regulatory mechanisms.

1. Increasing Reductions in Water Pollution

a. EPA: The Clean Water Act should effectively regulate pollutants that currently largely escape effective control.

Many pollutants known to stress to aquatic ecosystems that could be regulated under the Clean Water Act are not. To improve both water quality generally and aquatic ecosystem resilience in the face of climate change impacts, the EPA and the states should ensure that they regulate all known water pollutants that are sources of pollution stress to aquatic ecosystems.

One obvious example of this lack of effective regulation is nutrient pollution. Nutrients such as nitrogen and phosphorus, often incorporated into agricultural fertilizers, cause algae blooms and lead to hypoxia in many of the nation's waters—including the “dead zone” in the Gulf of Mexico and eutrophic conditions in Chesapeake Bay¹³⁸—yet few states have water quality criteria for them.¹³⁹ Nutrient pollution also stresses coral reefs.¹⁴⁰ Therefore, more effectively controlling nutrient pollution should be a high priority.

138. NATIONAL RESEARCH COUNCIL, MISSISSIPPI RIVER WATER QUALITY AND THE CLEAN WATER ACT: PROGRESS, CHALLENGES, AND OPPORTUNITIES 36-45, 126-28 (2008).

139. See, e.g., U.S. EPA Region 9, *Total Maximum Daily Loads for Nutrients San Diego Creek and Newport Bay, California*, 16 (1999), available at http://www.epa.gov/owow/tmdl/examples/nutrients/ca_sdnbay.pdf (noting that state nutrient

b. EPA and States: Regulate synergistic sources of pollution more stringently and effectively.

As noted above, as the sensitivities and vulnerabilities of particular water bodies to specific climate change impacts become known—such as with the effects of ocean acidification on marine ecosystems such as coral reefs—increased reductions in discharges of synergistic pollutants from ordinary point sources may become desirable. As a result, to reduce or limit the impacts of climate change on water quality in these situations, EPA and the states should make increased use of water-quality-based effluent limitations in NPDES permitting.

Relatedly, states should also enact or expand their enforceable best management practices requirements for synergistic nonpoint source pollution. For example, sediment is a common pollutant found in runoff, and sedimentation often leads to increased water temperatures.¹⁴¹ Thus, sediment-laden runoff in a climate change era can easily become a synergistic source of pollution in water bodies—such as Montana’s trout streams—that suffer temperature impacts from climate change.

c. EPA: Toxic effluent standards and other regulations should become more common.

Toxic pollutants are, by definition, detrimental to living organisms, and their presence in water bodies stresses aquatic species, decreasing those species’ resilience in the face of climate change. As noted, the EPA has clear authority under the Clean Water Act to more aggressively reduce, and in some cases eliminate, toxic water pollution, and it should exercise that authority more frequently in the climate change era.

criteria did not exist).

140. Robert Howarth *et al.*, *Nutrient Pollution of Coastal Rivers, Bays, and Seas*, 7 ISSUES IN ECOLOGY 2, 6 (Fall 2000), available at http://esa/org/science_resources/issues/FileEnglish/issue7.pdf.

141. Shabi Guptha, “Sediment Pollution,” *American Chronicle* (Aug. 1, 2008), <http://www.americanchronicle.com/articles/view/70255>.

d. *The EPA should develop more biocriteria like the ones it intends to propose for coral reefs.*

The EPA can develop different kinds of water quality tools in response to climate change impacts. For example, at the same time that the EPA began generating information about ocean acidification through its NODA in response to the CBD's petition, it also announced that it intends to develop biocriteria for coral reefs.¹⁴² Biocriteria, or biological criteria, are:

[N]arrative or numeric expressions that describe the reference biological integrity (structure and function) of aquatic communities inhabiting waters of a given designated aquatic life use. Biocriteria are based on the numbers and kinds of organisms present and are regulatory-based biological measurements.¹⁴³

The EPA and the states derive biocriteria from biological assessments of the relevant aquatic ecosystem, which “provide direct measures of the cumulative response of the biological community to all sources of stress: they measure the condition of the aquatic resource to be protected. Therefore, biocriteria set the biological quality goal, or target, to which water quality can be managed, rather than the maximum allowable level of a pollutant or other water quality condition in a water body.”¹⁴⁴

In a climate change era, biocriteria and bioassessments may become a more effective way to regulate water quality when the basic physical and chemical conditions of aquatic ecosystems are changing as a result of climate change impacts, because such criteria, and the biological assessments that produce them, require greater understanding of how aquatic ecosystems function and how changes in water quality affect those ecosystems. In its coral reef biocriteria, for example, the EPA intends to use information about ocean acidification to generate information and biological measures that will aid states in setting water quality standards that are more protective of coral reefs.¹⁴⁵

142. Letter from Benjamin H. Grumbles, to Ms. Miyoko Sakashita, *supra* note 2, at 2.

143. U.S. Environmental Protection Agency, *Biocriteria Basics: What Are Biocriteria and Bioassessment Data*, EPA.GOV (Sept. 16, 2008), <http://www.epa.gov/waterscience/biocriteria/basics.html>.

144. *Id.*

145. Letter from Benjamin H. Grumbles to Ms. Miyoko Sakashita, *supra* note 2, at 2.

e. Congress: Fix the Rapanos problem and clarify that jurisdiction extends to the limits of the Commerce Clause.

In its decision in *Rapanos v. United States*,¹⁴⁶ the U.S. Supreme Court split 4-1-4 regarding the proper assessment of the EPA's and Army Corps' jurisdiction over "waters of the United States,"¹⁴⁷ and the lower courts have since split regarding which analysis controls.¹⁴⁸ The EPA and the Army Corps have issued joint guidance that blends Justice Scalia's and Justice Kennedy's tests, but the guidance is invalid in the three circuits that allow only Justice Kennedy's tests and often unworkable everywhere. As a result, the agencies' Clean Water Act jurisdiction over several kinds of smaller but important waters in the United States is currently subject to considerable doubt and extensive legal challenges.

This level of jurisdictional doubt undermines the implementation of the Act generally, reducing its effectiveness in protecting the nation's waters. Because the EPA's and the Army Corps' remaining authority to issue new regulations defining the "waters of the United States" is also in doubt after *Rapanos*,¹⁴⁹ Congress should step in and clarify the scope of federal Clean Water Act jurisdiction. Clear jurisdiction is a critical precondition to comprehensively protecting the nation's waters and increasing their resilience to climate change impacts.

146. 547 U.S. 715 (2006).

147. *See id.* at 742 (plurality's test), 779–80 (Kennedy, J., concurring), 810 (Stevens, J., dissenting).

148. *See, e.g.,* *United States v. Robison*, 505 F.3d 1208 (11th Cir. 2007) (concluding that Justice Kennedy's test controls); *Northern California River Watch v. City of Healdsburg*, 496 F.3d 993, 999–1000 (9th Cir. 2007) (concluding that Justice Kennedy's test controls); *United States v. Gerke Excavating, Inc.*, 464 F.3d 723, 724–25 (7th Cir. 2006) (concluding that Justice Kennedy's test controls); *United States v. Johnson*, 467 F.3d 56, 64 (1st Cir. 2006) (concluding that jurisdiction exists if a water meets either Justice Scalia's or Justice Kennedy's test).

149. *Rapanos v. United States*, 547 U.S. 715, 739 (2006) (stating that the plurality's interpretation of "waters of the United States" is the "only plausible interpretation"); *see also id.* at 758 (J. Roberts, concurring) (stating that the EPA and Army Corps "would have enjoyed plenty of room" in their regulations had they acted earlier).

f. Congress: The Clean Water Act should extend enforceable regulation at the federal level to sources that have largely escaped control, such as agricultural sources and nonpoint sources.

The Clean Water Act expressly exempts many sources of pollution—notably nonpoint sources, as discussed, and agricultural pollution—from its normal regulatory mechanisms. For example, the Act explicitly excludes “agricultural storm water discharges and return flows from irrigated agriculture” from its definition of “point source.”¹⁵⁰ Thus, these discharges are not subject to any permitting program. In addition, Section 1344 exempts several kinds of discharges of dredged or fill material from its permit program, including discharges of dredged or fill material: “from normal farming, silviculture, and ranching activities such as plowing, seeding, cultivating, minor drainage, harvesting for the production of food, fiber, and forest products, or upland soil and water conservation practices”; “for the purpose of construction or maintenance of farm or stock ponds or irrigation ditches, or the maintenance of drainage ditches”; and “for the purpose of construction or maintenance of farm roads or forest roads”¹⁵¹

Nevertheless, nonpoint sources of pollution—and exempted agricultural nonpoint sources in particular—are among the most significant remaining sources of pollution. In 2003, for example, the EPA noted that “[s]tate inventories indicate that agriculture, including crop production, animal operations, pastures, and rangeland, impacts 18% of the total river and stream miles assessed, or 48% of the river [*sic*] and streams identified as impaired.”¹⁵² Subjecting these sources to increased and enforceable regulation will provide the next major step in improving water quality overall. Moreover, because many of these sources are sources of pollutants known to be particular problems for many ecosystems, such as nutrients,¹⁵³ expanded regulation under the Act would also contribute to a climate change adaptation goal of reducing existing pollution stressors on many aquatic ecosystems (like coral reefs) likely to also begin experiencing stresses from climate change impacts.

150. 33 U.S.C. § 1362(14).

151. 33 U.S.C. § 1344(f).

152. EPA, NATIONAL MANAGEMENT MEASURES FOR THE CONTROL OF NONPOINT POLLUTION FROM AGRICULTURE (EPA-84-1-B-03-004), at 1-1 (July 2003), available at <http://www.epa.gov/owow/nps/agmm/index.html>.

153. EPA Region 9, *supra* note 129, at 5, 16.

g. *Congress: Should the Clean Water Act require something more than BAT?*

As discussed, the Clean Water Act already imposes or allows for “zero discharge” standards for several kinds of pollutants, particularly toxics. In this climate change era, Congress may want to consider expanding these more stringent requirements and/or providing incentives for increased pollution control capacity, again with the goal of improving overall water quality in the nation and improving resilience.

2. *Increasing Flexibility in the Face of Climate Change Impacts*

The Clean Water Act contains a number of provisions intended to preserve existing water quality and prevent degradation of water quality because of future development. For example, the NPDES permit program contains an anti-backsliding requirement, under which “a permit may not be renewed, reissued, or modified . . . to contain effluent limitations which are less stringent than the comparable effluent limitations in the previous permit.”¹⁵⁴ With respect to pollutant-based—that is, non-climate-change-induced—stresses to aquatic ecosystems, these requirements aid adaptation efforts by ensuring that pollution stressors to aquatic ecosystems remain at lower levels, increasing those systems’ resilience.

Nevertheless, when it comes to climate change impacts that alter basic water quality conditions (temperature, pH, salinity) irrespective and point and nonpoint source pollution, the Clean Water Act’s protective inflexibility may actually impede governments’ efforts to adapt. For example, both ocean acidification and increasing water temperatures in streams like Montana’s will likely point out a climate change adaptation trap in the Clean Water Act’s water quality standards requirements. Under the EPA’s antidegradation policy, states *must* protect and maintain “[e]xisting instream water uses and the level of water quality necessary to protect the existing uses”¹⁵⁵

Moreover, while there are circumstances under which states can remove some designated uses,¹⁵⁶ states are *not* allowed to remove existing uses.¹⁵⁷

154. 33 U.S.C. § 1343(o)(1).

155. 40 C.F.R. § 131.12(a)(1). “Existing uses are those uses actually attained in the water body on or after November 28, 1975, whether or not they are included in the water quality standards.” 40 C.F.R. § 131.3(e).

156. 40 C.F.R. § 131.10(g).

157. 40 C.F.R. § 131.10(h)(1).

Thus, under current law, states cannot amend their water quality standards to reflect climate change impacts on previously existing uses, even if those impacts mean that it has become impossible to maintain those uses—like coral reefs in Florida or trout fishing in Montana—through the Act’s normal regulatory mechanisms, such as point source permits and nonpoint source best management practices.

The Clean Water Act’s antidegradation policy, therefore, may be so inflexible as to actually interfere with some climate change adaptation efforts.

If states can neither maintain previously existing uses because of climate-change-driven changes in water temperature, pH, quantity, timing of flow, or biological and chemical processes, nor amend their water quality to reflect these new ecological realities, they are basically “stuck” with water-quality-limited water bodies under the Act.

Moreover, because these water-quality-limited water bodies violate their water quality standards, the Act demands that the state set a TMDL for the water body in question. Establishing TMDLs is a time-consuming and often expensive process intended to bring water bodies into compliance with their water quality standards. However, if climate change has made those water quality standards unattainable through the Act’s normal regulatory mechanisms, the TMDL process will become an expensive and time-consuming exercise in futility.

Given these potential climate change “traps” in the Clean Water Act—situations where climate change impacts could put states irreversibly and expensively in permanent violation of the Act—Congress and the EPA should consider building more flexibility into the water quality standards program. Specifically, they should consider amending the antidegradation and TMDL requirements to allow for “climate change exceptions,” perhaps through an exemption process that allows the state to prove that changes in water quality derive from climate-change-driven impacts on water flow, temperature, pH, salinity, and so on. For example, the Act’s anti-backsliding provisions contain an exception allowing for less stringent effluent limitations in a renewed or modified NPDES permit if “a less stringent effluent limitation is necessary because of events over which the permittee has no control and for which there is no reasonable available remedy.”¹⁵⁸ A similar exemption could apply to circumstances where climate change has made previously existing uses impossible to maintain, allowing states to amend water quality standards and hence to avoid the TMDL process.

158. 33 U.S.C. § 1342(o)(2)(C).

V. What Can't the Clean Water Act do about Climate Change?

A. The Clean Water Act Cannot Stop Climate Change Impacts

As the above discussions have made clear, the Clean Water Act is a potentially very powerful tool for discovering, analyzing, providing information about, and responding to climate change impacts on the nation's water resources. More specifically, the Clean Water Act is and can be more expansively used as one tool for: (1) generating and compiling information about existing and projected climate change impacts and their effects on water availability, the variety of aquatic species and ecosystems, and the provision of ecosystem services, such as food, drinking water, water purification, and flood control; (2) generating expert recommendations regarding certain protective measures, such as climate-change-adjusted water quality criteria and best management practices for nonpoint sources; and (3) implementing a variety of measures that could mitigate, slow, or otherwise blunt the full impacts of climate change impacts on water quality, including more stringent requirements in NPDES permits for synergistic discharges or discharges into stressed aquatic ecosystems, increased use of best management practices to control nonpoint source pollution and some flooding problems, and increased or new protections for particular waters and aquatic ecosystems at risk.

All of these uses of the Clean Water Act, however, stress that it is, from a climate change perspective, most essentially a climate change adaptation tool. That is, the Clean Water Act functions most naturally to help governments identify and plan for climate change impacts and to help regulators to respond to those impacts.

In contrast, the Act provides no direct mechanism for reducing climate change impacts. Again, it addresses discharges to water, not emissions to air.

Reductions of water pollution and improvements in water quality certainly can help to increase species' and ecosystems' resilience and hence to blunt some of the potentially more drastic ecological and socio-ecological results of climate change impacts. However, pollution reductions in water cannot eliminate the most direct impacts of climate change on water quality: reductions in water flows; changes in the timing of water flows; increasing water temperatures; or changing water chemistry, including ocean acidification. Thus, the Clean Water Act should not be considered a "cure" for climate change, or even for all of the water problems that climate change creates.

B. The Clean Water Act Cannot Generate a Rational or Effective Regulatory Program for Reducing GHG Emissions, Despite the Potential Applicability of the TMDL Requirement to GHG Emitters

The core policy and legal question for the Clean Water Act in the climate change era is how the TMDL process should apply when a water quality standard violation arises because of climate change impacts—from climate-change-driven changes water temperatures, the amount and timing of water supply, and/or chemical interactions with greenhouse gases in the atmosphere—not from point source discharges or the traditional forms of nonpoint source pollution, such as runoff. Two basic answers are possible.

On the one hand, one could argue that although the water quality standard violation does not derive from traditional sources of water pollution, the impacts of increasing concentrations of GHG gases in the atmosphere is a form of nonpoint source pollution addressable through the TMDL process. There are precedents for this view, because both the EPA and the states have treated atmospheric deposition of mercury and nutrients—the deposit of air pollutants onto water—as a form of nonpoint source pollution.¹⁵⁹

This interpretation of the TMDL provisions, however, leads to expensive, haphazard, and ultimately futile results. First, states setting climate-change-related TMDLs would be compelled to use the TMDL process to regulate air emissions of greenhouse gases in an attempt to improve the water quality of individual water bodies. Thus, in addition to forcing a mismatch of regulatory tools—the Clean Water Act, again, regulates discharges of pollutants into water, not air emissions—this interpretation of the TMDL requirements would ignore a mismatch of scale: water quality issues are often local, and usually no greater than regional, in scope, while the greenhouse gas emissions that contribute to climate change impacts are global.

Second, the Act commits primary responsibility for TMDLs to the states,¹⁶⁰ but states do not have the authority to regulate any sources outside their respective borders. Thus, this interpretation of the Act's TMDL provisions ignores a mismatch of regulatory authority, because climate change mitigation efforts ultimately need to be global in scale. Indeed, absent global

159. See, e.g., EPA Region 9, *supra* note 129, at 16 (noting that atmospheric deposition of nutrients had to be accounted for in the TMDL); Connecticut Department of Environmental Protection *et al.*, *Northeast Regional Mercury Total Maximum Daily Load* 31-32 (Oct. 24, 2007), available at http://www.nelwpcc.org/mercury/mercury-docs/FINAL_Northeast_Regional_Mercury_TMDL.pdf (assigning most of the TMDL load allocation to atmospheric deposition of mercury).

160. 33 U.S.C. § 1313(d).

and national programs to reduce GHG emissions, state attempts to regulate those emissions *through the Clean Water Act* will neither resolve the water quality problem that triggered the TMDL nor contribute significantly to climate change mitigation efforts. Conversely, if global and national programs exist to regulate GHG emissions, states' use of the TMDL program is at best redundant and at worst preempted, forcing states to spend time and money setting a TMDL that either does not need to be or cannot be implemented.

Third, one could argue that the mismatch of regulatory authority simply means that *the EPA* should implement the TMDL program when climate change impacts cause the violations of water quality standards. While the Act allows the EPA to set TMDLs when states refuse to do so,¹⁶¹ nationalizing the TMDL process for climate change impacts would upset the federalism balance that Congress sought to achieve in assigning water quality responsibilities between the states and the federal government. More importantly, if the desired response to climate change is to have the EPA regulate GHG emissions on a national basis, the Clean Water Act is the wrong statute to use. As the petitioners and the U.S. Supreme Court recognized in *Massachusetts v. EPA*, the Clean Air Act is a far more appropriate tool for comprehensive regulatory approaches to climate change mitigation.

Finally, this interpretation of the Clean Water Act's TMDL requirements ignores the fact that the world is irreversibly committed to a certain amount of climate change, with largely irreversible impacts to be felt for at least the next few decades and perhaps for several centuries.¹⁶² It would effectively freeze water quality requirements to reflect ecological conditions that existed at the time the state established its water quality standards—ecological conditions that climate change may render unattainable for the foreseeable future regardless of how stringently the state and the EPA regulate point sources, nonpoint sources, *or* GHG emissions. Nevertheless, legally, the TMDL process could force the state to eliminate all other relevant sources of water pollution—all point source discharges and nonpoint sources of pollutants related to the climate-change-induced problem (temperature, acidification)—without achieving any improvement in water quality. This is almost certainly *not* the policy balance that the nation would reach, given the ability to more comprehensively assess its responses to climate change.

161. 33 U.S.C. § 1313(d)(2).

162. 2007 IPCC SYNTHESIS REPORT, *supra* note 47, at 12.

On the other hand, and perhaps counter-intuitively, one could conclude that the TMDL process should *not* encompass the GHG emissions that ultimately cause climate change and its impacts.

To be sure—and perhaps in contradiction to the CBD’s intentions for its petition regarding ocean acidification—this second interpretation eliminates the Clean Water Act as a climate change mitigation tool. However, for all the reasons discussed above, the Clean Water Act is not a particularly effective mitigation tool to begin with. Moreover, climate change mitigation policy is best pursued through specific national, regional, and global programs that are planned with a comprehensive overview of the problem—not piecemeal regulation to address relatively limited and local water quality problems. Therefore, as counterintuitive and perhaps even counter-textual as this interpretation might be, it is the most rational view of the TMDL program in a climate change era.

VI. Conclusion: So What Should President Obama’s Administration do about Climate Change Pursuant to the Clean Water Act?

President Obama’s Administration and the EPA should recognize and embrace the Clean Water Act as a relevant and potentially very powerful climate change adaptation tool. To that end, increases in the amount of funding provided to the EPA, other federal agencies such as the Army Corps and U.S. Geological Survey, and the states for basic water quality research and, in particular, water quality monitoring and modeling could greatly increase and improve federal, state, and local governments’ abilities to identify climate change impacts to particular water resources as they are occurring and to predict future changes and their effects on species, ecosystems, ecosystem services, and socio-ecological systems—including effects on human health, industry, and economics. Such information is essential to climate change adaptation planning and strategizing.

In addition, the Obama Administration and its EPA should fully embrace the plethora of authorities that the Clean Water Act provides that could help to reduce or blunt the ultimate ecological and socio-ecological effects of climate change impacts on water quality. They should provide renewed vigor in pursuing the Act’s aspirational goal of eliminating all discharges of pollutants into the nation’s waters, with particular attention to drastically reducing toxic water pollution and regulating pollutants and sources of pollutants currently escaping rigorous (or any) regulation even though they are known to impair water quality and stress aquatic ecosystems.

Similarly, the Obama Administration and Congress should strongly consider increasing states' capacities to implement more effective water quality programs, from NPDES permitting to water quality certifications to nonpoint source regulation. While increased and renewed funding to states will be an important component of this support, informational and technical support are equally important, particularly if the EPA is engaging in nationwide monitoring and modeling.

Finally, the Obama Administration and Congress should analyze what portions of the Clean Water Act could and should be strengthened—and what portions need additional flexibility to allow for rational responses to unavoidable and irreversible climate change impacts to water quality. The first important amendment in this regard should be a congressional “fix” to the *Rapanos* jurisdictional issue. Beyond that, Congress should seriously consider pulling agriculture and other nonpoint sources into the Act's federally enforceable reach and adding “climate change exemption” flexibility to the Act's water quality standards and TMDL provisions.

What the Obama Administration and Congress should *not* allow, however, is the attempted application (probably through litigation) of the Clean Water Act to climate change mitigation and the reduction of GHG emissions. The Clean Water Act does not provide mechanisms that allow for comprehensive and rational GHG emissions reductions measures, nor would the incorporation of GHG emissions into the Clean Water Act do much to reduce climate change's actual impacts on water quality. The time and expense that states and the EPA would devote in attempting to link the Clean Water Act to greenhouse gas emissions—again, largely through the TMDL requirements— would be much better spent in pursuit of a national climate change mitigation policy and regulatory regime. Therefore, President Obama's EPA and Congress may both want to make clear that the Clean Water Act—and especially its TMDL requirements—do not extend to GHG emissions.

Greening the Economy Sustainably

David L. Markell*

Table of Contents

I.	Introduction	49
II.	Defining "Greening the Economy Sustainably".....	52
III.	The Need for Foundational Work to Understand the Options for Climate Solutions and Their Implications for a Sustainable Green Economy	55
IV.	Climate Solutions and Institutional Governance.....	62
V.	Conclusion.....	69

I. Introduction

Key officials at all levels of government have characterized climate change as "the greatest challenge [we have] ever faced."¹ An enormous amount has

* Steven M. Goldstein Professor, Florida State University College of Law, Visiting Professor University of Virginia School of Law, Spring 2009 Semester. I would like to thank Jackie Roberts, Director of Sustainable Technologies at the Environmental Defense Fund, and Professors Robin Craig, John Dernbach, and J.B. Ruhl for very helpful comments on earlier drafts of this article. Thanks also to Professor Hari Osofsky of Washington and Lee University School of Law for inviting me to participate in this excellent symposium, and to the students at Washington and Lee for their work in convening the conference. Katherine Watlington, University of Virginia School of Law Class of 2011, provided terrific research assistance.

1. John M. Broder, *Title, but Unclear Power, For a New Climate Czar*, N.Y. TIMES, Dec. 12, 2008, at A28, available at <http://www.nytimes.com/2008/12/12/us/politics/12climate.html>. See also BarackObama.com, Obama Statement on Climate Change Negotiations in Bali, Dec. 10, 2007, http://www.barackobama.com/2007/12/10/obama_statement_on_climate_cha.php (last visited Nov. 20, 2009) (citing climate change as one of the greatest challenges faced); Juliet Eilperin, *Faster Climate Change Feared*, WASH. POST, Dec. 25, 2008, <http://www.washingtonpost.com/wp-dyn/content/article/2008/12/24/AR2008122402174.html> (last visited Nov. 20, 2009) (expanding on the 2007 findings of the United Nations Intergovernmental Panel on Climate Change and alluding to even more rapid changes in climate). Skeptics exist as well. For example, a March 2009 Gallop Poll reflects the "highest level of public skepticism about mainstream reporting on global warming seen in more than a decade," with 40 percent of those polled saying the media are "exaggerating the issue." Yale Forum on Climate Change & the Media, Gallup Poll Finds More Americans Say Media