A Round-up of Recent Waters of the United States Information

[Note: The title is reflective of another issue.]

Contents

Mark Ryan, Esq.: Notes and Samples of his Blog and Comments 2
Additional comments from Wiener 5
Lexis Search, June 2019: selected references and some notes 5
Blackman, Josh, 2018, Presidential Maladministration. 2018 University of Illinois Law Review 397. 9
Search of Google Scholar, "waters+of+the+united+states" 14
Migratory Birds: Greater Vulnerability under Trump Administration's Policies on Incidental Take and Habitat 14
[PDF] American Fisheries Society 14
[HTML] Advocating for Science: Amici Curiae Brief of Wetland and Water Scientists in Support of the Clean Water Rule 14
Clean Water Or a Guilty Conscience: The Newly Proposed Rulemaking to Rescind and Replace the Clean Water Rule Has Ethical and Professional Implications for … 14
[HTML] Science Societies Urge EPA Not to Change the Waters of the US Rule 15
[PDF] What Went Wrong with WOTUS 15
[PDF] Via regulations. gov: Docket ID No. EPA-HQ-OW-2018-0149 15
The Clean (Ground) Water Act? 15
[PDF] Defining an ecosystem approach to aquaculture (EAA) for federal **waters of the United States** 15
Headwater Streams and Wetlands are Critical for Sustaining Fish, Fisheries, and Ecosystem Services .15
[PDF] Defining an ecosystem approach to aquaculture (EAA) for federal **waters of the United States** 16
flTT4lIfTTIm 16
Headwater Streams and Wetlands are Critical for Sustaining Fish, Fisheries, and Ecosystem Services .16
[HTML] The Fight Over Waters of the US 16
Strategic Institutional Positioning: How We've Come to Generate Environmental Law Without Congress 17
Redefining the Waters of the United States: Did Government Overreach Just Get Trumped 17
[PDF] Environmental Law: Little Streams and Legal Transformations 17
Environmental Law-Clean Air Act 17
Perspectives of the Clean Water Rule and an Alternative Policy 17
Notes on American Water Works Association – comment to EPA, June 2019 18
Selected Law Reviews 19
Vos, Nathan. 2017, Agricultural Drainage and the Des Moines Water Works Lawsuit. 22 Drake Journal of Agricultural Law 109 19

Crawford, Amanda L., 2016, Nutrient Pollution and the Gulf of Mexico Dead Zone: Will Des Moines Water Works Be a Turning Point? 91 Tulane Law Review 157. 45
Jacobi, Dann1, and Caitlin Andersen n2, , 2016, Agriculture and the Law: Can the Legal Profession Power the Next Green Revolution? 21 Drake Journal of Agricultural Law 177. 73
Johnston, Jesse, 2015, From the Farm to the Gulf: Managing Nutrient Runoff Through Numeric Nutrient Standards. 20 Drake Journal of Agricultural Law 259. 86
Janet E. Milne, 2015, Storms Ahead: Climate Change Adaptation Calls for Resilient Funding. 36 Vermont Law Review 819. 116
Margot J. Pollans, 2015, The Safe Drinking Water / Food Law Nexus. 32 Pace Environmental Law Review 501. 162

This is an informal collection from several sources, for updating and introduction, by John D. Wiener, J.D., Ph.D., not representing the University of Colorado, the Natural Hazard Mitigation Association or any other institution. (https://ibs.colorado.edu/wiener).

This does not include the EPA/Corps of Engineers rule-making, guidance, and other formal publications, which are findable through Mr. Ryan's blog, or searching the rule-making dockets and Federal Register; if you are new to such things, it may be easiest to ask a reference or law librarian to save you some time. Waters of the US is often called WOTUS. A quote from the Clean Water Act blog by Mark Ryan, Esq: "The hopelessly complex world of the WOTUS rule just got worse." (February 6, 2018).

Mark Ryan, Esq.: Notes and Samples of his Blog and Comments

Ryan, Mark A., 2018, The WOTUS Rule Repeal. 33 Natural Resources & Environment 55-56. [Would not download with current security measures.] [Clean Water Act (CWA) left it to agencies to refine "waters of the US beyond "navigable waters". "The law was well settled until 2001…" with a "significant nexus" test between pollution source and "…downstream navigable-in-fact waters. *Solid Waste Agency of Northern Cook City v. U.S. Army Corps of Engineers*, 531 U.S. 159 (2001) (SWANCC). In 2006… Supreme Court further confused matters with… *Rapanos v. United States*, 547 U.S. 715 (2006)…" That left uncertainty, so a guidance document was issued by EPA/USACE in 2008, but it was "hard to follow" so in 2015 the agencies issued a new rule. But the new notice of rulemaking was 93 pages.

The agencies made arguments to invalidate the 2015 rule, as is clearly shown by the June 29, 2018, supplemental notice to support the repeal of the 2015 rule (83 Federal Register 32,227). There was a concerted effort to "aggressively" show the faults while doing nothing to defend the rule, but they must make the attacks, under the Administrative Procedures Act (APA).

First, the agencies treated CWA § 101(b) – role of the states – as equal to §101(a) – goal of CWA. 1972 Amendments to CWA recognized that "Without minimum federal standards, the states were in a well-documented race to the bottom to avoid scaring away employers." They were adopted. The CWA was applied to "waters of the United States". The focus on states' rights brings up several questions, including what to do with interstate waters? Do downstream state standards apply to a permit in upstream states? What about the federal purpose? In *Arkansas v. Oklahoma*, 503 U.S. 91 (1992), the downstream standards can be applied by the EPA.

The agencies second argument follows the policy in "…President Trump's February 28, 2017, Executive Order 13,778, Restoring the Rule of Law, Federalism, and Economic Growth by Reviewing the "Waters of the United States" Rule, 82 Fed. Reg. 12,497." The goal was to "emphasize Justice Scalia's plurality opinion (relatively permanent waters) from *Rapanos*. The agencies also read Justice Kennedy's concurring opinion much more narrowly than in the past, although it is not clear that they are completely abandoning the significant nexus standard." The agencies argued that the significant nexus test, as previously applied was not compatible with CWA limits on jurisdiction.

"The agencies now will be faced with the challenging task of convincing the courts that everything said before was wrong."

Third, the 2015 and prior practice was argued to be wrong regarding "aggregation", in the Kennedy decision in *Rapanos*. Aggregation allowed smaller wetlands in the same area, "and arguably tributaries" to be considered for "a significant nexus to downstream waters." The agencies argued misinterpretation of Kennedy and application of aggregation on too large a scale. [The point of that was the analogue of "segmentation" in EIS/DEIS work: One mile of road is tolerable, so the 20 miles should be 20 times tolerable. One little wetland is not significant, so a dozen, perhaps along a creek, are not significant because they have to be considered separately.]

There was also reversal of acceptance of "the connectivity report, which is the comprehensive, peer-reviewed science report that underpinned many of the findings to support the 2015 rule. *See* June 29 Notice at 50-54." (83 Federal Register 32,227). "The agencies now go to great lengths to discredit the report, to justify a new rule that does not protect all tributaries. This is because the report concluded that small intermittent and ephemeral headwater streams collectively have a significant impact on downstream navigable-in-fact waters. Can the agencies now argue that §101(b) of the CWA allows them to ignore well-documented science?"

Fourth, they argue that the 2015 rules does not provide regulatory certainty, though the rule never went into effect, nor "was tested in the real world," because of the court stay. "The 2008 Guidance was drafted by the Bush administration with no input from the EPA of Corps field offices, and it layered on confusion where none previously existed." Ryan was and EPA lawyer then, and wrote, "…we struggled to understand… which is why the agencies promulgated the 2015 rule."

Now (as of writing for the journal) the agencies argue for returning to the 2008 Guidance, for "regulatory certainty." But, uncertainty seems likely to continue, as the agencies in court will have to explain away the "robust record supporting the 2015 rule..".

"Ultimately… it comes down to the Supreme Court." Five votes will be needed to adopt the Scalia standard. "That would judicially rewrite the CWA to limit WOTUS to relatively permanent waters… which would, in

effect, exclude most of the headwaters systems, and all wetlands and other waters that do not abut…" a relatively permanent water. What will result? "[T]he CWA will become a shadow of its former self – and we will be litigating new issues such as whether irrigation ditches are now point sources where they empty back in rivers because they would not be WOTUS."

[Note: Mark A. Ryan provides an extremely informative blog on the Clean Water Act: https://www.ryankuehler.com/cwa-blog#!
He was one of the drafters of the 2015, rule, as an EPA attorney, but he left the agency before the final 2015 rule was promulgated. His long experience specializing in the Clean Water Act provides perhaps unique depth and perspectives on the CWA and the WOTUS issues, with informed commentary on case law from around the US as well as other materials.

For instance, Mr. Ryan, Esq., notes in the May 30, 2019 entry, that the Southern District of Texas held that EPA violated the APA (Administrative Procedure Act) in issuing the 2015 rule because it was not a "logical outgrowth" of the draft rule, which was hydrology-based, and the final rule was distance-based." [No comment on that.] The Northern District of Oklahoma held that a preliminary injunction against the 2015 rule was denied because evidence of harm from the rule remaining in effect was not persuasive, and there had been no showing that there had been "aggressive expansion of federal regulation of Oklahoma waters…"

From May 13: City of Seattle v. Monsanto Co., 2019 WL 1983936 (W.D. Wash. 2019) (on motion to strike, held that Monsanto lacked standing to bring CWA counterclaims against City where City alleged that PCB contamination was caused by Monsanto's manufacture of the chemical for years, and Monsanto's claims of harm were speculative)." [The stakes can be very high.]

From May 13: "Black Warrior River-Keeper, Inc. v. Drummond Co., 2019 WL 20122396 (N.D. Al. 2019) (denying motion for summary judgment on grounds of the existence of triable issues of fact related to WOTUS, existence of acid mine drainage, and continuing violations, held that the mine refuse pile and its appurtenant dams and drainage ditches are point sources)".

From May 12: " Two interesting briefs were filed in high-profile CWA cases in the last week. The County of Maui filed its brief in the groundwater connection case pending before SCOTUS. The brief argues that point source discharges can't be regulated if they migrate to WOTUS via nonpoint source groundwater. Here's a copy of the brief. https://docs.wixstatic.com/ugd/4c816d_0cf032a350dc4409ae56a0cb31c40e1a.pdf". {The other case is Columbia Riverkeeper V. EPA – a technical point of law with a TMDL for the Columbia River at stake.]

From April 28: Discussion of the April 23, 2019 EPA interpretive statement on groundwater coverage in the CWA. This is important for a big-effect case now (the *Maui* case) which also has very high stakes.

I hope this will stimulate both new-comers and old-timers to spend some time with the blog; it is a high form of scholarship! And it's organization makes it easy to go forward or backward in time, and to use the control-F search function. E.g., find tile drains in the draft WOTUS rule issued in December 2018, claiming that water coming out of a tile drain is not covered. The blog looks formidable but it is very good exposition.

+++

Additional comments from Wiener

Ironically, some agricultural interests were led to believe that there would be new certainty. And, the sharpest point may be tile drainage (subsurface perforated piping that conducts water below the crop root zone into a surface flow, bringing much faster discharge of nutrients, herbicides, and other applied chemicals). Tiling is named after the first commercial buried drainage made by Mr. French – the other name is French drains) from roofing tiles shaped as half-cylinders. It is spreading extremely fast, though there seems to be no good source on how far and how fast, though it has been said that the new machines for installation can do 30 miles of drainage in a day; the companies that install could supply up-to-date information. A good analysis of the problem came from the Environmental Working Group; see https://www.ewg.org/news/news-releases/2012/04/12/poor-farming-practices-foul-drinking-water-source but note that this was a 2012 report. I have not found a recent USDA estimate on that.

The issue had some prominence in the *Des Moines Water Works* case; see Farber, Brianna, 2018, Ground Truthing: The Politics and Culture of Soil and Water Conservation in Iowa Agriculture [dissertation], for a political ecology view with treatment of the case, https://scholarcommons.sc.edu/etd/4868/ , and Coppess, Jonathan, W., 2018, A Perspective on Agricultural Policy in the Age of Nutrient Loss, 23 Drake Journal of Agricultural Law 29, which responds to the Des Moines case and examines policy choices.

The Des Moines Register [newspaper] covered the complaint and the case carefully; in particular, reporter Donnelle Eller provided excellent reporting throughout the case. (https://www.desmoinesregister.com/staff/17637/donnelle-eller/).]

Lexis Search, June 2019: selected references and some notes

Lexis "Waters of the United States" -- last 2 years, 08 Jun 19 last look; search for "Waters of the United States" plus filter: last two years. Sorting by date seemed fruitless. Footnotes often result in odd formatting.

+++

Crowder, Jay, 2018, Note: Notice to SCOTUS: Coal Ash Should be a Point Source Discharge Under the Clean Water Act. 19 Vermont Journal of Environmental Law 89

+++

Duus, Hannah, 2018, Note: Waters of the United States: How the Governmental Branches Struggled to Settle the Jurisdiction of the Clean Water Act. 30 Georgetown Environmental Law Review 379.

+++

Allen, Craig NH., 2018, Arctic Law & Policy Year in Review: 2017. 8 Washington Journal of Environmental Law and Policy 106.

+++

Yantis, Brittany, Merin Cherian, Sean Lavin, Bridget Vuona, Julia Rugg, Teresa Rubinger, and Timothy Wilt, 2018, Environmental Crimes. 55 American Criminal Law Review 1095.

+++

Case Summaries, 2018, [case 2 is *United States v Robertson*, 875 F. 3d 1281 (9th Cir., 2017), on case arising from defendant failure to get permits for ponds and dredge and fill into wetlands on National Forest Lands on a privately owned mining claim. Court applied *Rapanos v. United States* in determination of whether Waters of the US were affected so as to put defendant under Clean Water Act jurisdiction. Held: Kennedy test [significant nexus] applied.] 48 Environmental Law 529.

+++

Buzbee, William W., 2019 Agency Statutory Abnegation in the Deregulatory Playbook. 68 Duke Law Journal 1511. [Statutory abnegation is defined as new claim by an agency that is lacks statutory power previously claimed. The article considers previous uses, as well as 2017 and 2018 "especially prevalent" use, how to distinguish this strategy, the legal complexities, and judicial treatment.]

+++

Kochran, Donald J., 2019, Strategic Institutional Positioning: How We Have Come to Generate Environmental Law Without Congress. 6 Texas A&M Law Review 323. [WOTUS as an example.]

+++

Buzbee, William W., 2018, The Tethered President: Consistency and Contingency in Administrative Law. 98 Boston University Law Review 1358. [WOTUS rule revision as an example.]

+++

Wells, Bret, and Tracy Hester, 2018, Abandoned But Not Forgotten: Improperly Plugged and Orphaned Well May Pose Serious Concerns for Shale Development. 8 Michigan Journal of Environmental and Administrative Law 115. [Waters of the US as an issue, because of question of jurisdiction over groundwater discharges.]

+++

Brickley, Alan K., Steven R. Schell and Edward J. Sullivan, 2018, Climate Change and Oregon Law: What is to be Done? 33 Journal of Environmental Law and Litigation 235. [WOTUS as example.]

+++

No author noted. 2018, Developments: Washington Update: Redefining "Waters of the United States" in the Trump Era. 48 Texas Environmental Law Journal 178.

+++

Johnson, Stephen M., 2018, Indeconstructible: The Triumph of the Environmental "Administrative State." 86 University of Cincinnati Law Review 653.

+++

Meshel, Tamar, 2018, Environmental Justice in the United States: The Human Right to Water. 8 Washington Journal of Environmental law and Policy 264. [WOTUS noted; may be among other points or foci.]

+++

Frost, Amanda, 2018, In Defense of Nationwide Injunctions. 93 New York University Law Review 1067.

+++

Schiff, Damien, 2018, Keeping the Clean Water Act Cooperatively Federal – Or, Why the Clean Water Act Does Not Directly Regulate Groundwater Pollution. 42 William and Mary Environmental Law and Policy Review 477. [Law over facts?]

+++

Schilling, Travis L., 2018, Note: Redefining the Waters of the United States: Did Government Overreach Just Get Trumped? 23 Drake Journal of Agricultural Law 131. [A perspective other than water quality and hydrology.]

+++

Geltman, Elizabeth Glass, 2018, The new Anti-Federalism: Late Term Obama Environmental Regulations and the Rise of Trump. 93 North Dakota Law Review 243. [**Abstract**: Donald Trump ran his campaign on an anti-federalist agenda. He asserted that the federal government was too large and that regulation was the key problem choking the economy. A large portion of the country agreed. Apparently, Trump's arguments especially resonated with voters in Republican led states. Polling did not accurately predict Trump's success in the 2016 Electoral College. To many, Donald

Trump's election as President came as a great surprise. Traditional polling reported in the press did not predict Trump's electoral victory.

Patterns in public response to some of President Obama's second term environmental health regulation more accurately predicted the electoral map. As the second term Obama EPA proposed additional regulation, resistance in the central United States grew.

This Article tracks the legal reaction of states across the country to Obama second term regulations governing shale oil and gas extraction (what the public calls "fracking"), the rule revising the

definition of "Waters of the United States," 1 and the "Clean Power Plan." 2 The Article demonstrates that with each new regulation, opposition to the Obama environmental plan grew. The map of state reaction to the Clean Power Plan (the final rule in the suite of rules examined) shows a map that resembles, if not mirrors, the November 2016 electoral map.]

+++

Gutermuth, William, 2017, Circling the Drain: Regulating the Nutrient Pollution from Agricultural Sources. 30 Journal of Law and Health 80.

+++

No Author noted, 2017, Running Down the Controlling Opinion in *Rapanos v. United States*. 21 University of Denver Water Law Review 47.

+++

Scanlan, Melissa K., 2019, Droughts, Floods, and Scarcity on a Climate-Disrupted Planet: Understanding the Legal Challenges and Opportunities for Groundwater Sustainability. 37 Virginia Environmental Law Journal 52. [Note: begins with some information on groundwater hydrology, and then overview of US groundwaters, and some efforts to jointly manage surface and ground water. The California effort, including the *Agua Caliente…v. Coachella* case shows the complexities.]

+++

Boger, Daniel, 2018, Pre-enforcement Review: An Evaluation from the Perspective of Ripeness. 36 Virginia Environmental Law Journal 77. [*Rapanos* case as an example, but the focus is on legalities and timing of review.]

+++

Cecot, Caroline, 2019, Deregulatory Cost-Benefit Analysis and Regulatory Stability. 68 Duke Law Journal 1595. [BCA – here called CBA; no difference except order -- as source of reasonable regulatory stability is under-appreciated.] [WOTUS is an example, but not the main one.]

Abstract: Cost-benefit analysis ("CBA") has faced significant opposition during most of its tenure as an influential agency decisionmaking tool. As advancements have been made in CBA practice, especially in more complete monetization of relevant effects, CBA has been gaining acceptance as an essential part of reasoned agency decisionmaking. When carefully conducted, CBA promotes transparency and accountability, efficient and predictable policies, and targeted retrospective review.

This Article highlights an underappreciated additional effect of extensive use of CBA to support agency rulemaking: reasonable regulatory stability. In particular, a regulation based on a well-supported CBA is more difficult to modify for at least two reasons. The first reason relates to judicial review. Courts take a "hard look" at agency findings of fact, which are summarized in a CBA, and they require justifications when an agency changes course in ways that contradict its previous factfinding. A prior CBA provides a powerful reference point; any updated CBA supporting a new course of action will naturally be compared against the prior CBA, and the agency will need to explain any changes in CBA inputs, assumptions, and methodology. The second reason relates to the nature of CBA. By focusing on the incremental costs and benefits of a proposed change, CBA can make it difficult for an agency to justify changing course, especially when stakeholders have already relied on the prior policy. Together, these forces constrain the range of changes that agencies could rationally support. CBA thus promotes regulatory stability around transparent and increasingly efficient policies.

But, admittedly, this CBA-based stabilizing influence gives rise to several objections. This Article responds to, among others, concerns about democratic accountability and, most importantly, the use of alternative methods of policy modification. Overall, the Article concludes that CBA and judicial review of CBA play a desirable role in stabilizing regulatory policy across presidential administrations.

Blackman, Josh, 2018, Presidential Maladministration. 2018 University of Illinois Law Review 397.

[Note: Highlight: In Presidential Administration, then-Professor Elena Kagan re-envisioned administrative law through the lens of the President's personal influence on the regulatory state. Rather than grounding Chevron deference on an agency's "special expertise and experience," Kagan would "take unapologetic account of the extent of presidential involvement in administrative decisions in determining the level of deference to which they are entitled." The stronger the President's fingerprints on the executive action, a practice she praises as "presidential administration," the more courts should defer. There is a flipside to Kagan's theory: four species of high-level influence, which I describe as "presidential maladministration," are increasingly problematic. First, where an incoming administration reverses a previous administration's interpretation of statute, simply because a new sheriff is in town, courts should verify if the statute bears such a fluid construction. Second, where an administration discovers a heretofore unknown power in a statute that allows it to confer substantive rights, courts should raise a red flag, especially when the authority exercised was one Congress withheld. Third, where an administration declines to enforce a statute that Congress refuses to repeal, under the guise of prosecutorial discretion, courts should view the action with skepticism. Fourth, where evidence exists that the White House attempted to exert its influence and intrude into the rule-making process of independent agencies,

courts should revisit the doctrine concerning altered regulatory positions. As the Federal Register has recently turned the page from Obama to Trump, this article: provides a timely analysis of how courts react to unpresidented approaches to maladministration.

+++

Spanjer, Elan L., 2018, Swamp Money: The Opportunity and Uncertainty of Investing in Wetland Mitigation Banking. 113 Northwestern University Law Review 371.

[Note: **ABSTRACT**--In recent years, the wetland mitigation banking program has emerged as a favored mechanism for protecting the nation's aquatic resources while allowing for economically beneficial development projects to proceed. Mitigation banks generate wetland credits, which in turn can be sold at a profit to developers who need them to offset wetland impacts. The number of mitigation banks has grown significantly in recent years, and the market has seen an influx of institutional investment. However, investors face significant risks and uncertainty, and many prospective investors lack access to information about wetland credit prices--which are neither reported to the regulatory authorities nor made available to the general public--and are therefore deterred from entering the market.

This Note proposes that the market for wetland mitigation credits would be more efficient if bank sponsors were required to report credit price information to regulatory authorities and if this information were made publicly available. Transparency of credit price information would incentivize both greater entry into the wetland mitigation banking market and improved planning on the part of prospective bank sponsors and developers alike. Moreover, by encouraging the establishment of more mitigation banks, regulatory authorities would have greater ability to ensure wetland credits purchased by developers more accurately match the type and functional values of the wetlands impacted.]

+++

Adler, Robert W., 2019, Coevolution of Law and Science: A Clean Water Act Case Study. 44 Columbia Journal of Environmental Law 2.

[Note: The case is CWA “biocriteria”, not WOTUS. “Despite recent political attacks, science is integral to environmental law and other regulatory regimes that are informed by new scientific research. It is inaccurate, however, to view the relationship between law and science as static. Traditionally, science is either seen as a servant of the legal system, responding to and supporting the applicable statutes and regulations; or we expect the legal system to respond or "catch up" to scientific advances. A more useful model, borrowed from evolutionary biology, is coevolution, an ongoing process in which law and science interact over time in an iterative process. A case study from the Clean Water Act ("CWA") biocriteria program illustrates this dynamic process and suggests ways in which law and science can interact more effectively in the CWA and other regulatory regimes. It also highlights the conceptual difference between "scientific knowledge" and "regulatory knowledge," and the importance of that distinction for separation of powers and democratic governance in the administration and enforcement of complex regulatory statutes.”]

+++

Lin, Elbert, 2018, State Responses to Federal Executive Power: States Suing the Federal Government: Protecting Liberty or Playing Politics? 52 University of Richmond Law Review 663.

[Note: WOTUS is mentioned, but is not a major topic. This is Introduction: It has become increasingly common in recent years to scan the news and find that a state or group of states has sued the federal government. During the eight years of the Obama Administration, states led mostly by Republican attorneys general challenged federal action on matters ranging from health care to immigration to the environment to overtime pay. And during just the first year of the Trump Administration, states led by Democratic attorneys general have brought suits in many of those same areas and others, including federal student loan relief and regulation of the internet.

Many of these state-led lawsuits have put the brakes on federal executive actions. Though some of the cases have challenged alleged congressional overreach in federal statutes - most notably the

Affordable Care Act ("ACA") 1 - the overwhelming majority have challenged actions by federal agencies or the President himself. And many have been successful. In February 2016, West Virginia's multistate action against the signature climate-change rule of the Obama Administration Environmental Protection Agency ("EPA") resulted in a United States Supreme Court stay of the rule that, for all practical purposes, made possible the Trump Administration EPA's current efforts

to repeal that rule. 2 Two years later, [*634] Washington State's lawsuit challenging President Trump's Executive Order 13769 (sometimes called the "Travel Ban") succeeded in blocking the

enforcement of significant parts of the Order 3 and caused the Trump Administration to issue a

revised Executive Order. 4]

+++

Buzbee, William W., 2019, Deregulatory Splintering. 94 Chicago-Kent Law Review 439.

[Note: this is **highlight**: When new administrations arrive and consider agency policy changes, they often must choose what actions to take in court or through regulatory process. They may seek to stay an existing regulation, rescind, or possibly replace it. This article assesses strategic uses of, and responses to, agencies that pursue deregulatory roll-backs through a splintered series of steps. Through such splintering, agencies sometimes seek to avoid direct apples-to-apples comparison of the baseline regulation and new proposal, also often squelching opportunities for comment. They may seek to achieve a deregulatory outcome without the full process, disclosure, and reason-giving that ordinarily must accompanying any notice-and-comment regulation and that longstanding Supreme Court precedents require when an agency changes policy. This article highlights problems with such deregulatory splintering, analyzes governing law, and also illuminates misunderstandings about deference regimes that are sometimes erroneously relied upon to justify deregulation via procedural shortcuts. Courts have generally rejected deregulatory splintering strategies, correctly

noting how such deregulatory splintering violates both positive law requirements and central precepts about accountability and legitimacy in the administrative state.]

+++

Ball-Blakely, Christine, 2017, CAFOs: Plaguing North Carolina Communities of Color. 18 Sustainable Development Law & Policy 4.

[Note: This is Introduction: Grocery shopping has become a foraging expedition through a market of lies. The coolers are stocked with milk cartons boasting pastoral scenes of cows grazing on verdant hills. Egg cartons are stamped "all-natural." Sausage is neatly packaged in a tube and emblazoned with a red barn. But the origins of most meat and dairy products are far divorced from these depictions of traditional farming. In stark contrast, animal products are overwhelmingly

produced in Concentrated Animal Feeding Operations (CAFOs), 1 otherwise known as

"factory farms." 2

The Environmental Protection Agency (EPA) defines CAFOs as particular types of Animal Feeding

Operations (AFOs). 3 AFOs are facilities where animals are confined together in a small area,

along with "feed, manure and urine, dead animals, and production operations." 4 In AFOs,

food is brought to the animals rather than the animals grazing in pastures. 5 AFOs are designated as CAFOs under two circumstances: (1) where the AFO is a "significant contributor of

pollutants to waters of the United States," 6 or (2) where the AFO "stables or confines" a

minimum number of animals. 7

Today, about ten billion animals are raised and slaughtered in the United States every year. 8

More than 99% of those animals are raised and slaughtered in CAFOs. 9 American meat

consumption has nearly doubled over the last century, 10 and the USDA projects this

consumption will further swell over the next decade. 11 With this level of consumption, it comes as no surprise that animal products are cheap. Meat and dairy prices have been steadily dropping in the United States for over a century, in part due to the advent of CAFOs in the

1950s. 12 But while the price Americans pay for animal products at the grocery store may seem low in dollars, the true price is staggeringly high.

CAFOs are deleterious to human and nonhuman animals alike. In addition to causing unquantifiable animal suffering, 13 CAFOs put independent family farmers out of business, 14 and they create deplorable working conditions for employees. 15 CAFOs also create massive externalities in the form of environmental destruction while they ravage their vulnerable host communities and trample civil rights. 16 Section II examines some of these communities, located on the North Carolina Coastal Plain, which are home to many African American, Latino, Native American, and economically disadvantaged people. 17 This Section also describes the significant environmental damage that CAFOs deal to these vulnerable communities, which in turn causes plummeting property values and endangers health. 18 Section III explores relevant law and how it fails to protect these vulnerable communities, creating the enforcement gap.19 Section IV explains how the idea of farming is America's sacred cow, spurred by rosy visions of wholesome white farmers and their families living out the rugged individualism that our country has worshipped for centuries. Big Agribusiness ("Big Ag")20 eagerly and effectively exploits this idea, raking in immense profit (including subsidies from misinformed tax payers) and power. 21 With this power, Big Ag purchases politicians. Those politicians twist the law into an instrument of oppression by carving out the enforcement gap. The enforcement gap invites CAFOs to exploit vulnerable communities. Section V reckons that North Carolina presents a potential blueprint for the way forward. 22 Though federal environmental and civil rights laws face further weakening (and perhaps even extinction) under the Trump administration and a Republican-controlled Congress, these vulnerable communities in North Carolina can fight CAFOs at the state level.]

+++

Johnston, Craig N., 2018, Resisting Deregulation: How Progressive States Can Limit the Impact of EPA's Deregulatory Efforts. 48 Environmental Law 875

[Note: EPA v. CWA is a major topic.]

+++

Light, Sarah E., 2018, Regulatory Horcruxes. 67 Duke Law Journal 296.

[Note: the author adapted the Harry Potter novels idea of a "horcrux" to refer to scattered or fragmented features of a program that might insulate it from easy repeal. She examines the idea, for instance, of putting a program into parts within several agencies or regulations. There are pros and cons.]

+++

The Lexis search returned many hundreds of items; this is a selection that seemed most useful.

+++

Search of Google Scholar, “waters+of+the+united+states”

Note: this is their format; the purple titles are live links; please inform Wiener if they are not functioning after posting. The notes are those supplied in the listing. Please inform Wiener if they are not useful or correct.

Migratory Birds: Greater Vulnerability under Trump Administration's Policies on Incidental Take and Habitat
CJ Miller - Animal Law, 2019 - go.galegroup.com
… Regulatory changes made by the Trump Administration threaten the legal protections for these birds. This article briefly summarizes regulatory changes to the interpretation of the Migratory Bird Treaty Act, the Endangered Species Act, and the **Waters of the United States** …

[PDF] wildlife.org

[PDF] American Fisheries Society
MAR Wheeler, MRD James, DA Wheeler, AS James - 2019 - wildlife.org
… Mr. RD James Assistant Secretary of the Army for Civil Works US Army Corps of Engineers 441 G Street, NW Washington, DC 20314 Re: Revised Definition of “**Waters of the United States**” (84 FR 4154; Docket ID No. EPA-HQ- OW-2018-0149) …

[HTML] springer.com

[HTML] Advocating for Science: Amici Curiae Brief of Wetland and Water Scientists in Support of the Clean Water Rule
RC Gardner, E Okuno, S Tai, MS Fennessy… - Wetlands, 2019 - Springer
… OHWMs of the Great Lakes. This review article is adapted from that amici brief. Keywords Clean Water Act . **Waters of the United States** . Wetlands . Navigable waters . Significant nexus . Regulation The Clean Water Act (CWA …

Clean Water Or a Guilty Conscience: The Newly Proposed Rulemaking to Rescind and Replace the Clean Water Rule Has Ethical and Professional Implications for …
J Powell - J. Legal Prof., 2018 - HeinOnline
…The EPA attorneys' participation in the proposed rule to rescind the Clean Water Rule and promulgate a new rulemaking defining "waters of the United States" is contrary to attorney duties and roles, the law, and ethics …

[HTML] fisheries.org

[HTML] Science Societies Urge EPA Not to Change the Waters of the US Rule
MAR Wheeler, MRD James - fisheries.org
… Via regulations.gov: Docket ID No. EPA-HQ-OW-2018-0149. Re: Scientific Societies Comments on Proposed Rule – Revised Definition of "Waters of the United States" (84 FR 4154; Docket ID No. EPA-HQ-OW-2018-0149). CC …

[PDF] perc.org [Property and Environment Research Center]

[PDF] What Went Wrong with WOTUS
RD Simpson - perc.org
50 days ago - … What Went Wrong With WOTUS: Reflections on Economic Valuation and Environmental Regulation Page 4. To the Reader In 2015, the Environmental Protection Agency issued a regulation addressing the definition of the "**waters of the United States**," also known …

[PDF] freshwater-science.org

[PDF] Via regulations. gov: Docket ID No. EPA-HQ-OW-2018-0149
MAR Wheeler, MRD James - 2019 - freshwater-science.org
52 days ago - … Via regulations.gov: Docket ID No. EPA-HQ-OW-2018-0149 Re: Society for Freshwater Science Comments on proposed rule - Revised Definition of "Waters of the United States" (84 FR 4154; Docket ID No. EPA-HQ- OW-2018-0149) …
All 2 versions

The Clean (Ground) Water Act?
D Chung, EB Dawson - HeinOnline
… taken the position that the CWA leaves groundwater regulation and nonpoint-source pollution control to the states, that has not stopped litigants from arguing that the federal CWA regulates discharges of pollutants to groundwater that ultimately reach waters of the United …

+++

[PDF] Defining an ecosystem approach to aquaculture (EAA) for federal **waters of the United States**
A Katherine, B Michael - Bull. Jap. Fish. Res. Edu. Agen. No, 2019 - fra.affrc.go.jp
The increase in world population, along with increased demand for seafood as a source of human nutrition, and stagnant wild fisheries catches, will necessitate the growth and diversification of marine aquaculture globally. However, marine aquaculture …
Related articles

+++

Headwater Streams and Wetlands are Critical for Sustaining Fish, Fisheries, and Ecosystem Services
SAR Colvin, SMP Sullivan, PD Shirey, RW Colvin… - Fisheries, 2019 - Wiley Online Library

… Headwaters ecosystems and the natural, socio-cultural, and economic services they provide are already severely threatened, and would face even more loss under the Waters of the United States (WOTUS) rule recently proposed by the Trump administration …
+ Cited by 2 Related articles All 4 versions**[PDF]** affrc.go.jp

+++

[PDF] Defining an ecosystem approach to aquaculture (EAA) for federal **waters of the United States**
A Katherine, B Michael - Bull. Jap. Fish. Res. Edu. Agen. No, 2019 - fra.affrc.go.jp
79 days ago - The increase in world population, along with increased demand for seafood as a source of human nutrition, and stagnant wild fisheries catches, will necessitate the growth and diversification of marine aquaculture globally. However, marine aquaculture …
Related articles

+++

flTT4lIfTTIm
CW Act - HeinOnline
135 days ago - … 617 (2018), the Court once again addressed a question related to the Clean Water Act's (CWA's) phrase "waters of the United States." In a series of prior cases, the Court evaluated whether agency interpretations of this phrase-which imposes jurisdictional linits on the …
Related articles

+++

[PDF] oregonstate.edu
Headwater Streams and Wetlands are Critical for Sustaining Fish, Fisheries, and Ecosystem Services
SAR Colvin, SMP Sullivan, PD Shirey, RW Colvin… - Fisheries, 2019 - Wiley Online Library
141 days ago - … Headwaters ecosystems and the natural, socio-cultural, and economic services they provide are already severely threatened, and would face even more loss under the Waters of the United States (WOTUS) rule recently proposed by the Trump administration …
Cited by 2 Related articles All 4 versions
[HTML] envirobites.org

+++
[HTML] The Fight Over Waters of the US
+++

FI Credit, W Kroschel - envirobites.org
160 days ago - … EPA Proposal (Dec. 11, 2018): Revised Definition of Waters of the US. On December 11, 2018 the Trump Administration's Environmental Protection Agency and US Army Corps of Engineers issued a proposal defining waters of the United States …
Related articles
[PDF] tamu.edu

+++

Strategic Institutional Positioning: How We've Come to Generate Environmental Law Without Congress
DJ Kochan - 2018 - papers.ssrn.com
… Part IV discusses agencies as self-interested actors that will accept legislative-like authority if it is offered to them. Part V uses case studies on National Monuments and the Waters of the United States (WOTUS) Rule as demonstrative of the strategic positioning phenomenon …
Related articles All 2 versions

+++

Redefining the **Waters of the United States**: Did Government Overreach Just Get Trumped
TL Schilling - Drake J. Agric. L., 2018 - HeinOnline
274 days ago - Since the 2008 Waters of the United States Rule (WOTUS) was issued, stakeholders, including farmers, local governments, commercial developers, environmental advocacy groups, and states, have expressed dissatisfaction with the rule's lack of clarity. …
Related articles [Note: duplicate listing above.]

+++

[PDF] Environmental Law: Little Streams and Legal Transformations
D Owen - The Judges' Book, 2018 - repository.uchastings.edu
305 days ago - … In 2015, the United States Army Corps of Engineers (the Corps) and the United States Environmental Protection Agency (EPA) finalized a rule slightly expanding the scope of the phrase "waters of the United States," which establishes the boundaries of federal jurisdiction …
Related articles

+++

Environmental Law-Clean Air Act
D Hawkins - Wisconsin Law Journal, 2018 - search.proquest.com
315 days ago - … Not wanting to run afoul of the Clean Water Act, Orchard Hill requested a determination from the United States Army Corps of Engineers that the wetlands (or the "Warmke wetlands") were not jurisdictional "waters of the United States." The Corps decided that they were …

+++

Perspectives of the Clean Water Rule and an Alternative Policy
K Kelley, KA Hopkins - 2018 - ir.uiowa.edu [Iowa Research Online; this is an Honors Thesis]
351 days ago - … justifications behind those considerations. We will begin by outlining forecasted benefits from clarifying the definition of Waters of the United States (WOTUS) determined by the Army Corp of Engineers and Environmental Protection Agency (EPA) …
Related articles All 2 versions

+++

Notes on American Water Works Association – comment to EPA, June 2019

https://aquadoc.typepad.com/files/20190607_awwa_hydrologicconnectionnotice.pdf

American Water Works Association statement to EPA on: "Comments on "Interpretive statement on application of the Clean Water Act National Pollutant Discharge Elimination System Program to Releases of Pollutants from a Point Source to Ground Water" (EPA-HQOW-2019-0166)."

"EPA is not appropriately balancing environmental protection with regulatory certainty. Given the "One Water" nature of all water resources, an important balance must be reached to help protect all water resources. This proposed interpretative statement inappropriately eliminates a potentially beneficial tool that could be used to protect sources of drinking water without consideration for the impacts of this decision. Moreover, this action contravenes the basic science of hydrology and the interaction between surface waters and groundwater. AWWA recommends that EPA not finalize this interpretive statement and instead proceed to rulemaking to clarify these issues in a balanced manner informed by science and state regulatory needs. Should EPA proceed with this interpretative statement, it should take a more balanced approach that weighs the benefits of source water protection against the benefits of eased permitting and regulatory certainty."

AWWA asserts that there has been long-standing practice of NPDES permitting under the "direct hydrologic connection theory", with testimony to Senate Committee on Environment and Public Works:

Fn 3: Southern Environmental Law Center testimony on April 18, 2018 to the Senate Committee on Environment and Public Works. https://www.epw.senate.gov/public/index.cfm/2018/4/the-appropriate-role-of-states-and-thefederal-government-in-protecting-groundwater

Without this, there can be added surface water pollution, by dischargers using adjacent groundwater systems [which will connect to surface, in some cases, and in other cases, the groundwater may be a drinking water source].

"[I]t would hardly make sense for the CWA to encompass a polluter who discharges pollutants via a pipe running from the factory directly to the riverbank, but not a polluter who dumps the same pollutants into a man-made settling basin some distance short of the river and then allows the pollutants to seep into the river via the groundwater."5

Fn 5 and 6: 5 N. Cal. River Watch v. Mercer Fraser Co., No. C–04–4620 SC, 2005 WL 2122052, at *2 (N.D.Cal. Sept. 1, 2005)
6 May 21, 2018 comments from the Colorado Department of Public Health & Environment. https://www.regulations.gov/document?D=EPA-HQ-OW-2018-0063-0509 "

The AWWA asked for two clarifications; one is: "A robust list of factors and processes to be used in the fact-specific process necessary for identifying whether or not a direct hydrologic connection to Waters of the U.S. exists. This list would be designed to reduce the overall burden of determining if a direct hydrologic connection exists and to increase consistency amongst said determinations."

[Note: this comment is related to the issues of regulatory certainty and "statutory abnegation" and past practice. See Ryan, 2018, first item; American Water Works Association; and Buzbee, 2019, P 5 above, in particular. There is a great deal more in the Ryan CWA Blog.

+++

Selected Law Reviews

Please note: these are somewhat peripheral to the Round-up idea. Perhaps they will be useful. There are some conventions to observe: (1) these marks **[*110]** show the page number following the mark. There are sometimes apparently quite short pages, and sometimes large gaps, due to machinery's handling of footnotes and spacing for headings or other reasons.

(2) "Id." – refers to the immediately preceding citation or citation earlier in the same footnote.

(3) "Ibid." – citation for "occurs in the same place"; can be "Ibid (page 23") for a reference not close by, with the case or author cited earlier. If a new reference appears, start again after the first full citation.

(4) "Op. cit" – somewhat disused, now. It means "opus citato" – work cited and should not be used without author's name or case name, and works best for formats with a bibliography or references set.

Now, the common approach is "Williams, *supra* n. 39"

These definitions were checked with internet search; traditionally, there was a printed "Blue Book – A Uniform System of Citation." The basic idea, from 19th Century and later concerns, was that every claim of fact or attribution should have a source or reference, and that type-setting and paper were expensive, so that elaborate sets of abbreviations were developed. Footnotes were used, rather endnotes so readers could find the citation easily, and, unfortunately, so that readers looking for a citation had to flip a lot of pages. Traditionally, in a legal brief [description of case, argument, etc., for the judge, and courts to which a case could be appealed] a partial remedy was a list of "authorities" – cases and sources; not so for law reviews. Good luck! This style might be more attractive than it first seems.

Finally, in this set, the Red Words are those used for a search.

+++

Vos, Nathan. 2017, Agricultural Drainage and the Des Moines Water Works Lawsuit. 22 Drake Journal of Agricultural Law 109.

HIGHLIGHT:

Preface

Two important cases have been decided since this Note was completed. First, on January 21, 2017, the Iowa Supreme Court answered the United States Northern District of Iowa's Certified Questions in Board of **Water** Works Trustees of City of **Des Moines** v. Sac County Board of Supervisors. [n1] As expected, the Iowa Supreme Court held the Drainage Districts of the Iowa counties, Sac, Calhoun, and Buena Vista, were not proper parties to sue under Iowa statute or common law and, therefore, could not be sued for any kind of damages under state law. [n2] Second, and surprisingly, on March 17, 2017, the District Court [n3] dismissed the

Des Moines Water Works lawsuit in its entirety - both on the state claims and the federal Clean **Water** Act claims. [n4] **Des Moines Water** Works is not expected to appeal this decision.

Importantly, none of the **water** municipal's federal claims were addressed substantively when the case was dismissed. [n5] Instead, the federal District Court dismissed the claim on procedural standing technicalities [n6] due to the limited governing nature of drainage districts. [n7] Readers interested in this litigation and development of similar environmental litigation, will find this Note helpful as it addresses several substantive legal issues concerning the Clean **Water** Act's application to drainage infrastructure and discusses the history of agriculture drainage generally and in Iowa. Due to the timing of the District Court's decision to dismiss, this Note has been left substantially the same as when it was first submitted for final publication. The author apologizes for any past and present tense verb discrepancies.

TEXT:
[*110]

I. Introduction

On January 9, 2014, the **Des Moines Water** Works ("DMWW"), a **water** municipal, servicing about 500,000 people [n8] in the **Des Moines** area of Iowa, [n9] sent a letter of intent to sue rural drainage districts in Sac, Calhoun, and Buena Vista counties ("Drainage Districts") in northwest Iowa. [n10] Under the citizen enforcement action in 33 U.S.C. § 1365 of the Federal **Water** Pollution Control **[*111]** Act ("Clean **Water** Act" or "CWA") and Iowa Code section 455B.111, DMWW alleges these Drainage Districts are in violation of the Clean **Water** Act, 33 U.S.C. Sections 1311(a) and 1342(a), and Iowa Code section 455B.186, for failure to obtain a National Pollution Discharge Elimination System (NPDES) permit for unlawfully discharging nitrate pollution into the Raccoon River, which leads to the **Des Moines** area drinking **water** supply. [n11] **Des Moines Water** Works contends the Drainage Districts' drainage activity has a detrimental environmental impact on the Raccoon River, which is a raw **water** source for DMWW. [n12] This polluted **water** must then be cleaned by DMWW at a substantial cost to make the **water** safe to drink for its customers. [n13] If the lawsuit is successful on its state law and federal claims, DMWW expects compensation for past and recurring damages from the cost of cleaning the nitrates out of its drinking **water** as well as enforcement of the CWA. [n14]

Many reactions to the lawsuit have not been overly pleasant. Although it is not difficult to understand why a city municipal suing rural entities intrinsically tied to a dominate sector of Iowa's economy would be unpopular, perceptions of the lawsuit have also been negatively affected by advertisements from the newly formed political group, the Iowa Partnership for Clean **Water.** [n15] These negative advertisements have been against the **Water** Works CEO Bill Stowe, [n16] DMWW itself, [n17] and lawyers generally. [n18] Because of the general nature of the litigation and subsequent negative advertisements, **Des Moines Water** Works, as a **Des Moines** lobbyist once stated, has been considered by those involved in governmental affairs to be "toxic waste that nobody wants to handle." [n19]

[*112] This said, agricultural groups' and farmers' concerns over agricultural drainage regulation are not without merit. It has been estimated by some that the requirement of NPDES permits and implementation of nitrate reducing apparatuses and practices could cost many Iowa farmers up to $ 100 an acre every year over the course of fifty years. [n20] However, this estimate is rather high due to being based on the Iowa Nutrient Reduction Strategy to reduce current nitrate and phosphorus levels by 45 percent. [n21] This reduction would "require 60% of all corn and soybeans acres to be planted with cover crops; 27% of all agricultural land drained into wetlands, and 60% of the drained land treated with bioreactors." [n22] This would require 6,000 wetlands constructed and 90,000 bioreactors attached to fields over 12 million acres of crops. [n23] Such a dramatic implementation does not seem likely.

At the heart of this controversial lawsuit is the agricultural practice of land drainage. As such, this Note will concern itself mostly with agricultural drainage. The Note will be divided into three main parts: the

history of agricultural drainage generally and in Iowa; the benefits and disadvantages of agricultural drainage; and discussion of the DMWW lawsuit's substantive claims.

II. General Agricultural Drainage History

Drainage is "the act, process, or method of draining" or a "system of drains, arrangement of pipes, etc. for carrying off waste matter." [n24] Draining is defined as "drawing off (liquid) gradually" or "to draw **water** or any liquid from gradually so as to dry or empty: to drain swamps." [n25] In agriculture, drainage is the removal of excess **water** and the artificial lowering of a field's **water** table for agricultural use. [n26] Draining **water** from agricultural lands is not a new concept. [n27] In Western civilization, agricultural drainage existed before and during the early Christian Era as Cato, and later Columella, Pliny, and Palladius wrote about the **[*113]** drainage of Roman lands for growing crops. [n28]

Two kinds of drainage system infrastructures were used during these early BC and AD centuries on agricultural lands: open and covered ditches. [n29] According to Cato for the cultivation of olive trees, both open and covered ditches were to be made four feet deep, three feet wide at the top, and one foot wide at the bottom. [n30] Open ditches were reserved for hard clay areas in the field, and covered ditches were reserved for areas in the field with looser soils that could be washed away with rain. [n31] As opposed to open-faced ditches, the bottoms of closed ditches were filled with stone, or if none were available, willow branches or twigs were used. [n32] Soil would then be placed on top to cover the ditches. [n33] Cato recommended the ditches be dug in a "V" like fashion, like an upside down roof tile. [n34] These covered ditches were interconnected to the open-faced ditches to discharge excess surface **water** away from the field. [n35] This drainage did not artificially lower the field's **water** table. [n36]

In England, where it is considerably boggier, [n37] the utility of drainage was rediscovered and pursued with vigor after the publishing of Walter Bligh's, The English Improver Improved or the Survey of Husbandry Surveyed, in 1652. [n38] **[*114]** The drainage practices advocated by Mr. Bligh were generally the same as early Roman open and closed ditches with a focus on deeper drainage limited to boggy or swampy lands. [n39] This method continued to be the predominant means of draining until the eighteenth century. [n40]

Drainage by open and covered ditches required extensive maintenance and generally did not produce desired long term results. [n41] Mr. Bligh's methods of drainage were largely replaced after John Johnstone, an English land surveyor, appointed by the British Board of Agriculture, published a report on a book in 1797, named the Art of Draining Land, that was dictated [n42] by Joseph Elkington, an English farmer. [n43] Mr. Elkington's drainage system focused on alleviating wetland areas where natural springs occurred by auguring into the spring and forcing the spring to drain into an adjacent ditch rather than come up through the soil. [n44] This method saw much success, but by the mid-1800s, it too was gradually replaced by another method to drain croplands - tiling. [n45]

The modern system of subsurface drainage, a series of parallel clay conduit placed about three feet below the surface of an entire field, originated from James Smith, [n46] a Scottish inventor, businessman, industrialist, and engineer. [n47] "Smith **[*115]** advocated and practiced a systematic operation over the whole field, at regular distances and shallow depths. Smith stated, in Scotland, much more injury arises from retention of rain **water,** than from springs; while Elkington's attention seemed to have been especially directed to springs, as the source of the evil." [n48] This new method of draining by tile emerged as the best way to drain entire fields. [n49] The early design of tiles then quickly evolved from clay horseshoe shaped tile to clay collared pipe by the late 1860s. [n50] The placement of depth and pattern of tile systems [n51] also evolved to better facilitate drainage.

Modern tiling made its way to the United States by a Scottish immigrant, John Johnston, who brought the ideas of tiling with him to America when he moved to New Jersey from Scotland in 1821. [n52] He began to tile his farm land in 1838. [n53] By 1848, Mr. Johnston's successful use of drainage and the increase to **[*116]** his yields had caught the attention of fellow agriculturists. [n54] John Delafield, a colleague of Mr. Johnston,

imported the first tile making machine from England to the United States. [n55] Early experts and advocates of drainage wrote numerous articles and treatises on agricultural drainage, bringing national attention to the process of tiling to drain land in the United States. [n56] Most prominent of these men were Colonel George Waring, judge and attorney Henry F. French, and Ohio's Secretary of Agriculture, John H. Klippart, all of whom fervently advocated that most land in the United States be drained. [n57] The purchasing of tiling and tiling machines grew rapidly; in 1871 there were ten tile making factories in Waterloo, New York, and by 1882, there were 1,140 tile making factories in the United States. [n58]

Congress passed the Swamp Land Acts of 1849, 1850, and 1860, granting over 82 million acres of federal land to sixteen states, including Iowa (4,572,816 acres), on the condition these states drain and reclaim these swamp lands for cultivation. [n59] Due to the cost of labor intensive hand installation of drainage tile at the time, drainage of these swamp land was not realized until several decades after these enactments. [n60] Eventually, steam engine trenching machines in the later part of the 1800s largely eased the labor involved with larger ditch digging and channel straightening projects. [n61] This, in conjunction with states establishing local drainage districts to overcome eminent domain issues, facilitated drainage of boggy lands in the late 1800s and early 1900s. [n62] In 1902, Congress established a Bureau of Reclamation within the USDA and directed federal money to investigate various drainage methods. [n63] In 1935, Congress authorized the Reconstruction Finance Corporation to assist cash strapped drainage districts in twenty-six states and directed the Civilian Conservation Corps to work with **[*117]** drainage enterprises and local governments to drain land. [n64] The Flood Control Act of 1944 and the Federal Watershed Protection and Flood Prevention Act of 1954 "authorized the Corps of Engineers to construct major drainage outlets and flood control channels" and authorized the USDA "to plan and construct various watershed works of improvement, including drainage outlet channels, in cooperation with State and local governments." [n65]

Just as digging ditches and channel straightening by hand gave way to horse-drawn, steam-driven trenchers in the mid-1800s, steam-powered trenchers gave way to internal combustion tractor driven trenchers in the early 1900s. [n66] The labor-intensive process of digging tile by hand and plow on private land also steadily gave way in the early decades of the 1900's as farmers gained access to internal combustion tractors that could be fitted with trenching equipment. [n67]

By the early 1970s, cement and clay tiling was supplanted by corrugated plastic tubing and continues to be the widely accepted means for tiling agricultural land. [n68] Since corrugated plastic tubing is much lighter than clay or cement tiles, it costs substantially less to ship, handle, and install. [n69] It also does not require precise alignment during installation since the tubing itself is flexible. [n70] As such, private tiling has increased exponentially in recent decades [n71] even though governmental assistance for tiling largely ended by the 1970s and "80s. [n72]

[*118]

III. Drainage History in Iowa

Iowa's drainage in the northwest and northcentral areas starts with tile drainage infrastructure on private land that drain into county open ditches [n73] or county underground systems, [n74] which then either drain into larger ditches or other **water** tributaries following their respective watersheds. [n75] As Iowa was not admitted into the Union until a few days before 1847, [n76] drainage of its agricultural lands did not begin until the later part of the nineteenth century. After Iowa was deeded approximately 4,572,816 acres of federal swampland, [n77] Iowa deeded this land to its counties. [n78] The counties in turn appointed commissioners to oversee swampland reclamation. [n79] Many parts of Iowa were a pothole prairie, with central to northwest Iowa and the Bear Creek Watershed, in both, Hamilton and Story counties, having the wettest farmland. [n80] Originally, Storm Lake, a northwest Iowa city (with a current population of 10,600 people), "stretched away in a shallow expanse much farther toward the north and west, as was historically evident by a reedy, marshy swamp, extending halfway to Alta, [Iowa]." [n81] These swamps and wetlands were considered a hindrance to settlement and development. [n82]

[*119] After flooding events in Iowa and the Midwest in 1881, [n83] 1891, [n84] and serious flooding in 1903, [n85] Iowa Governor Albert B. Cummins stated to the 1904 Iowa General Assembly, "our experience during the past two years has shown with conclusive force that our laws relating to drainage need complete revision ... . I earnestly recommend such adequate legislation as will enable the land owners of this State to protect themselves against rainfalls such as we have recently witnessed." [n86] Later that session, the General Assembly overhauled its laws on agricultural drainage to facilitate more effective drainage of Iowa wetlands. [n87] In enacting these drainage laws, the General Assembly made it clear they assumed agricultural drainage to be a benefit for the public good. [n88] The law states:

The drainage of surface **waters** from agricultural lands and all other lands, including state-owned lakes and wetlands, or the protection of such lands from the overflow shall be presumed to be a public benefit and conductive to the public health, convenience, and welfare.

The provisions of this subchapter and all other laws for the drainage and protection from overflow of agricultural or overflow lands shall be liberally construed to promote leveeing, ditching, draining and reclamation of wet, swampy, and overflow lands. [n89]

In 1908, the Iowa legislature specifically added constitutional protection for drainage and drainage districts in Article I, section 18, governing eminent domain:

The general assembly, however, may pass laws permitting the owners of lands to construct drains, ditches, and levees for agricultural, sanitary or mining purposes across the lands of others, and provide for the organization of drainage districts, vest the proper authorities with power to construct and maintain levees, drains and ditches and **[*120]** to keep in repair all drains, ditches, and levees heretofore constructed under the laws of the state, by special assessments upon the property benefited thereby. [n90]

This part of the Iowa Constitution has remained the same to this present day. [n91]

The drainage of Iowa agricultural land continued on in the early 1900s with specific focus on the northern half of the state, which was more prone to flooding. [n92] The Iowa State Drainage Waterways and Conservation Commission, appointed by Governor Beryl F. Carroll, reported "that considerable areas of over-flowed land could be reclaimed by clearing out and straightening the channels of bordering streams ... ." [n93] In the Storm Lake Watershed, three formal drainage districts were formed between 1910 and 1925 to straighten channels and drain boggy land. [n94] Most of the drainage systems in the upper **Des Moines** River basin where Sac, Calhoun, and Buena Vista counties are located, were completed from 1900 to 1915. [n95] Subsequent federal involvement in large drainage projects in Iowa was also conducted, one example being the Little Sioux Watershed Project in the 1930s and 1940s. The U.S. Army Corps of Engineers worked with state government and local drainage districts to enlarge and straighten the Little Sioux River to help with flood control. [n96]

Although these early 1900 dates mention legislated drainage, there is also evidence that private tiling was done before this time, as well as private dredge ditching and stream straightening around the late 1800s. [n97] Also, while the basic drainage infrastructure implemented by state and local efforts were largely completed in the early 1900s, this is not to say drainage infrastructure has not been added within private land holdings - it has. [n98] In general, as in Iowa, **[*121]** farmland in the Midwest is being privately tile-drained at an increasing rate every year. [n99] However, since this drainage is privately done without governmental oversight, [n100] the extent of drainage statewide in Iowa, although estimated from 17 to 22 [n101] percent of its land having drainage infrastructure, is not known with complete accuracy. Since these records are not kept, it is not

known to what extent tiling is done in new areas or to what extent more tiling is done in an already tiled area or to what extent tiling in a tiled area may be an upgrade or replacement for an older tiling system. [n102] However, it is known that Iowa's tiling drainage infrastructure is predominately in the northwest to north central to central Iowa area with drainage infrastructure heavily along the Missouri River as well. [n103] This is because the main drainage district and county infrastructure (generally open ditch and tile combinations or complete underground systems) [n104] that the individual private tiling infrastructures drain into, have remained relatively the same. [n105] The combined efforts of government and private entities to cultivate and drain Iowa lands have been dramatic: "within the span of 150 years, Iowa plowed 99.9 percent of its prairie, drained 95 percent of its wetlands, and eliminated 70 percent of its forests." [n106]

In Iowa, as in other states, "drainage districts are a quasi-public association of property owners formed to facilitate cooperative drainage in a defined **water** shed. Drainage districts have many of the powers of municipals or **[*122]** counties-to tax, to bond, to construct, etc. in respect to improving, constructing, and maintaining drainage district projects." [n107] Trustees are put in charge of these **water** drainage districts. [n108] Drainage districts in Iowa, unlike other states, by default, have the board of supervisors from their respective counties as their trustees. [n109] There are more than 3,000 drainage districts in Iowa, covering 9 million acres of land. [n110] This is larger than the combined landmass of Connecticut, Rhode Island, and Massachusetts. [n111]

IV. Benefits of Draining Agricultural Land

The benefits of draining agricultural land are best put in the title of George Waring's work, Draining for Profit and Draining for Health. [n112] With this said, the main justification for farm land drainage has always been higher crop yields, and subsequently increasing profits, as opposed to health concerns as noted presently and historically. [n113] The positive effect of draining wet farm land on yields has been apparent to farmers for centuries. [n114] The science behind draining is also rather straight forward.

To germinate, a corn or soybean seed needs the proper amount of sunlight, **[*123]** moisture, and oxygen as well as the proper temperature. [n115] If a field is saturated with **water,** the germinating seed may not only suffer from stunted growth but may die from suffocation due to **water** saturation expelling the seed's needed oxygen. [n116] A full grown or growing corn or soybean plant needs oxygen to respire and carbon dioxide for photosynthesis. [n117] Full grown and growing corn and soybean plant roots need oxygen because photosynthesis does not occur at the root level as their roots do not have access to sunlight. [n118] Unsaturated soils with minimal moisture have air pockets from which plant roots are able to draw oxygen. [n119] If a soil is saturated with **water, the water** replaces a plant's needed oxygen, and the plant will suffocate. [n120] In addition, draining crop land encourages deeper root structure because a plant's roots will grow further down in the soil to draw **water** from a lowered **water** table, so when there is drought, the root structures will be able to reach an even lower **water** table. [n121] Plants are also less prone to disease and rot if grown in a drier environment. [n122]

Draining farm soil also provides better access to fields and reduces the labor involved with planting, taking care of, and harvesting crops. [n123] Drier soil, which is not compacted or bound together by excessive moisture, reduces wear on farming equipment like tractors and combines as well as reducing the fuel needed to propel farm equipment. [n124] Since tiling eases access to crops and increases farmland productivity, it increases land value. [n125]

Another important reason, although not the primary reason, [n126] for Midwest settlers to drain wetlands was the health concern of living on wet, swampy land. [n127] To early settlers, swamps in Iowa and in general, were to be avoided because of the disease and mystery surrounding wet lands. [n128] Mosquitos breed in **[*124]** wet areas like swamps, and female mosquitos, carrying an anopheline parasite which causes malaria, can pass malaria on to humans when the mosquitos draw blood. [n129] However, early settlers, doctors, and scientists, up until the 1860s and later, believed malaria was probably spread through miasmic air. [n130] Interestingly enough, although unsure what caused malaria, early advocates for draining farmland inadvertently found the "effect of drainage in removing the cause of malarial diseases ... complete and conclusive ... ." [n131] Of course, it is

now known that removing **water** in these wet areas effectively removes the breeding ground for disease spreading mosquitoes rather than removing supposed disease causing miasmic air.

V. Negative Aspects of Agricultural Drainage

Benefits to crop yields and health do not come without their costs to the environment. Approximately 92 percent of nitrate pollution in Iowa comes from agricultural sources like tiled farm fields. [n132] Nitrates in Iowa streams are an environmental concern because excessive nitrates cause hypoxia in the Gulf of Mexico and are a financial cost to downstream **water** treatment facilities downstream when they need to be removed from drinking **water.**

Common fertilizers, [n133] like anhydrous ammonia, [n134] ammonium nitrate, and urea, [n135] are used extensively to increase crop yields in crops like corn. [n136] **[*125]** Generally, upon application of these fertilizers to soil, the nitrogen in these fertilizers converts to plant consumable nitrates. [n137] Nitrates are **water** soluble and by their very nature move freely with **water.** [n138] Nitrates not taken up by plants or lost through volatilization, [n139] denitrification, [n140] or run off, naturally leach from the ground surface to below the crop's root zone near or at the **water** table. [n141] If there is tiling infrastructure in place, these nitrates are then flushed out with groundwater after sufficient precipitation. [n142] This nitrate polluted **water** from private subsurface drainage infrastructure drains into county drainage infrastructure, which then carries this groundwater with its nitrates and phosphorus into main **water** sources.

Because nitrates are used extensively to increase corn yields, nitrates are **water** soluble, and corn is extensively grown in the Midwest, the Midwest is the major source of nitrate pollution to the Mississippi River. [n143] High levels of nitrates and phosphorous traveling in **water** flowing into the Mississippi River has led to growing aquatic hypoxia - low levels of oxygen in aquatic areas [n144] - down in the gulf coast region. [n145]

Most important to the discussion here, **water** treatment facilities are financially harmed by nitrates in their **water** supply because these facilities must remove these nitrates at a substantial cost. Nitrates are removed from drinking **water** as they are injurious to the public health when consumed in sufficient **[*126]** amounts. These health risks include blue baby syndrome (Methemoglobinemia) and low fertility endocrine disruption impacts. [n146] By Environmental Protection Agency (EPA) and Clean **Water** Act standards, **water** facilities downstream must then clean the polluted **water** to bring nitrates down to safe drinking levels. [n147]

In the Calhoun, Buena Vista, and Sac county areas, where the defendant drainage districts are located, rain fall is greater in the spring and summer months than in the late fall and winter. [n148] Land drainage in this area occurs most prominently from April to November, with October having the least subsurface drainage [n149] and the least rainfall. [n150] About half of the precipitation during April through November occurs in April, May, and June with 70 percent of the total drainage occurring those months. [n151] The wettest month is in June, which accounts for 20 percent of the total rainfall and 31 percent of the total drainage volume for the eight months of April through November. [n152] Although there is significant rainfall from September to November, little drainage occurs during this time. [n153] Looking at a whole year, it has been found that approximately 40 percent of all precipitation on farmland in this area is flushed out by subsurface drainage. [n154]

[*127] The flushed-out **water** from these areas makes its way through drainage district and county drainage infrastructure, before it drains into the North Raccoon River, a tributary of the **Des Moines** River. [n155] The Raccoon and **Des Moines** River have had high nitrate loads in recent years. Between 2012 and 2013, nitrate levels achieved record highs, with the Raccoon River's level climbing to 24 milligrams of nitrates per liter, and the **Des Moines** River's levels climbing to 18.6 milligrams of nitrates per liter in its **water.** [n156] The EPA's maximum nitrate allowance is only 10 milligrams of nitrates per liter of **water.** [n157] To get the nitrates back to a safe drinking levels, nitrate removal cost the DMWW approximately $ 500,000 in the summer of 2013 (the equivalent of $ 7,000 per day). [n158] In 2014, the average July nitrate load in the Raccoon River was 11.98 milligrams of nitrates per liter of **water** and was again above the ten milligram allowance in September, October, November, and December at 11.89, 13.23, 13.43, and 12.56 milligrams of nitrate per

liter of **water** respectively. [n159] Again, DMWW had to use its costly nitrate removal facilities to lower the high nitrate levels. [n160]

VI. **Des Moines Water** Works Lawsuit

The continual pollution in DMWW's **water** source and the subsequent cost of cleaning the **water** led to the current lawsuit. In January 2014, as per requirements of the Clean **Water** Act, DMWW sent a letter of intent to sue to drainage districts in Sac, Calhoun, and Buena Vista counties on state and federal claims alleging these drainage districts in particular are a main source of nitrate pollution in DMWW's raw **water** source. [n161] Although the state and federal claims will be examined in turn, more focus will be given to DMWW's federal claims as it is highly probable most of DMWW's state claims will be dismissed, and if DMWW's Iowa Code section 455B.111 claim survives, it will be substantially similar to the federal Clean **Water** Act claim.

A. State Law Claims

Since the state law claims filed by DMWW deal with issues beyond the scope of this Note and will likely be dismissed, they will only be discussed here briefly. On September 24, 2015, the Sac, Calhoun, and Buena Vista Drainage **[*128]** Districts submitted a memorandum asking for partial summary judgment of DMWW's state law claims. [n162] The Drainage Districts asserted that DMWW cannot sue the Drainage Districts under state claims, as the districts are "not proper parties to adversary litigation, are not subject to suit on tort claims, and only may be sued in mandamus to perform their statutorily delegated duties." [n163] This assertion is backed by binding Iowa precedent. As forcefully stated by the Iowa Supreme Court in Fisher v. Dallas County, "a drainage district [can] not be subject to a money judgment in tort under any state of facts." [n164] Furthermore, the only remedy against a drainage district under Iowa law is a mandamus to compel a drainage district to do its statutory duties, drain more land. [n165] These basic principles have been reaffirmed by the Iowa Supreme Court in 1994, in Gard v. Little Sioux Intercounty Drainage District of Monona and Harrison Counties, [n166] and 2012 in Chicago Central & Pacific Railroad Company v. Calhoun County Board. of Supervisors. [n167] The Drainage Districts contends because of this precedent, the Drainage Districts cannot be sued for money damages. [n168]

In rebuttal, DMWW made several arguments, many of which need not be discussed here, [n169] contending their state law claims should be preserved. [n170] Generally, DMWW argued Iowa law regarding drainage district tort immunity from damages is outdated. [n171] However, the Iowa Supreme Court has not strayed from denying tort damages generally to this present day. [n172]

The federal Northern District Court of Iowa, where DMWW filed its **[*129]** lawsuit, sent these state law questions on to the Iowa Supreme Court to decide. Judge Mark W. Bennett, the judge presiding over the case, stated, "I would have to reject the thoughtful, creative, novel, and well-argued position of DMWW, as unsupported by Iowa law and unlikely to be adopted by the Iowa Supreme Court ... ." [n173] Owing to the long standing principle that drainage districts in Iowa are immune from state law claims for money damages as stated by the Iowa Supreme Court in Fisher (1986), Gard (1994), and as recent as the 2012 decision in Chicago Central & Pacific Railroad Company, it is unlikely DMWW will recover under its state statutory and common law claims. [n174]

B. Federal Claims

Immunity from state law claims, however, would not necessarily immunize the drainage districts from federal claims under the Clean **Water** Act. Under the federal Clean **Water** Act, a drainage district may be regulated by the EPA if it is a point source polluter. [n175] The Clean **Water** Act prohibits the discharge of a pollutant by any person from any point source to navigable **waters** except when authorized by a permit issued under the National Pollutant Discharge Elimination System ("NPDES"). [n176] Whether an entity is a point source polluter or a nonpoint source polluter determines if the entity is required to obtain a NPDES permit. [n177] If an entity is a point source polluter, it must obtain a permit. [n178] If it is a nonpoint source polluter,

the entity does not need to obtain a NPDES permit. [n179] Traditionally, agricultural operations are considered nonpoint sources, [n180] and agricultural operators have not needed to get a NPDES permit for agricultural **[*130]** drainage. [n181]

The Clean **Water** Act defines a point source as "any discernible, confined and discrete conveyance, included but not limited to any pipe, ditch, channel, tunnel, conduit, well, discrete fissure, container, rolling stock, concentrated animal feeding operation, or vessel or other floating craft, from which pollutants are or may be discharged." [n182] Discharge of a pollutant under the CWA means "any addition of any pollutant to navigable **waters.**" [n183] Pollutant is defined under the CWA as "dredged spoil, solid waste, incinerator residue, sewage, garbage ... chemical wastes, biological materials ... rock, sand, cellar dirt and industrial, municipal, and agricultural waste discharged into the **water.**" [n184] Pollution is defined as a "man-made or man-induced alteration of the chemical, physical, biological, and radiological integrity of **water.**" [n185]

Factually, it appears drainage district infrastructure, a series of "pipes, ditches, channels, tunnels, [and] conduit" [n186] from which pollutants like "biological materials ... and agricultural waste" [n187] are or may be discharged [n188] into navigable **waters,** [n189] would clearly be a point source under the CWA. Indeed, DMWW's argument is the drainage districts of Sac, Calhoun, and Buena Vista County are point sources under this very definition. [n190] DMWW alleges, because these districts are point source polluters, they are in violation of the Clean **Water** Act, 33 U.S.C. sections 1311(a) and 1342(a) for failure to obtain a NPDES permit when unlawfully discharging nitrate pollution into the Raccoon River, which leads to the **Des Moines** area drinking **water** supply. [n191]

In rebuttal to this assertion, since the enactment of the **Water** Quality Act of 1987, [n192] agricultural stormwater discharges have been exempt from NPDES permit requirements. [n193] In fact, the definition of point source specifically "does **[*131]** not include agricultural stormwater discharges." [n194] This would indicate that stormwater coming from agricultural drainage infrastructure would be exempt from NPDES permit requirements under this provision. However, agricultural stormwater discharge is not defined by federal statute or regulation and could be construed narrowly to apply only to agricultural surface run-off and not groundwater discharged by drainage infrastructure. [n195]

Since stormwater discharge is not defined, DMWW contends the stormwater discharge exemption only exempts stormwater surface run-off and not groundwater discharge. [n196] As previously discussed, much of the nitrate polluted **water** does come from groundwater flushed out by tiling. DMWW contends that because groundwater discharge is not stormwater discharge, or surface run-off, the Drainage Districts would not be exempt from NPDES permit requirements. [n197] However, it would be expected and logical for the Drainage Districts to assert that even if much of the discharged **water** is groundwater, the groundwater flushed out of the Drainage Districts' infrastructure predominately comes from recent stormwater and would therefore be exempt for purposes of the stormwater discharge exemption.

Few cases have explored the meaning of "agricultural stormwater discharge" but one case in particular decided by the United States Court of Appeals for the Second Circuit may shed light on the drainage districts arguments why their drainage infrastructure is exempt from regulation by the EPA. In Waterkeeper Alliance, Inc., v. EPA, the Second Circuit stated

“We believe it reasonable to conclude that when Congress added the agricultural stormwater exemption to the Clean **Water** Act, it was affirming the impropriety of imposing, on "any person,' liability for agriculture-related discharges triggered not by negligence or malfeasance, but by the weather - even when those discharges came from what would otherwise be point sources. There is no **[*132]** authoritative legislative history to the contrary. [n198] “

Congress has on occasion clarified, albeit concerning different provisions of the CWA, that it has not intended to regulate minor agricultural drainage. [n199] After public concerns were raised over the Army Corps

of Engineers broad expansion of power to regulate dredge and fill permits following the 1975 federal court decision, Natural Resources Defense Council, Inc., v. Callaway, [n200] Congress amended the CWA to exclude many farming activities such as drainage from requirements for dredge and fill permits. [n201] Under this provision, farmers are exempt under the CWA from having to obtain a permit to discharge dredged or fill material during the normal course of their farming activities. [n202] The provision specifically includes minor drainage as a normal farming activity along with plowing, seeding, cultivating, and harvesting. [n203]

In the past, the EPA has also declined to promulgate regulations requiring individual farmers or agricultural entities with farming drainage infrastructure to obtain NPDES permits. [n204] During promulgation of regulations affecting concentrated animal feeding operations in the 1970s, several commentators wrote to the EPA stating NPDES permit requirements did not regulate but should regulate agricultural drainage infrastructure. [n205] Substantially similar to the DMWW argument, these commentators asserted "all agricultural runoff that is channeled into ditches, pipes or culverts before being discharged into navigable **waters** should be subject to the permit program regardless of whether or not such runoff is a result of the controlled application of **water.**" [n206] According to these commentators, entities and individual farmers with subsurface drainage **[*133]** infrastructure should have had to obtain NPDES permits. [n207] At the time, the EPA declined to "expand the definition of point source" to require individual famers and other like agricultural entities from having to obtain NPDES permits. [n208] However, the EPA left the option open "to re-examine, expand or contract the definition of agricultural point source" to perhaps include individual farmers and similar entities "depending on the effectiveness of the general permit program, the results of the on-going research program, and other changing factors ... ." [n209] The EPA continues to unofficially refer to agricultural drainage as a nonpoint source to this day. [n210]

VII. Conclusion

Congress's intentions when enacting the 1972 and 1977 CWA and the 1987 stormwater discharge exemption will be the prominent fighting federal issues in this DMWW lawsuit. As noted historically and factually, modern agricultural drainage infrastructure for the last couple hundred years has been implemented to artificially lower the **water** table and to also discharge excess stormwater. Lowering the **water** table and discharging excess stormwater are both needed to farm land in areas that were originally unfarmable due to saturated soil. DMWW contends the main purpose of drainage infrastructure is to lower a field's **water** table and as such would not fit under their narrowly construed definition of the stormwater discharge exemption. With this said, even if the main purpose of drainage infrastructure is to lower the **water** table, the question still remains whether such practice was intended to be exempted under the CWA and specifically, the 1987 CWA exemption. A wider reading of the exemption, looking to probable legislative intent of the CWA rather than a stricter reading of the exemption's language, would be required to decide that the Drainage Districts' infrastructure is exempt from NPDES permit requirements.

DMWW claims are novel in that this direct issue has never been litigated before. [n211] The EPA has only touched on the issue once in the 1970s, declining to regulate agricultural drainage infrastructure. Waterkeeper Alliance, Inc., the previously quoted case, was a CAFO case, not directly related to agricultural **[*134]** drainage infrastructure. [n212] Much uncertainty lies ahead in the outcome of this case due to its fact and science intensive nature, little direct legislative history, and it being the first of its kind. Whatever the outcome, this case will undoubtedly set the tone for any prospective CWA litigation in other jurisdictions between drainage infrastructure entities upstream and municipals downstream.

Legal Topics:

For related research and practice materials, see the following legal topics:
Constitutional LawBill of RightsFundamental RightsEminent Domain & TakingsEnvironmental LawNatural Resources & Public LandsWetlands ManagementEnvironmental LawWater QualityClean Water ActEnforcementCitizen SuitsGrounds

FOOTNOTES:

n1. Bd. of **Water** Works Trs. of **Des Moines** v. Sac Cty. Bd. of Supervisors, 890 N.W.2d 50 (Iowa 2017).

n2. Id. at 52.

n3. The DMWW case was reassigned from Judge Mark W. Bennett to Judge Leonard T. Strand on February 17, 2016.

n4. Bd. of **Water** Works Trs. of **Des Moines** v. Sac Cty. Bd. of Supervisors as Trs. of Drainage Dists. 32, No. C15-4020-LTS, 2017 U.S. Dist. LEXIS 39025 at 2 (N.D. Iowa 2017).

n5. See id.

n6. The court dismissed the claim based on the third standing prong of redressability. See id. at 13-17 ("DMWW may well have suffered an injury, but the drainage districts lack the ability to redress that injury.").

n7. Id. Although the author believes **Des Moines Water** Works would have standing to sue in federal court, there is little need to discuss the procedural aspects of standing for purposes of this Note.

n8. Brief of Board of **Water** Works Trustees of the City of **Des Moines,** Iowa in Resistance to Defendants' Motion for Partial Summary Judgment at 3, Bd. of **Water** Works Trs. of **Des Moines** v. Sac Cty. Bd. of Supervisors as Trs. of Drainage Dists., No. 5:15-cv-04020 (N.D. Iowa Oct. 19, 2015) [hereinafter **Des Moines Water** Works Brief in Resistance].

n9. **Des Moines Water** Works is an independently operated utility, owned by **water** rate payers and, separate from the corporate entity, **Des Moines,** Iowa. Organizational Chart, **Des Moines Water** Works, www.dmww.com/about-us/organizational-chart/ (last visited April 8, 2017); see Iowa Const. art. III, § 38A.

n10. See Letter from William Stowe, **Des Moines Water** Works, to the Cty. Bd. of Supervisors of Sac, Calhoun, and Buena Vista Ctys. 1 (Jan. 9, 2014), http://www.dmww.com/upl/documents/about-us/announcements/notice-of-intent-to-sue.pdf [hereinafter Letter from William Stowe]; Complaint at 2, Bd. of **Water** Works Trs. of **Des Moines** v. Sac Cty. Bd. of Supervisors as Trs. of Drainage Dists., No. 5:15-cv-04020 (N.D. Iowa Mar. 16, 2015) [hereinafter **Des Moines Water** Works Complaint] (listing all of the drainage districts by county: Sac County Board of Supervisors as Trustees of Drainage Districts 32, 42, 65, 79, 81, 83, 86; Calhoun County Board of Supervisors and Sac County Board of Supervisors as Joint Trustees of Drainage Districts 2 and 51, Buena Vista County Board of Supervisors and Sac County Board of Supervisors as Joint Trustees of Drainage Districts 19, 26, 64, and 105).

n11. **Des Moines Water** Works Complaint, supra note 10, at 1-2.

n12. Id. at 2.

n13. See Letter from William Stowe, supra note 10, at 2.

n14. See id. at 9.

n15. Neil Hamilton, Dir. of Agric. Law Ctr., Drake Univ. Law Sch., Presentation to the 2015 American Agricultural Law Association Annual Meeting: Ten New Things to Know about the **Des Moines** Waterworks Lawsuit, in **Water** Quality and Agriculture: Issues raised by the **Des Moines** Waterworks Litigation against Drainage Districts in Three Iowa Counties 10, 10-11 (Oct. 22, 2015).

n16. What Is Bill Hiding?, Iowa Partnership for Clean **Water** (Dec. 3, 2015), http://iowapartnershipforcleanwater.org/2015/12/what-is-bill-hiding/.

n17. Marcus McIntosh, New TV Ad Takes Aim at **Water** Works Drinking **Water** Lawsuit, KCCI 8 **Des Moines** (May 13, 2015, 6:01 PM), http://www.kcci.com/news/new-tv-ad-takes-aim-at-**water**-works-drinking-**water**-lawsuit/33007014.

n18. Farmers - Not Lawyers - Are the Solution, Iowa Partnership for Clean **Water** (June 16, 2015), http://iowapartnershipforcleanwater.org/2015/06/video-farmers-not-lawyers-are-the-solution/.

n19. Robert Palmer, Lobbyist, League of Cities, Lecture at Drake University Law School (Oct. 20 2015).

n20. Mark J. Hansen, et al., The Debate about Farm Nitrates and Drinking **Water,** Choices, Jan. 2017, no. 1, 2016, http://www.choicesmagazine.org/Userfiles/file/cmsarticle_485.pdf.

n21. Id.

n22. Id.

n23. Id.

n24. Drainage, Webster's New World Coll. Dictionary (3d ed. 1988).

n25. Drain, Webster's New World Coll. Dictionary (3d ed. 1988).

n26. Bioreactors, **Water** Table Management, and **Water** Quality: Drainage Tile History in the U.S., U. Ill. Extension, http://web.extension.illinois.edu/bioreactors/history.cfm (last visited April 8, 2017).

n27. See generally Walter Bligh, The English Improver Improved or the Survey of the Husbandry Surveyed (London 1652); 1 Adam Dickson, The Husbandry of the Ancients 366 (Edinburgh 1788).

n28. John Johnstone & Joseph Elkington, An Account of the Mode of Draining Land, According to the System Practised by Mr. Joseph Elkington 132-33 (3d ed. 1808) ("Upon strong tenacious land, where the **water** could only be received at the top, [Roman farmers] preferred open drains; on other soils, where the **water** could be drawn equally from both sides, or could rise from the bottom, they used covered ones."). For an in-depth history of Roman husbandry of the land and especially their agricultural tiling systems, see Dickson, supra note 27, at 358.

n29. Dickson, supra note 27, at 366.

n30. Id.

n31. Id. at 367.

n32. Id. at 366.

n33. Id. at 367.

n34. Id. ("It is proper to make both the open and covered drains shelving, broad at the top and narrow at the bottom, like roof tiles turned upside down; for those whole sides are perpendicular are soon damaged by the **water,** and are filled with the falling earth from the top.").

n35. Id. at 367-68.

n36. Johnstone & Elkington, supra note 28, at 136 ("Hollow drains that come under the present description, are chiefly used to correct that wetness of soil which results from rain ... .").

n37. Henry F. French, Farm Drainage 14-15 (2d ed. 1884).

n38. See generally Bligh, supra note 27 ("Discovering the Improveable of all Lands: Some to be under a double and Treble others under a Five or Six Fould. And many under a Tenn fould, yea, some under a Twenty fould Improvement.") (original spelling); French, supra note 37, at 24 (Judge French said The English Improver Improved was published in 1650 and this date seems to be repeated in several other works without citation since his writing, but the original copy the author of this Note found states The English Improver Improved was printed in 1652).

n39. See generally Bligh, supra note 27.

n40. See Dickson, supra note 27, at 366; see generally Johnstone & Elkington, supra note 28, at 132-33.

n41. See French, supra note 37, at vii.

n42. Id. at 28 (Mr. Elkington was illiterate).

n43. Johnstone & Elkington, supra note 28, at vi-vii.

n44. Id. at 11. This reprinted 1797 report to the British Board of Agriculture contains a then new detailed method of draining "boggy" lands from springs in the English countryside by a farmer named Mr. Joseph Elkington, who had been practicing this on his land thirty years before the commission of this report. The system worked well in comparison to the drainage ditches of the era. The report contains letters from farmers around the English country side to Mr. Elkington commenting on the increased "herbage" and increase in land value from using Mr. Elkington's drainage system on swampy parts of their estates. A man named John Maughan said, "[After draining] I [now] have the satisfaction of saying it is now the driest land on the estate... . I have seen land of little or no value, when drained on Mr. Elkington's principles, made worth forty or fifty shillings per acre and producing the richest crops, both of corn and grass." Id. at 126-28.

n45. George E. Waring, Jr., Draining for Profit and Draining for Health 62-63-64 (3d ed. 1902) (indicating that Mr. Elkington's system was used predominantly for partial draining where springs were forcing **water** up. By 1833, draining of the whole field, without reference to springs, was being advocated.).

n46. James Smith, (1789-1850) Grace's Guide to Brit. Indus. Hist., http://www.gracesguide.co.uk/James_Smith (last modified Dec. 2, 2013, 6:14 PM); James Smith, Remarks on Thorough Draining & Deep Ploughing 3, 5-6 (6th ed. 1843); French, supra note 37, at 37. There seems to be a discrepancy as to whether modern tile drainage originated from Mr. Smith. After an extensive review of agricultural articles of the era, the author of this Note is convinced Mr. Smith was the first to advocate this system of drainage - or at least the first to have his ideas published in 1832.

n47. See generally James Smith, supra note 46.

n48. French, supra note 37, at 37.

n49. M. M. M., On the Improvement of Cold Clays, 15 Farmers Mag. 114, 117 (1847) (stating, "the material for forming drains seems to be generally settled to be tiles. Stones and thorns, and instruments and sods, and various other modes, have all given way to tile draining ... ."); see also Waring, supra note 45, at 64 (stating "Elkington's system need have no place in our calculations." The first edition of this book was published in 1867.).

n50. " Round pipes, with collars, are far superior to the "horse-shoe' tiles, and are equally easy to obtain, it is not necessary to consider the manner in which these latter should be used, - only to say that they ought not be used at all." Albeit, the note to the first edition at page three states, "[The author] has purposely taken the most radical view of the whole subject ... ." Horseshoe shaped tiles were still in use at the time of publication. "These processes (Elkington's system, horse-shoe tiles, and traditional open and closed ditches filled with stone and brush) are all of occasional use, even at this day ... ." Waring, supra note 45, at 63-64.

n51. French, supra note 37, at 38.

n52. Bill Treichler, The Mike Weaver Drain Tile Museum in the Home of John Johnston, Crooked Lake Rev. (July 1994), http://www.crookedlakereview.com/articles/67_100/76july1994/76treichler.html. The Crooked Comically, many American farmers were wary of an "English" practice such as tile drainage even though those farmers stood to gain tremendously by tile draining their farmland. See French, supra note 37, at 19-21. Also, the statement that modern tiling made its way to America at this time does not preclude the fact that Americans had been draining their land since colonial times, they just generally did not use the tiling method like John Johnston's. See Keith H. Beauchamp, A History of Drainage and Drainage Methods, in Farm Drainage in the United States 13, 15-16 (USDA 1987).

n53. Treichler, supra note 52.

n54. French, supra note 37, at 46.

n55. Id. at vii.

n56. See generally Waring, supra note 45; French, supra note 37; John H. Klippart, The Principles and Practice of Land Drainage (Robert Clarke & Co. ed., 1861).

n57. See generally Waring, supra note 45 (emphasizing the importance of thorough training); French, supra note 37 (describing the advances of U.S. drainage); Klippart, supra note 56 (documenting his consultation with drainage experts and his experiences in Ohio).

n58. Treichler, supra note 52.

n59. J. O. Wright, USDA, Swamp and Overflowed Lands in the United States 5-6 (1907).

n60. Beauchamp, supra note 52, at 17.

n61. George A. Pavelis, Summary of Farm Drainage in the United States, at v (USDA 1987).

n62. See Beauchamp, supra note 52, at 17-18.

n63. Id. at 18.

n64. Id.; see also Reconstruction Finance Corporation, Encyclopedia Britannica, https://www.britannica.com/topic/Reconstruction-Finance-Corporation (last updated June 10, 2004) (The Reconstruction Finance Corporation was a government agency established during the Great Depression to provide financial assistance to distressed railroads, financial institutions, and corporations).

n65. Beauchamp, supra note 52, at 18.

n66. See id. at 22-23.

n67. See id. at 23.

n68. See James L. Fouss & Ronald C. Reeve, Advances in Drainage Technology: 1955-85, in Farm Drainage in the United States 30, 33 (USDA 1987).

n69. Id.

n70. Id.

n71. See Dave Orrick, Minnesota Farm Drain Tiling: Better Crops, but at What Cost?, Twin Cities Pioneer Press (Feb. 18, 2016, 6:19 PM), http://www.twincities.com/2012/08/31/minnesota-farm-drain-tiling-better-crops-but-at-what-cost/.

n72. George A. Pavelis, Economic Survey of Farm Drainage, in Farm Drainage in the United States 110, 121 (USDA 1987) ("As of 1985, less than 10 percent of all existing surface or subsurface drainage improvements could be attributed to Federal financing provided under [federal programs].").

n73. Drainage Infrastructure in Iowa, What's Happenin' (Iowa Dep't Nat. Res., **Des Moines,** Iowa), Apr. 2006, at 1, https://programs.iowadnr.gov/nrgislibx/newsletters/2006-04_GIS_Newsletter.pdf.

n74. Rameshwar S. Kanwar et al., Drainage Needs and Returns in North-Central Iowa, 26 Transactions of the ASAE 457, 457 (1983), reprinted in Iowa St. Univ., Dept. of Agric. & Biosystems Engineering Publications 457 (July 20, 2014), http://lib.dr.iastate.edu/cgi/viewcontent.cgi?article=1780&context=abe_eng_pubs.

n75. See Drainage Infrastructure in Iowa, supra note 73, at 1-2.

n76. Iowa, History, http://www.history.com/topics/us-states/iowa (last visited April 8, 2017).

n77. W.S. Allen, Report of the Secretary of State to the Governor of Iowa of the Transactions of the Land Department 32 (1914).

n78. Maria Elizabeth Howe, Reclaiming the Little Sioux River Valley: A History of Drainage along the Monona-Harrison Ditch in Western Iowa 24 (2012) (unpublished graduate dissertation, Iowa State University) (on file at Iowa State University Digital Repository).

n79. Id. at 24-25.

n80. Katherine Louise Anderson, Historical Alterations of Surface Hydrology in Iowa's Small Agricultural Watersheds 18 (2000) (unpublished graduate dissertation, Iowa State University) (on file at Iowa State University Digital Repository) (circa 1865, one settler stated "We started across the county northeast from Nevada [Iowa] and everything looked like a great lake; not a house within six miles of town. Winding our way through **water** until we arrived at Johnson Grove.").

n81. Id. at 15.

n82. Id. at 25.

n83. Howe, supra note 78, at 26 (indicating newspapers in the region described the 1881 flood as comparable to the story of Noah's Ark in the Genesis flood).

n84. Id. at 27 (stating the 1891 flood killed several people and destroyed several miles of railroad track and seventy five homes).

n85. Souvenir of the Corning Flood (1903); Chicago and Alton Railway: The Flood of 1903 (1903).

n86. H. Journal, 30th Gen. Assemb., at 46 (Iowa 1904).

n87. See id. at 104, 143, 348, 361-62, 384, 603 (An important need to facilitate drainage, as noted in these laws, was allowing drainage districts to use eminent domain to create the needed drainage infrastructure).

n88. Iowa Code § 468.2(1) (2016).

n89. Id. § 468.2(1)-(2).

n90. Iowa Const. art. I, § 18.

n91. Id.

n92. Iowa State Drainage Waterways & Conservation Comm'n, Report of the Iowa State Drainage Waterways and Conservation Commission 15-16 (1911) ("The question of drainage is of great importance to Iowa, especially to the northern part of the state, probably demanding more attention from our farmers than any other question coming under the head of conservation.").

n93. Id. at 20.

n94. Anderson, supra note 80, at 16.

n95. Kanwar et al., supra note 74, at 457.

n96. Howe, supra note 78, at 68.

n97. Anderson, supra note 80, at 16.

n98. See generally Kanwar et al., supra note 74 (explaining that study involved asking farmers about their farm grounds and if they were tiled; presumably these farmers either installed the tiling themselves or it was done to their recent memory). Also, through common experience and observation in Iowa, anyone traveling a gravel road could run across a farmer's property where tiling is being done.

n99. See Orrick, supra note 71.

n100. Drainage Infrastructure in Iowa, supra note 73, at 3 ("Upon realizing that the data collected from counties is the main drainage infrastructure of trunk lines for the county drainage districts, the user might pose the question: "What about the smaller, privately owned, tile lines that make up the entire drainage system?' Members of the GIS staff have been contemplating this as well."); see also D. B. Jaynes & D. E. James, Presentation at the Annual Meeting of the Soil and **Water** Conservation Society: The Extent of Farm Drainage in the United States 1 (July 21-25, 2007), https://www.ars.usda.gov/ARSUserFiles/50301500/TheExtentofFarmDrainageintheUnitedStates.pdf (stating, "Thus, there are 4 estimates of drained cropland from the 70's, 80's, and 90's, but no estimates since.").

n101. Jaynes & James, supra note 100, at 5.

n102. Orrick, supra note 71 (It has been suggested this is intentional: "Is there data [on the extent of tiling]? No... . "Everybody should be shocked by that. The dead ends are intentional. It's one of the best-kept secrets in the world ... . There is very little data being gathered. It's the hidden infrastructure that the public doesn't have a clue about. No government agency wants to regulate tiling because (regulation) is politically unpopular with the ag community.'").

n103. Drainage Infrastructure in Iowa, supra note 73, at 2 fig.1.

n104. Kanwar et al., supra note 74, at 457.

n105. Id.

n106. Anderson, supra note 80, at 7.

n107. Everything You Wanted to Know about Drainage Districts in Iowa, Boone Cty. http://www.boonecounty.iowa.gov/home/showdocument?id=186 (last visited April 8, 2017).

n108. Id.

n109. Id.; see Howe, supra note 78, at 37-38 (stating, in 1915, the state legislature had changed the structure of who was in charge of drainage districts from commissioners to a board of trustees which were by default the county board of supervisors).

n110. Facts about Drainage and Drainage Districts, Iowa Drainage Dist. Ass'n, http://www.iowadrainage.org (last visited April 8, 2017).

n111. Id.

n112. See generally Waring, supra note 45.

n113. Id. at 208 (stating, "It is not probable that the mere question of health would induce the undertaking of costly drainage operations ... "the chills' are accepted by farmers, especially at the West, as one of the slight inconveniences attending their residence on rich lands ..." while also mentioning on page 209 that it may be for the public benefit to drain urban areas even if health is the only reason to do so); see also Don Hofstrand, Economics of Tile Drainage, Iowa St. Univ. Extension & Outreach, https://www.extension.iastate.edu/agdm/articles/hof/HofJuly10.html (last visited April 8, 2017) ("The major reason for installing subsurface drainage is to improve the productivity of the farmland. Higher yields translate into more returns.").

n114. Dickson, supra note 27, at 358-59 ("Cato [said] ... "In the winter ... it is necessary that the **water** be left off the fields ... When the first of the autumn is rainy, then it is the greatest danger from **water** ... Wherever the **water** stagnates amongst the growing corn ... that should be removed, the ditches opened and the **water** let away."); Johnstone & Elkington, supra note 28, at 126 ("Those drained boggy lands that have had the proper manure laid upon them, are not only made dry, but the herbage produced on them is [sic] become excellent ... .").

n115. Waring, supra note 45, at 11.

n116. Id. at 12.

n117. Do Plants Have to Have Oxygen to Survive? Or Can Plants (Other than the Plants in Wetlands) Live Without Oxygen?, UCSB ScienceLine, http://scienceline.ucsb.edu/getkey.php?key=760 (last visited April 8, 2017).

n118. Id.

n119. Id.

n120. Id.

n121. W.L. Powers & T.A.H. Teeter, Land Drainage 24 fig.7 (J.B. Davidson ed., John Wiley & Sons, Inc. 1922).

n122. Hofstrand, supra note 113.

n123. Id.

n124. Id.

n125. Id.

n126. See Waring, supra note 45, at 208.

n127. Anderson, supra note 80, at 3.

n128. Id. at 25.

n129. Anapheles Mosquitoes, Ctr. for Disease Control & Prevention, http://www.cdc.gov/malaria/about/biology/mosquitoes/ (last visited April 8, 2017).

n130. Carl S. Sterner, A Brief History on Miasmic Theory 4-5 (2007), http://www.carlsterner.com/research/files/History_of_Miasmic_Theory_2007.pdf (Miasmatic Theory is a disease theory that predates the modern Germ Theory; the theory is that bad or corrupt air arising from moist, rotten and wet places causes disease).

n131. Waring, supra note 45, at 216.

n132. Iowa Dep't of Agric. & Land Stewardship et al., Iowa Nutrient Reduction Strategy: A Science and Technology-Based Framework to Assess and Reduce Nutrients to Iowa **Waters** and the Gulf of Mexico 8 (2013) (stating however, only 5 percent of total nitrogen input in farming is lost to waterways. The rest is removed by harvesting, grazing, or lost to the atmosphere).

n133. This list is not conclusive. See generally, John Weiss et al., Cornell Univ. Coop. Extension, Nitrogen Fertilizers for Field Crops, Fact Sheet 44, at 1 (2009), http://nmsp.cals.cornell.edu/publications/factsheets/factsheet44.pdf (listing common nitrogen fertilizers).

n134. Id. at 2.

n135. Id. at 1-2 (Urea is not a recommended starter fertilizer because of its possible toxicity to germinating seeds).

n136. Charles C. Mitchell, Ala. Coop. Extension Sys., ANR-174, Nutrient Content of Fertilizer Materials 1 (1999) (Anhydrous ammonia, urea, and ammonium nitrate, fertilizers are usually composed of 82, 45, and 35 percent nitrogen, respectively).

n137. Weiss et al., supra note 133, at 1.

n138. John A. Lamb et al., Understanding Nitrogen in Soils, AG-FO-3770-B, (2014), http://www.extension.umn.edu/agriculture/nutrient-management/nitrogen/understanding-nitrogen-in-soils/docs/AG-FO-3770-B.pdf.

n139. Id. (stating, volatilization occurs when nitrogen escapes ammonium-based fertilizer to the atmosphere).

n140. Id. (stating, denitrification occurs when nitrates are converted to nitrogen gas. This occurs when bacteria in the soil uses these nitrates for respiration.).

n141. Id.

n142. Johnathan Coppess, Nitrogen Loss: Why Drainage Tile Matters, AGFAX (Mar. 11, 2016), http://agfax.com/2016/03/IVnitrogen-loss-why-drainage-tile-matters/.

n143. Differences in Phosphorus and Nitrogen Delivery to the Gulf of Mexico from the Mississippi River Basin, U.S. Geological Surv. (Mar. 4, 2014, 2:45:03 PM), http://**water.**usgs.gov/nawqa/sparrow/gulf_findings/primary_sources.html [hereinafter Differences in Phosphorus and Nitrogen Delivery].

n144. Bioreactors, **Water** Table Management, and **Water** Quality: **Water** Quality and Tile Drainage, supra note 26.

n145. See Differences in Phosphorus and Nitrogen Delivery, supra note 143. The process of hypoxia starts when algae grows excessively due to abundant nitrates in the **water.** When the excess algae dies, it consumes oxygen and suffocates aquatic life, creating hypoxia. Hypoxia is very damaging to the gulf coast region and its aquatic life. See Bioreactors, **Water** Table Management, and **Water** Quality: **Water** Quality and Tile Drainage, supra note 26.

n146. See Iowa Envtl. Council, Nitrate in Drinking **Water:** A Public Health Concerns for all Iowans 1 (2016), http://www.iaenvironment.org/webres/File/News%20%26%20Resources/Publications/Nitrate_in_Drinking_**Water**_Report_Web.pdf. (indicating, blue baby syndrome is caused when a sufficient amount of nitrites are consumed and deprive a person's blood of oxygen. This condition is especially dangerous for babies and small children. Symptoms may lead to death); Endocrine Disruptors, Nat'l Inst. Envtl. Health Sci., http://www.niehs.nih.gov/health/topics/agents/endocrine/ (last visited Mar. 6, 2017).

n147. Letter from William Stowe, supra note 10, at 2-3.

n148. Matthew J. Helmers et al., ASAE Meeting Paper No. 052234, Presentation at the 2005 ASAE Annual International Meeting: Temporal Subsurface Flow Patterns from Fifteen Years in North-Central Iowa 7 (July 17-20, 2005). This fifteen year study was conducted in Pocahontas County, which is directly east of Buena Vista, directly north of Calhoun County, and directly northeast of Sac County. Pocahontas County has substantially similar rainfall and weather to these other counties. See Iowa **Water** Science Center, USGS, https://ia.**water.**usgs.gov/climate/precipitation.html. (last modified Dec. 20, 2016 10:35 AM)

n149. Helmers et al., Supra note 148 at 7. (only 1 percent of the **water** volume drained from fields during the prominent drainage months occurs in October).

n150. Id. (6 percent of the total rainfall during the prominent drainage months occurs in October).

n151. Id. The high drainage volume in April, May, and June is likely due to little plant growth during this period and high rainfall. See id.

n152. Id.

n153. Id. (This is because this rainfall "rechargees the soil profile after the soil moisture [is] depleted during the growing season.").

n154. Id. at 1.

n155. Drainage Infrastructure in Iowa, supra note 73, at 2 fig.1.

n156. Letter from William Stowe, supra note 10, at 2.

n157. 40 C.F.R. § 141.11(d)(2) (2016).

n158. Letter from William Stowe, supra note 10, at 2.

n159. Id.

n160. Id.

n161. Id. at 1-2.

n162. Defendants' Memorandum in Support of Motion for Partial Summary Judgment at 3, Bd. of **Water** Works Trs. of the City of **Des Moines** v. Sac Cty. Bd. of Supervisors as Trs. of Drainage Dists., No. 5:15-cv-04020 (N.D. Iowa Sept. 24, 2015) [hereinafter Defendants' Memorandum].

n163. Id. at 1.

n164. Fisher v. Dallas Cty., 369 N.W.2d 426, 430 (Iowa 1985).

n165. Id. at 429.

n166. See Gard v. Little Sioux Intercounty Drainage Dist., 521 N.W.2d 696, 699 (Iowa 1994).

n167. Chi. Cent. & Pac. R.R. Co. v. Cty. Bd. of Supervisors, 816 N.W.2d 367, 374 (Iowa 2012).

n168. Defendants' Memorandum, supra note 165, at 4; see, e.g., Fisher, 369 N.W.2d at 429-30.

n169. Most of these arguments are not particularly relevant to the broader issues discussed in this Note. The issues asserted concern the Drainage Districts immunity revolving around home rule, the Dillon Rule, distinction of past cases because DMWW's unique factual circumstances, rebutting drainage district presumption of public benefit, etc.

n170. **Des Moines Water** Works Brief in Resistance, supra note 8, at 6-7.

n171. Id. at 7.

n172. See, e.g., Chi. Cent. & Pac. R.R. Co., 816 N.W.2d at 378.

n173. Order Certifying Questions to the Iowa Supreme Court at 25, Bd. of **Water** Works Trs. of **Des Moines** v. Sac Cty. Bd. of Supervisors as Trs. of Drainage Dists., No. C 15-4020-MWB25 (N.D. Iowa Jan. 11, 2016).

n174. With this said, although it would be very unpopular and costly, making it unlikely, DMWW could amend its suit to include individual farmers or the counties to "cure" the drainage district immunity issue.

n175. 33 U.S.C. § 1362(5) (2012) ("The term "person' means an individual, corporation, partnership, association, State, municipality, commission, or political subdivision of a State, or any interstate body.").

n176. 33 U.S.C. §§1251, 1311(a), 1342 (2012).

n177. About NPDES, EPA, https://www.epa.gov/npdes/about-npdes (last visited April 8, 2017).

n178. Id.

n179. Id.

n180. But see Animal Feeding Operations (AFOs), EPA, https://www.epa.gov/npdes/animal-feeding-operations-afos (last visited April 8, 2017) (stating, EPA regulations considering large Concentrated Animal Feeding Operations "CAFOs" as point source polluters requiring NPDES permits).

n181. What is Nonpoint Source Pollution?, EPA, https://www.epa.gov/nps/what-nonpoint-source (last visited April 8, 2017) (the EPA website lists land runoff and drainage as nonpoint sources).

n182. 33 U.S.C. § 1362(14) (2012).

n183. Id. § 1362(12).

n184. Id. § 1362(6).

n185. Id. § 1362(19).

n186. Id. § 1362(14).

n187. Id. § 1362(6).

n188. Id. § 1362(14).

n189. Id. § 1362(12).

n190. **Des Moines Water** Works Complaint, supra note 10, at 31.

n191. Id. at 31-33.

n192. **Water** Quality Act of 1987, Pub. L. No. 100-4, 101 Stat. 7 (1987).

n193. 33 U.S.C. § 1362(14).

n194. Id.

n195. See generally id. § 1362 (indicating there is no definition of "agricultural stormwater discharge" under statute or in federal regulations). There is also no discussion on the specific scope of the exemption in the legislative history of the **Water** Quality Act of 1987. See generally, Legislative History of the **Water** Quality Act of 1987 at 351, 352, 528, 665, 672, 1053 (1988). However, it has been stated the agricultural stormwater drainage exemption was created so "local, State, and Federal officials would [not] be inundated with an enormous permitting workload even though most of the discharges would not have significant environmental impacts." Id. at 672.

n196. Letter from William Stowe, supra note 10, at 7-8.

n197. Id. at 7-8.

n198. Waterkeeper All., Inc. v. EPA, 399 F.3d 486, 507 (2d Cir. 2005).

n199. Presidential Statement on Signing the Clean **Water** Act of 1977 (Dec. 28, 1977), reprinted in Legislative History of the Clean **Water** Act of 1977 at 181 (1978) [hereinafter Presidential Statement] ("Certain farming and forestry activities that were never intended to be covered under this original act are specifically exempted from requirements to obtain permits.").

n200. Nat'l Res. Def. Council, Inc. v. Callaway, 392 F. Supp. 685, 686 (D.D.C. 1975) (stating Congress intended to assert federal jurisdiction to the maximum extent constitutionally allowed over the nation's **waters)**.

n201. Presidential Statement, supra note 205, at 181.

n202. 33 U.S.C. § 1344(f)(1)(C) (2012) (stating the maintenance of drainage ditches are not prohibited).

n203. 33 U.S.C. § 1344(f)(1)(A) (2012).

n204. Application of Permit Program to Agricultural Activities, 41 Fed. Reg. 28,493 (July 12, 1976).

n205. Id.

n206. Id.

n207. Id.

n208. Id.

n209. Id.

n210. What is Nonpoint Source Pollution?, supra note 1841("Nonpoint source pollution generally results from land runoff, precipitation, atmospheric deposition, drainage, seepage or hydrologic modification.") (emphasis added).

n211. Since this lawsuit is the first of its kind, it can be surmised that at least from 1987 to now, agricultural drainage was assumed to be exempted.

n212. Waterkeeper All., Inc. v. EPA, 399 F.3d 486, 507 (2d Cir. 2005).

+++

Crawford, Amanda L., 2016, Nutrient Pollution and the Gulf of Mexico Dead Zone: Will Des Moines Water Works Be a Turning Point? 91 Tulane Law Review 157.

TEXT:
[*158]

I. Introduction

According to the World Economic Forum, the number one "global risk[] in terms of ... impact" is **water** crisis. [n1] As the need for **water** continues to increase due to population growth and energy demand, our **water** problems are only exacerbated. [n2] While many think this risk is not a problem for most U.S. states, data shows otherwise. [n3] A recent report by the Government Accountability Office (GAO) even found that forty out of fifty state **water** managers expect to face **water** shortages "under average conditions" within the next ten years. [n4] Nevertheless, our limited **water** resources continue to be undervalued and mismanaged. While there has recently been increased concern regarding **water** quantity, we still fail to adequately maintain **water** quality. [n5]

In fact, due to pollution from sources throughout the Mississippi River Basin, a hypoxic zone, or "dead zone," began forming in the Gulf of Mexico as early as 1972. [n6] A dead zone is an area of depleted oxygen that kills and displaces fish and marine life and is caused primarily by nutrient (mainly nitrogen and phosphorus) runoff from agriculture and other human activities. [n7] According to the National **[*159]** Oceanic and Atmospheric Administration (NOAA), the Gulf of Mexico Dead Zone (Dead Zone) is the second largest human-caused dead zone in the world. [n8] Though the size of the Dead Zone varies each year, in 2015 it was "about the size of Connecticut and Rhode Island combined," or 6474 square miles, much larger than the 1900-square-mile target set by the task force created to combat it. [n9]

This Comment discusses **water** quality issues that result from nutrient pollution, focusing on the Mississippi River Basin and the northern Gulf of Mexico. The nutrient pollution currently affecting the Mississippi and Gulf regions is primarily attributable to agriculture and has significant economic, ecological, and human health impacts. [n10] Without changes in current agricultural practices, nitrogen and phosphorous pollution have been predicted to more than double by 2050. [n11] Since 2009, the Environmental Protection Agency (EPA) has recognized that nutrient pollution is "one of the costliest, most difficult environmental problems we face" and causes "significant **water** quality and public health concerns," including "growing drinking **water** impacts." [n12] In light of this and looming **water** scarcity problems, it is imperative that we do more to address nutrient pollution.

In order to adequately confront the problem and evaluate potential solutions, it is necessary to understand the regulatory, economic, and political incentives that influence the Dead Zone's major contributors. Thus, Part II of this Comment begins by discussing the accomplishments and deficiencies of the current regulatory regime. Next, Part III compares the effectiveness of approaches taken to manage nutrient pollution in other watersheds within the United States, namely the Chesapeake Bay, the Florida **[*160]** Everglades, and Lake Erie. Finally, Part IV discusses the potential impacts of climate change and **water** scarcity on **water** quality in the Mississippi and the Gulf and analyzes possible legal mechanisms to address the current and impending challenges. This Comment considers how different means such as developing a total maximum daily load (TMDL), creating numeric nutrient criteria, amending the Farm Bill, and expanding National Pollutant Discharge Elimination System (NPDES) program coverage could be utilized to address these problems. It

suggests that a currently pending lawsuit brought by an Iowa **water** utility may be key to bringing at least some agricultural producers within the reach of the NPDES permitting program, which could be the tool needed to control nutrient pollution in the Mississippi and shrink the Dead Zone.

II. The Current Regulatory Regime

A. Federal **Water** Pollution Control Act and the Clean **Water** Act Amendments

Until the end of World War II, **water** pollution was seen as a local problem, and pollution control was left almost exclusively to the states. [n13] The 1948 Federal **Water** Pollution Control Act (FWPCA) created a federal program to combat **water** pollution, but the federal role was mainly limited to providing technical and financial assistance to state programs. [n14] Each state maintained an individual agency in charge of monitoring and controlling pollution. [n15] Unfortunately, state enforcement was very limited. [n16] As a result, by 1961, the "**water** pollution problem had reached alarming proportions." [n17]

Though both state and federal governments recognized that **water** pollution was a serious problem, they disagreed about the solution. [n18] The key point of contention regarded the appropriate level of federal involvement, mainly whether the federal government should establish specific **water** quality standards. [n19] Many of the states sought to maintain the control they had exercised in this area for so **[*161]** long. [n20] At the time, the notion that states should retain control seemed well grounded because **water** pollution was thought of as a "uniquely local blight." [n21] On the other hand, people were beginning to realize that state-based programs were not working. [n22] The Senate Public Works Committee recommended an expansion of the federal government's enforcement authority. [n23] Eventually, after many proposed bills, hearings, and compromises, Congress amended the Federal **Water** Pollution Control Act in 1972. [n24]

The 1972 amendments to the Federal **Water** Pollution Control Act created the Clean **Water** Act (CWA) we know today. [n25] The purpose of the CWA was to "comprehensively and ambitiously address[] the ... growing problem of **water** pollution" in the United States. [n26] In many ways, the CWA has been a "vast improvement" for **water** pollution regulation [n27] and has made great strides toward its goal of "restoring and maintaining the chemical, physical, and biological integrity of the Nation's **waters.**" [n28] Nevertheless, the CWA is less effective in regulating certain areas, particularly nutrient pollution. [n29]

B. Basic Regulatory Framework of the Clean **Water** Act

The CWA characterizes pollution sources as either "point" or "nonpoint" sources and imposes different regulatory standards for each type. [n30] Point sources include "discernible, confined[,] and discrete conveyances," such as pipes, ditches, and channels. [n31] Conversely, the term nonpoint source refers to diffuse sources such as **[*162]** surface **water** runoff. [n32] Under the CWA, discharges of pollutants from point sources are prohibited unless they comply with the conditions of a permit issued pursuant to the NPDES program. [n33]

Under the NPDES program, anyone who discharges pollutants from a point source is required to obtain a permit from the EPA or an authorized state agency subject to EPA oversight. [n34] NPDES permits typically include technology-based standards to limit pollutant discharges. [n35] When technology-based standards are insufficient, they may also include specific **water**-quality-based effluent limitations. [n36] Additionally, NPDES permits often impose monitoring and reporting requirements. [n37] Contrary to this rigorous regulation of point sources, the CWA leaves nonpoint source regulation largely to the states. [n38] In many ways, nonpoint source pollution became a mere "afterthought." [n39]

Congress's decision to maintain state control over nonpoint source pollution was not necessarily unfounded. [n40] In fact, some scholars argue that states are often better positioned to address pollution problems within their own borders. [n41] For example, "states have a better understanding of their local environments" and can "find solutions tailored to their specific needs." [n42] Nevertheless, concentrating regulatory control within the states comes with significant challenges such as lack of political will and

inadequate funding. [n43] These challenges can be especially pronounced for **[*163]** interstate bodies of **water.** [n44] As a result, regulation of nonpoint source pollution has proven largely ineffective. [n45] This fact is especially relevant for the Mississippi River and the Gulf of Mexico, which are substantially affected by nutrient pollution from agricultural nonpoint sources. [n46]

C. Reaching Nonpoint Source Pollution: **Water** Quality Standards, the TMDL Program, and the Section 319 National Monitoring Program

Despite a general lack of federal regulation for nonpoint source pollution, the CWA does provide some methods for reaching these sources. Under the CWA, each state is required to set **water** quality standards for the **water** bodies within its borders. [n47] First, states must establish "designated uses, which are the uses that the state wants the **water** body to be able to support, even if aspirational." [n48] Then, states are required to develop **water** quality criteria, which describe the conditions a **water** body must meet to achieve its designated uses. [n49] These criteria may be set out in either numerical or narrative form. [n50] Numeric criteria set out specific, measurable standards for pollutant concentration levels. [n51] Conversely, narrative criteria are general descriptions that "give no ... objective, **water** quality baseline against which to measure progress." [n52]

[*164] Most states have elected to use narrative criteria to express their **water** quality standards because they are much easier to establish. [n53] Unfortunately, when narrative criteria are used, it is more difficult to recognize violations and to enforce standards. This challenge has been widely recognized and even acknowledged by the EPA. In 1998 for example, the EPA issued a "National Strategy for the Development of Regional Nutrient Criteria," which acknowledged that narrative criteria are inadequate to address nutrient pollution and encouraged states to adopt numeric criteria instead. [n54] Despite this encouragement, many states have made little, if any, headway in this area. [n55]

Regulation does not end with the creation of **water** quality criteria. The CWA also targets **water** bodies that do not meet **water** quality standards through the TMDL program. [n56] Under section 303 of the CWA, states must establish a TMDL for each listed **water** body and each pollutant that fails to meet **water** quality standards. [n57] Once maximum pollutant levels are established for a particular body of **water,** the state must allocate allowable pollutant discharges among point and nonpoint sources in the watershed. [n58] If the EPA disapproves of a state's TMDL, it may substitute its own TMDL as "necessary to implement the **water** quality standards." [n59] This program provides a mechanism for reaching typically unregulated nonpoint sources by allowing restrictions to be placed on both point and nonpoint sources to ensure that the maximum pollutant loads are not exceeded. [n60] **[*165]** Nevertheless, the TMDL program can only be effective if TMDLs are actually created and enforced.

Finally, the CWA's section 319 National Monitoring Program, [n61] added as part of the 1987 amendments, is meant to address nonpoint source pollution. [n62] Under section 319, states that develop management programs to control nonpoint source pollution are eligible to receive grant money. [n63] Unfortunately, section 319 does not require that states actually carry out their management plans and does not provide an enforcement mechanism. [n64] Also, aside from denying grant applications, the EPA has no authority to act if states fail to submit any plan at all. [n65] Section 319 does provide, however, that if a state fails to meet the standards set out in its management plan due in whole or in part to nonpoint sources from another state, then the EPA can convene a management conference of all states that contributed to the pollution. [n66] The purpose of the conference is to develop an agreement between the states to reduce nonpoint source pollution in the particular **water** body at issue. [n67] Nevertheless, if the states fail to reach an agreement, the EPA has no authority to compel one. [n68] Moreover, even if the states do reach an agreement, the measures they propose do not necessarily need to be enforceable. [n69]

D. Agricultural Exemptions

In addition to imposing very few requirements on nonpoint source pollution in general, the drafters of the CWA also created several exemptions specifically for agriculture. [n70] When the CWA was first enacted,

agricultural exemptions may have been justified. At the time, though the development of industrial agriculture was underway, **[*166]** farming practices were not as intensified as they are today. [n71] Additionally, scientists and policymakers were only beginning to understand the impacts of nonpoint source pollution [n72] and the shift from small family farms to fewer, more specialized industrial farms. [n73]

Initially, several types of agricultural **water** pollution that are now exempted fit within the definition of a point source, [n74] but after courts "ordered EPA to regulate farms" under the CWA, Congress amended the point source definition to exclude certain agricultural sources. [n75] It was first amended in 1977 to exclude agricultural irrigation return flows and later in 1987 "to exclude agricultural stormwater discharges." [n76] Additionally, the CWA also excludes "normal farming ... activities such as plowing, seeding, cultivating, minor drainage, [and] harvesting for the production of food" from dredge and fill permit requirements intended to protect wetlands. [n77]

Such exemptions are not unique to the CWA. In fact, some have even argued that when it comes to agriculture, environmental law is generally "characterized more by exemption than inclusion." [n78] There are similar exemptions or general lack of regulation under the Clean Air Act, agrochemical regulation laws, and hazardous waste management laws to name a few. [n79] Due to the point and nonpoint source distinction, reliance on elusive narrative criteria, and broad **[*167]** agricultural exemptions, it is not surprising that nutrient pollution remains a problem.

E. The Farm Bill and Agricultural Subsidies

If these exceptions and exemptions were not enough, the "Farm Bills" [n80] and accompanying agricultural subsidies exacerbate the problem by manipulating the incentives of agricultural producers. Since the majority of pollution-causing problems in the Mississippi and Gulf regions result from agriculture, it would be imprudent to ignore the impacts of agricultural policy and subsidies that in many ways create an incentive structure that works against **water** quality improvement.

Agricultural subsidies and the Farm Bill program can be traced back to the Agricultural Adjustment Act of 1933, which was introduced in response to plummeting crop prices during the Great Depression. [n81] At the time these subsidies were introduced, approximately 25% of the U.S. population lived on farms, [n82] so the drop in crop prices had a widespread impact. Pursuant to the Agricultural Adjustment Act of 1933, farmers were paid to produce less in an effort to decrease supply and stabilize prices. [n83] Initially the subsidies introduced were intended to be temporary emergency response measures, but they "have not only persisted but have thrived and expanded." [n84]

Over time, the policies and goals underlying agricultural subsidies have evolved. Rather than providing an incentive to produce less, more modern farm subsidies encourage "maximum production of certain commodity crops." [n85] This has led to expanded and intensified production of these commodity crops, which has many negative implications for **water** quality. For example, one highly **[*168]** subsidized commodity crop, corn, "is one of the most energy-intensive, **water**-intensive, ... pesticide-and fertilizer-intensive crops we grow." [n86] U.S. corn production causes "more **water** pollution than any other crop." [n87] Based on this data and the fact that approximately 40% of the world's corn supply comes from the Mississippi River watershed, [n88] it should come as no surprise that nutrient pollution is a major problem for the Mississippi River.

This shift in agricultural policy has resulted in vast improvements in agricultural yields and efficiency, but has also caused changes in the composition of the agricultural sector in general. [n89] Now, agricultural production is concentrated among fewer, larger farms that tend to be highly specialized. [n90] These farms are able to take advantage of economies of scale and technological improvements that make highly mechanized production possible. [n91] Unfortunately, this intensive, industrialized agriculture is also accompanied by significant environmental impacts and other negative externalities. [n92] There have been attempts to address the environmental effects by creating conservation subsidy programs. Such programs condition subsidy payments on the implementation of various conservation measures. [n93] However, these programs are limited

both by types of land and practices that qualify for subsidies and the overall amount of subsidies received per year. [n94] Moreover, while these programs are important, they tend to focus on taking certain lands out of production or mitigating limited types of environmental impacts rather than addressing the underlying factors that make large-scale commodity crop production unsustainable. [n95] As long as the majority of subsidy programs continue to encourage intensive production of commodity crops, these limited conservation subsidy programs are unlikely to make a significant difference. Overall, the negative implications of limited nonpoint source regulation, agricultural **[*169]** exemptions, and commodity crop subsidies are likely to outweigh the positive effects of these conservation measures.

III. How Have Other Regions Addressed Similar Issues?

While the Gulf Dead Zone may be one of the largest in the world, [n96] the Mississippi River and the Gulf of Mexico are certainly not the only **water** bodies that suffer from nutrient pollution. In fact, according to the EPA, there are over 15,000 **water** bodies with nutrient impairments in the United States alone. [n97] As unfortunate as this is, there is some benefit in that it gives us the ability to compare the approaches that have or have not been successful in other regions in order to determine the most promising course of action for the Mississippi and Gulf regions. At the same time, it is important to recognize that the successes and failures of other regions must be considered against the background of the social, economic, and political forces unique to each region.

A. The Chesapeake Bay

The Chesapeake Bay (Bay) is home to one of the first dead zones ever discovered in the United States. [n98] Since the 1980s, studies have recognized that nutrient pollution is the main source of contamination affecting the Bay. [n99] In 1983 several states formed the Chesapeake Bay Program (Bay Program) to combat pollution in the Bay watershed. [n100] While the Bay Program made significant progress in certain areas, it failed to achieve meaningful improvement for nutrient pollution partially because of reliance on "underfunded voluntary programs." [n101]

Eventually, it became clear that the Bay Program was inadequate, and on May 12, 2009, President Obama issued an executive order calling for federal agencies, in coordination with the states, to develop **[*170]** a plan for the protection and restoration of the Bay and its tributaries. [n102] As a result, the EPA worked with the states to prepare a TMDL for the Bay. [n103] The Bay TMDL limits the amounts of nitrogen, phosphorous, and sediment that may be discharged into the Bay and allocates the allowable discharges among point sources and nonpoint source sectors. [n104] The TMDL incorporates "Watershed Improvement Plans" (WIPs) submitted by each Bay jurisdiction, [n105] which detail how the states plan to meet the target levels of pollutant discharges and provide "reasonable assurance" that the discharge allocations will be met. [n106] The TMDL also provides for EPA-created "backstop allocations" that can be used if the states' efforts are inadequate. [n107] Compared to prior devices, the TMDL is much more prescriptive and emphasizes regulatory, as opposed to purely voluntary, measures. [n108]

Less than a month after the TMDL was issued, the American Farm Bureau Federation and the Pennsylvania Farm Bureau (Farm Bureaus) challenged it. [n109] The Farm Bureaus asserted that the EPA exceeded its authority by, among other things, attempting to establish pollutant allocations for specific point sources and nonpoint source sectors. [n110] The Farm Bureaus argued that, in setting a "total maximum daily load," the EPA has authority only to establish a "total," a single number, rather than a "comprehensive framework" including source allocations. [n111] The United States Court of Appeals for the Third Circuit found that the EPA had not exceeded its statutory authority. [n112] The court, granting deference to the EPA, [n113] reasoned that the term "total maximum daily load" is ambiguous, and, in light of the broad **[*171]** authority conferred upon the EPA through the CWA, the EPA's interpretation of the term was reasonable. [n114]

Nevertheless, despite being upheld by the courts and hailed as a precursor to "the next generation of cooperative federalism," [n115] the Bay TMDL is far from perfect. Though the TMDL has already achieved

significant improvements in Bay **water** quality, several Bay states are "lagging far behind in implementing the Bay TMDL," especially when it comes to nutrient pollution. [n116] This is largely due to the fact that some states have focused their attention on improving wastewater treatment systems to the detriment of other sectors, including agriculture, stormwater, and septic systems. [n117] Moreover, enforcement by the states has been deficient, and the EPA has failed to take any significant enforcement action against the states despite a lack of progress in many areas. [n118] Without EPA intervention or a significant threat of enforcement, state incentives to take additional action to reduce pollution are significantly diminished, and the "cooperative federalism" framework of the CWA becomes ineffective. As a result, the Chesapeake Bay TMDL has failed to reach its full potential.

B. Florida

Like the Bay, Florida also has a long history of nutrient pollution problems. In the late 1980s, insufficient state efforts caused the U.S. government to bring suit against the State of Florida and the South Florida **Water** Management District for nutrient pollution contamination of the **waters** of the Everglades National Park and Loxahatchee National Wildlife Refuge. [n119] The lawsuit led to a consent decree and, ultimately, to the Everglades Forever Act of 1994 (EFA). [n120] **[*172]** Unfortunately, a lack of progress and extension of deadlines under the EFA led to more litigation, and ultimately to the determination that the EFA, and the "Phosphorous Rule" enacted pursuant to it, violated the CWA. [n121]

The pollution problem was not limited to the Everglades. In 2008, outside the Everglades, Florida had not yet adopted numeric nutrient criteria. [n122] As a result, environmental groups filed a lawsuit that tested the boundaries of cooperative federalism under the CWA. In Florida Wildlife Federation, Inc. v. Jackson, plaintiffs argued that either the EPA's 1998 Clean **Water** Action Plan or its 1998 National Strategy report "constituted a "determination' that Florida's narrative nutrient standard was inadequate," which triggered a nondiscretionary duty under the CWA to adopt new standards within ninety days. [n123] This suit also resulted in a consent decree. [n124] Pursuant to the consent decree, unless the state established its own **water** quality criteria, the EPA was required to adopt numeric nutrient standards for Florida waterbodies. [n125]

The EPA published its proposed rule, which, despite challenges from the state, local governments, industry groups, and environmentalists, was at least partly upheld. [n126] Nevertheless, both the consent decree and the EPA rule prompted significant backlash. [n127] Opponents criticized the projected cost of implementing the rule and argued that it lacked a valid scientific basis. [n128]

Shortly after such strong opposition to the rule became apparent, the EPA "radically shifted" its approach to development of numeric nutrient criteria, [n129] adopting a "states-first approach to **[*173]** addressing nutrient pollution problems." [n130] It has been suggested this deviation from the EPA's prior approach was likely due to political pressure. [n131] The Florida Department of Environmental Protection (DEP) capitalized upon this new approach and petitioned the EPA to rescind its rule so that the state agency could regain control over Florida **water** quality criteria. [n132] Eventually, the EPA conceded and approved **water** quality standards promulgated by Florida. [n133] While Florida's numeric nutrient criteria are still in place and appear to be more palatable politically, they are "riddled with shortcomings and loopholes" [n134] that may prevent Florida from achieving significant **water** quality improvements. [n135] For example, the state rule "still allows **waters** to exceed criteria levels without triggering [enforcement] if other biological metrics do not indicate harm." [n136] As a result, Florida continues to experience toxic algal blooms at "unprecedented" levels, [n137] demonstrating the failure of the DEP rule to improve and maintain **water** quality.

C. Lake Erie

The story of nutrient pollution in Lake Erie is somewhat different than the Chesapeake and Florida stories. Prior to the enactment of the CWA, Lake Erie was so polluted it was "dying," [n138] yet state law failed to adequately address the problem. [n139] Fortunately, however, Lake Erie quickly became one of the CWA's biggest "success stories." [n140] In 1972 Canada and the United States signed **[*174]** the Great Lakes **Water**

Quality Agreement (Agreement), establishing a commitment to restore **water** quality in the Great Lakes. [n141] This Agreement acknowledged that nutrients (mainly phosphorus) were harmful and called for their reduction. [n142] The Agreement and resulting programs were quite successful in achieving phosphorus reductions, in large part due to increases in secondary wastewater treatment plants, elimination of phosphorus from laundry detergent, and implementation of no till farming practices. [n143] It was also very helpful that Lake Erie is so shallow that the **water** in the lake completely turns over in less than three years. [n144] Unfortunately, the success for Lake Erie did not last long.

Beginning as early as 1979, scholars alleged that government failure to enact and enforce implementing legislation had subverted the goals and purpose of the Agreement and would continue to do so if changes were not made. [n145] By the mid-1990s, algal blooms in the lake began to return. [n146] The Ohio Environmental Protection Agency convened the Ohio Lake Erie Phosphorus Task Force in 2007; [n147] despite their work, Lake Erie continues to suffer from **water** quality problems. By 2011 the lake had experienced the largest algal bloom ever recorded. [n148] In 2014 a harmful algal bloom forced the city of Toledo to shut off drinking **water** for half a million residents; [n149] the bloom returned in 2015. [n150] The reoccurrence of Lake Erie's **water** quality problems has been attributed to agriculture (especially the **[*175]** increased use of dissolved phosphorous fertilizers) and climate change. [n151] "Ohio, Michigan, and Ontario, Canada[] have agreed to reduce phosphorus" pollution by 40% in the next ten years, but researchers suggest that this may not be enough. [n152] Only time will tell what the outcome of such an agreement will be, but so far, contrary to the moderate improvements in Florida and the Chesapeake, **water** quality in Lake Erie seems to be on the decline, demonstrating that legislation without action is meaningless.

D. The Mississippi and the Gulf: What Has Been Done So Far?

The story of nutrient pollution in the Mississippi River and Gulf of Mexico in many ways resembles those in Florida and the Chesapeake. Pollution in the Gulf region is not new, and there have been several attempts to address it. In 1988 the EPA created the Gulf of Mexico Program (Gulf Program) to "protect, maintain, and restore" the Gulf "in ways consistent with the economic well-being of the Gulf region." [n153] Similar to the Bay Program, the Gulf Program was aimed at interstate cooperation and voluntary, nonregulatory solutions. Also like the Bay Program, the Gulf Program's initial progress was minimal. [n154] In the mid-1990s, recognizing the size of the issue and the limited progress, the Sierra Club petitioned the EPA and the State of Louisiana to convene an interstate management conference under section 319 of the CWA. [n155] The petition was denied. [n156] However, the EPA acknowledged the problem and instructed the Gulf Program to further evaluate the problem and develop possible solutions. [n157]

Understanding the need for federal, state, and tribal involvement, the EPA created the Nutrient Task Force (Task Force) to study the causes and effects of the Dead Zone and coordinate efforts to limit its **[*176]** impacts. [n158] In 2001 the Task Force issued its first "Action Plan." [n159] The 2001 Action Plan proposed to reduce nitrogen discharges to the Gulf and reduce the size of the Dead Zone to 5000 square kilometers (about 1930.5 square miles) by 2015, a goal that has not yet been met. [n160] Despite changes in goals, plans, and deadlines over time, the Task Force has consistently recognized that nutrient pollution threatens both surface and ground **water** and that it is caused by runoff and agricultural activity. [n161] In spite of the work the Task Force has done, even the Task Force itself has recognized that the Dead Zone has not been reduced, there are insufficient resources available to achieve its goals, and "much work remains to be done." [n162]

In addition to the Task Force, in the early 2000s, several agencies and organizations including the EPA, the GAO, and the National Research Council cautioned that the problem of hypoxia in the Gulf was quickly escalating and recommended immediate action. [n163] Also in response to the inadequate progress, environmental groups filed two more petitions for EPA action in 2003 and 2008, both of which were denied. [n164] These denials were issued despite the EPA having consistently acknowledged that more needed to be done to address the problem of nutrient pollution in the Mississippi and the Gulf. [n165] Finally, after the most recent

petition was denied in 2011, the Gulf Restoration Network (GRN) filed suit in 2012 challenging the EPA's denial as a violation of the Administrative Procedure Act (APA). [n166]

[*177] In Gulf Restoration Network v. Jackson, the GRN asserted that the EPA violated its duty under the APA to determine whether new or revised **water** quality standards were "necessary to meet the requirements of" the CWA, and the agency "failed to provide reasons for the denial that conform to the relevant statutory factors" in the CWA. [n167] The GRN argued that the EPA could not base its decision to deny the petition solely on "non-statutory "administrative' factors," such as the "sizable regulatory and oversight burdens" that would be placed on the EPA if it chose to comply with GRN's request to establish **water** quality standards. [n168] The United States District Court for the Eastern District of Louisiana held that the EPA was required "to conduct a necessity determination," but was not limited in the factors it could consider when making that determination. [n169]

On appeal, the United States Court of Appeals for the Fifth Circuit vacated and remanded the district court's decision. [n170] The Fifth Circuit held that the EPA's denial of the petition was "presumptively subject to judicial review," [n171] but the EPA was not required to make a necessity determination as long as it ""provided some reasonable explanation as to why it cannot or will not exercise its discretion' to make a necessity determination." [n172] The "reasonable explanation," however, must be "grounded in the statute." [n173] The Fifth Circuit based its decision on the U.S. Supreme Court's reasoning in Massachusetts v. EPA and underscored the fact that, in light of agency deference, "the agency's burden" to justify its decision "is slight." [n174] Thus, despite finding that the EPA's decision was subject to judicial review, the decision was seen as a victory for the EPA because it "broaden[ed the] EPA's flexibility in responding to" such petitions and confirmed that the EPA is entitled to "extreme deference." [n175]

Although the case has yet to be considered on remand, it seems likely that the EPA will be able to satisfy its slight burden. Indeed, in **[*178]** light of the fact that the district court "affirmed the relevance of [the] administrative considerations" cited in the EPA's denial, it seems that the EPA will need to do little more than "simply maintain its earlier denial of the petition" in order to justify its decision. [n176] However the EPA attempts to justify its decision, it is likely that it will do so ardently in order to avoid the type of political opposition it faced in Florida. [n177] Ultimately, if the denial of the petition is upheld, the "states-first" approach to nutrient pollution regulation will likely continue.

IV. Moving Forward: What Are the Problems and Potential Solutions?

Since the GRN litigation is unlikely to change the status quo, it is important to consider other possible approaches to addressing nutrient pollution problems in the Mississippi and the Gulf. The issue is especially pressing in light of "competing **water** uses (e.g., growing population, energy production, agriculture, etc.) and limited **water** supplies." [n178] Allowing nutrient pollution to continue unabated "can lead to increased competition among **water** users for the shrinking supplies of unpolluted **waters.**" [n179] There already have been proposals to transport **water** from the Mississippi to dryer regions in need of **water;** [n180] while these plans may seem extreme, even they may not be an option if the **water** is too polluted to be useful. Further, it is important to note that problems of **water** shortages and hypoxia are likely to be exacerbated by climate change. [n181] Climate change is predicted to decrease total **water** supplies in the United States, change the timing of **water** supplies and rainfall patterns, and influence **water** temperature and chemical reactivity. [n182]

[*179] While there has been extensive research and considerable attention devoted to problems of **water** scarcity and nutrient pollution individually, there has been inadequate consideration of the relationship between the two. **Water** quality is unequivocally related to available **water** quantity. [n183] Pollution leads to reductions in **water** supply and increases in **water** treatment costs. [n184] As such, "preventing pollution is among the most cost-effective means of increasing **water** supplies." [n185] Nonetheless, in spite of current and impending **water** quantity issues, we continue to overlook the importance of **water** quality management and its potential to mitigate the impacts of **water** scarcity. If unaddressed, nutrient pollution is likely to increase due to factors such as greater population size, livestock production, and urbanization. [n186] Thus, it is important

to consider the different options we have to reduce it such as creating a TMDL, imposing numeric nutrient criteria, convening a section 319 conference, revising agricultural regulations and subsidies, or expanding coverage of the NPDES permitting program.

A. Mississippi/Gulf of Mexico TMDL

As with the Chesapeake, one possibility is to implement a TMDL for the Mississippi and the Gulf. A TMDL would establish the maximum amounts of nitrogen and phosphorus that could be discharged into either the Mississippi or the Gulf. Decreased nutrient discharges could be accomplished by imposing stricter regulations on point source dischargers or by regulating nonpoint source dischargers. Either method would reduce the number of nutrients entering these **water** bodies, which would have a positive impact on **water** quality.

Nevertheless, this approach would not be easy. First, there would likely be substantial political opposition. Several states in the Mississippi River watershed supported the Farm Bureaus in their opposition to the Bay TMDL. [n187] This opposition is due, at least in part, **[*180]** to their concern that the Mississippi River Basin "could be next." [n188] Thus, strong opposition to a Mississippi or Gulf TMDL is all but guaranteed. Moreover, development of a TMDL can be an extremely costly and time-consuming process. [n189] The cost factor is likely to increase resistance to the TMDL. The time factor, on the other hand, may cause supporters of the TMDL to question whether it is the best and most efficient solution to this pressing issue. Furthermore, the Bay TMDL also came about largely as a result of President Obama's executive order, and equivalent mandates for the Mississippi and Gulf region are not forthcoming.

In addition to the obstacles that may thwart the TMDL development, there are several factors that could affect the implementation of the TMDL. As in the Chesapeake Bay region, there may be enforcement issues. [n190] For example, despite having a TMDL in effect for several years, the Bay still has significant problems with nutrient pollution. [n191] Many argue that this is due to a lack of enforcement by both the states and the EPA. [n192] Enforcement and oversight are especially difficult when it comes to nonpoint source pollution due to the diffuse nature of the pollution. [n193] If a TMDL were created for the Mississippi and the Gulf, enforcement and oversight could be particularly challenging due to the large size of the watershed. Thus, these regions would likely experience even more problems than the Bay.

B. Numeric Nutrient Criteria

Similar to implementing a TMDL, another possibility would be to establish numeric nutrient criteria as in Florida. Again, this approach could have substantial benefits by causing a reduction in the total amount of nutrients discharged into the Mississippi and the Gulf. As stated earlier, numeric criteria also have the benefit of being easier to monitor and more easily enforceable. It is clear after Florida Wildlife Federation v. Jackson that the EPA has the authority to develop such criteria. [n194] Nevertheless, there would still be several **[*181]** challenges to this approach. For example, as in Florida, the establishment of such criteria would likely face strong political backlash. [n195]

Additionally, developing numeric nutrient criteria for the entire Mississippi River watershed would be an extremely large and complicated undertaking. [n196] One possible approach would be for each state to develop its own criteria individually. [n197] However, this approach would clearly lack uniformity. Moreover, like Florida, many states would be resistant to imposing strict numeric limitations and, due to political pressures, could either develop inadequate criteria or refuse to develop criteria at all. As a result, such an approach could result in the development of criteria with significant "loopholes" similar to those complained of in Florida. [n198] If this happens, the EPA could either disapprove the criteria and create its own criteria for each offending state [n199] or accept the inadequate criteria, which could result in failure to solve the problem at all, potentially inviting litigation from environmental organizations. As in Florida, the EPA could develop its own numeric criteria. However, this would be a substantial undertaking, difficult for an agency constrained

by limited resources to accomplish. [n200] Furthermore, the EPA is likely to be highly resistant to taking on this responsibility after its experience in Florida. [n201]

C. Section 319 Conference

A third alternative is to convene a management conference pursuant to section 319 of the CWA. [n202] Convening a section 319 conference could be a good starting point, but it too has its drawbacks. First, many of the states within the watershed are greatly separated from each other not only with respect to geography but also in regard to political, social, and economic contexts. As such, it may be difficult for the states to come to a consensus, and the EPA has no **[*182]** means by which to compel an agreement. [n203] Moreover, even if a consensus is reached, it may rely primarily on voluntary measures, which have proven to be inadequate in the past. [n204] Finally, if an agreement were reached, there would still be significant difficulties when it comes to enforcement as with a TMDL. [n205]

D. Utilize the Farm Bill

Changes in agricultural regulations, such as the Farm Bill, though an indirect way to address **water** pollution, could effectively tackle the problem of nonpoint source pollution. Addressing only one sector is surely not the most comprehensive approach. Nevertheless, since 71% of nitrogen and 80% of phosphorus that reach the Gulf of Mexico come from agriculture, [n206] significant benefits could be achieved by regulating just this one sector. In their article Subsidies With Responsibilities: Placing Stewardship and Disclosure Conditions on Government Payments to Large-Scale Commodity Crop Operations, Linda Breggin and D. Bruce Myers Jr. describe how agricultural subsidy programs could be altered to incentivize agricultural producers to reduce pollutant outputs. [n207]

Breggin and Myers describe a variety of different ways that subsidies could be used to curb nutrient pollution, such as conditioning subsidy payments on the implementation of conservation practices. [n208] Other methods might include changing the types of crops that are subsidized and subsidizing winter cover crops to reduce runoff. Breggin and Myers argue that such conditions would not only reduce pollution but also reduce future costs to the public. [n209] In addition, they note that this potential solution would not be overly complicated to implement because "there is ample precedent for attaching conditions to federal payments to ensure that the dollars are used" in a manner consistent with the public interest. [n210] However, any **[*183]** attempt to increase the responsibilities of farmers would likely be met with substantial opposition from the agricultural sector, one of the most powerful lobbying groups in the country. [n211] Thus, this option may not be politically feasible.

E. Expand the NPDES Program - The **Des Moines Water** Works Case

The most promising option may lie in a case currently pending in the United States District Court for the Northern District of Iowa. On March 16, 2015, **Des Moines Water** Works (DMWW), a regional **water** utility, filed suit against three Iowa drainage districts (Districts), alleging that the Districts had violated the CWA by discharging nutrient pollution from a point source without a NPDES permit. [n212] DMWW argues that discharges from drainage districts constitute point source pollution within the meaning of the CWA. [n213] DMWW further contends that these discharges increase nitrate concentrations in the Raccoon River, from which DMWW obtains its **water,** forcing DMWW to operate its nitrate removal facility at a cost of $ 4000-$ 7000 per day. [n214] DMWW also notes that continued discharges could force it to install a new nitrate removal facility at a cost between $ 76 million and $ 183.5 million. [n215]

The case involves several preliminary issues that must be resolved, such as whether DMWW has authority to sue the Districts or whether they are entitled to unqualified immunity. [n216] However, the key issue in the case is whether discharge from a tile drain outlet qualifies as a point source or whether such a discharge should be considered an agricultural stormwater discharge. If the court finds that the discharges qualify as agricultural stormwater discharges, they will be exempt from regulation under the CWA.

However, if the court agrees with DMWW that such discharges are neither agricultural **[*184]** stormwater discharges nor irrigation return flows, [n217] the decision could have widespread impacts. [n218] Such an outcome could bring agricultural producers that utilize tile drains within the reach of the NPDES permitting program.

The fact that the suit was brought by a public utility rather than the EPA or an environmental organization demonstrates that this is more than just frivolous litigation attempting to stir up opposition to the agriculture industry. Rather, it is a problem with significant economic, political, environmental, and public health impacts. Regulating tile drains under the NPDES program could provide the regulatory tool necessary to address this problem. Even members of the agricultural community recognize that "no amount of money or programs will solve the problem until we have a farmland compliance system ... with some teeth." [n219] This lawsuit has the potential to provide those "teeth."

A holding that tile drains are point sources and must obtain NPDES permits could level the playing field for sustainability-conscious agricultural producers by preventing their competitors from cutting corners and externalizing the costs of environmental harm. In fact, the lawsuit is welcomed by some "stewardship minded farmers [who] are tired of their neighbors and competitors not following the same rules and conservation ethics." [n220] Also, by regulating only tile drain users rather than all agricultural producers, such regulation could serve as a test case to determine whether the agricultural industry is truly capable of internalizing its environmental costs or if continued protection of the industry is necessary.

Even if the suit does not result in a NPDES permit requirement, the mere possibility of regulation could make the agricultural industry more willing to implement voluntary pollution control measures and consider cooperative agreements. For example, the mere threat of future regulation has already caused "a growing interest in cover crops," which can absorb nitrates before they reach waterways, **[*185]** thereby reducing nutrient pollution. [n221] Alternatively, the suit might result in a consent decree, such as the one between the EPA and Florida, which could impose requirements or deadlines on states for creating **water** quality standards or implementing more conservation measures. Potentially, the lawsuit could even spark reconsideration of whether agricultural runoff should be exempt from NPDES permitting requirements at all. [n222] Although the end result of the litigation is far from guaranteed, it has potential to reduce the environmental impacts of agricultural production methods regardless of the outcome.

Though some may disagree that a strict regulatory approach is the best way to combat nutrient pollution, [n223] it is difficult to argue that such an approach is not necessary in light of the clear lack of progress under the current, primarily voluntary regime. In addition to increasing enforcement, or at least the threat of enforcement, a stronger regulatory approach could encourage the expansion of more cooperative methodologies. [n224] While it goes without saying that the agricultural industry plays a "vital role in our society," [n225] this does not mean that agricultural producers should have a free license to cause substantial environmental harm without paying the associated costs. It is a fundamental principle of U.S. environmental law that the polluter pays. [n226] This principle should be upheld, and the agriculture **[*186]** industry, like other industries, should be required to internalize the costs of pollution.

Unfortunately, the current political climate makes it unlikely that legislative changes will bring about significant expansions in environmental regulation and protection. [n227] However, courts and the DMWW lawsuit may hold at least a partial solution to the problem. The lawsuit has the potential to change the status quo by providing the regulatory "hammer" necessary to curb nonpoint source nutrient pollution. We already know the NPDES program has been quite successful in controlling **water** pollution from point sources. [n228] By expanding this program to cover tile drain users, we can gain additional **water** quality improvements without needing to create a completely new regulatory program from the ground up. Not only could this lead to faster results, but it could also be a more cost-effective approach than, for example, creating a TMDL for the entire Mississippi River. By bringing tile drain users into the NPDES permitting program, we can ensure that at least a portion of the environmental costs of agricultural production are internalized and potentially reduce overall nutrient pollution in the Mississippi River and shrink the Dead Zone.

V. Conclusion

The CWA was enacted with the goal of protecting the "chemical, physical, and biological integrity of the Nation's **waters.**" [n229] Over forty years later, largely as a result of nutrient pollution, we still fall far short of that goal. In order to successfully address this persistent problem affecting the Mississippi River and the Gulf of Mexico, we must learn from our mistakes and consider new approaches to controlling **water** pollution. We have seen time and again that relying completely on voluntary, cooperative approaches simply does not **[*187]** work. [n230] By continuing to rely on these ineffective methods, we do a disservice to ourselves and future generations. The DMWW case has the potential to set the tone for the future agricultural pollution regulation. If the DMWW court interprets the CWA's definition of a "point source" in a manner consistent with the CWA's express purpose of protecting our waterways, this case could be a turning point for nutrient pollution regulation and could provide a solution to the 6474-square-mile problem we call the Dead Zone. [n231]

FOOTNOTES:

n1. Oliver Cann, Top 10 Global Risks 2015, World Econ. F. (Jan. 15, 2015), http://www.weforum.org/agenda/2015/01/top-10-global-risks-2015/ ?utm_content=buffer8433f&utm_medium=social& utm_source=twitter.com&utm_campaign=buffer.

n2. Ellie Kincaid, California Isn't the Only State with **Water** Problems, Bus. Insider (Apr. 21, 2015, 5:56 PM), http://www.businessinsider.com/americas-about-to-hit-a-**water**-crisis-2015-4.

n3. Id.

n4. Freshwater: Supply Concerns Continue, and Uncertainties Complicate Planning, GAO (May 20, 2014), http://www.gao.gov/assets/670/663344.pdf.

n5. See Codi Kozacek, United States Clean **Water** Rule Quandary Begins on Land, Circle Blue (Mar. 4, 2015), http://www.circleofblue.org/2015/world/united-states-clean-**water**-quandary-begins-on-land/ ("Improvements in **water** quality have reached a plateau over the last decade, and in many parts of the country **water** quality is deteriorating, according to federal and state monitoring.").

n6. Maya C. Rommwatt, The Impact of Hypoxia on the Louisiana Brown Shrimp Fishery and the Potential for the Public Trust Doctrine to Slow Nonpoint Source Pollution 3 (June 2015) (unpublished M.S. thesis, University of Oregon) (on file with author).

n7. 2015 Gulf of Mexico Dead Zone "Above Average,' NOAA (Aug. 4, 2015), http://www.noaanews.noaa.gov/stories2015/080415-gulf-of-mexico-dead-zone-above-average.html. Other factors contributing to the Dead Zone include sewage disposal, industrial emissions, artificial drainage systems, and destruction of wetlands. Eileen McLellan, Fertilizer Runoff Is Just One Piece of the Dead Zone Puzzle, Envtl. Def. Fund: Growing Returns (Oct. 21, 2015), http://blogs.edf.org/growingreturns/2015/10/21/fertilizer-runoff-is-just-one-piece-of-the-dead-zone-puzzle/; Roddy Scheer & Doug Moss, What Causes Ocean "Dead Zones"?, Sci. Am. (Sept. 25, 2012), http://www.scientificamerican.com/article/ocean-dead-zones/.

n8. 2015 Gulf of Mexico Dead Zone "Above Average,' supra note 7.

n9. Id.

n10. America's Great Watershed Initiative, Conservation Gateway, https://www. conservationgateway.org/Documents/americas-great-watershed-initiative-fact-sheet_1.pdf (last visited Oct. 2, 2016); Dahr Jamail, Environmentalists Sue EPA over Dead Zone in Gulf of Mexico, Truthout (Aug. 14, 2015), http://www.truth-out.org/news/item/32354-environmentalists-sue-epa-over-dead-zone-in-gulf-of-mexico.

n11. Rommwatt, supra note 6, at 6; David Tilman et al., Forecasting Agriculturally Driven Global Environmental Change, Sci., Apr. 2001, at 281, 283.

n12. An Urgent Call to Action, St.-EPA Nutrient Innovations Task Grp. 1 (Aug. 2009), http://www.epa.gov/sites/production/files/documents/nitgreport. pdf. These impacts may be exacerbated by climate change, which increases the vulnerability of coastal ecosystems. Ashanti Johnson & Melanie Harrison, The Increasing Problem of Nutrient Runoff on the Coast, Am. Scientist, Mar.-Apr. 2015, at 98, 99.

n13. N. William Hines, History of the 1972 Clean **Water** Act: The Story Behind How the 1972 Act Became the Capstone on a Decade of Extraordinary Environmental Reform 4 (Univ. of Iowa Legal Studies, Working Paper No. 12-12, 2012), http://papers.ssrn.com/sol3/papers.cfm?abstract_id=2045069.

n14. Id. at 9-10.

n15. Id. at 4-5.

n16. Id.

n17. Id. at 14.

n18. Id. at 15-16.

n19. Id.

n20. Id. at 5-6, 13; see also Oliver A. Houck, Cooperative Federalism, Nutrients, and the Clean **Water** Act: Three Cases Revisited, 44 Envtl. L. Rep. 10426, 10427-28 (2014) ("[States] fought bitterly to retain state leadership of **water** pollution control.").

n21. Hines, supra note 13, at 13.

n22. Houck, supra note 20.

n23. Hines, supra note 13, at 34.

n24. Id. at 31-37.

n25. David Drelich, Restoring the Cornerstone of the Clean **Water** Act, 34 Colum. J. Envtl. L. 267, 268 (2009).

n26. Id.

n27. Id. at 269.

n28. 33 U.S.C. § 1251 (2012).

n29. Robin Kundis Craig, Climate Change Comes to the Clean **Water** Act: Now What?, 1 Wash. & Lee J. Energy, Climate, & Env't 9, 37 (2010).

n30. 33 U.S.C. § 1362; Mary Tharin, Note, Restoring Our Nation's **Waters** Through Public Land Law, 39 Ecology L.Q. 571, 573 (2012).

n31. 33 U.S.C. § 1362(14).

n32. Daniel R. Mandelker, Controlling Nonpoint Source **Water** Pollution: Can It Be Done?, 65 Chi.-Kent L. Rev. 479, 480 (1989).

n33. 33 U.S.C.§§1311(a), 1342.

n34. Robin Kundis Craig & Anna M. Roberts, When Will Governments Regulate Nonpoint Source Pollution? A Comparative Perspective, 42 B.C. Envtl. Aff. L. Rev. 1, 6-7 (2015).

n35. Id. at 8.

n36. Id. at 9.

n37. Id. at 8.

n38. Robin Kundis Craig, Urban Runoff and Ocean **Water** Quality in Southern California: What Tools Does the Clean **Water** Act Provide?, 9 Chap. L. Rev. 313, 319-20 (2006).

n39. William L. Andreen, **Water** Quality Today - Has the Clean **Water** Act Been a Success?, 55 Ala. L. Rev. 537, 593 (2004).

n40. See Laura Kerr, Compelling a Nutrient Pollution Solution: How Nutrient Pollution Litigation Is Redefining Cooperative Federalism Under the Clean **Water** Act, 44 Envtl. L. 1219, 1250 (2014).

n41. Id. at 1249.

n42. See id.; see also Petition for Writ of Certiorari at 32, Am. Farm Bureau Fed'n v. EPA, 792 F.3d 281 (3d. Cir. 2015) (No. 15-559) (noting that the EPA has distorted the balance between federal and state interests).

n43. See, e.g., Brian M. Dowd et al., Agricultural Nonpoint Source **Water** Pollution Policy: The Case of California's Central Coast, 128 Agric., Ecosystems, & Env't 151, 158-59 (2008) (describing problems California had obtaining secure funding, ensuring adequate monitoring, and preventing "capture" of the **water** control board by the farming industry).

n44. Jamail, supra note 10.

n45. Craig & Roberts, supra note 34, at 2.

n46. See, e.g., Zdravka Tzankova, The Difficult Problem of Nonpoint Nutrient Pollution: Could the Endangered Species Act Offer Some Relief?, 37 Wm. & Mary Envtl. L. & Pol'y Rev. 709, 719 (2013) (stating that agricultural sources are responsible for 71% of nitrogen and 80% of phosphorous in the Gulf of Mexico); Rommwatt, supra note 6, at 1 (stating that the Mississippi and Atchafalaya Rivers contribute 91% of nitrogen and 88% of phosphorous that reaches the Gulf).

n47. 33 U.S.C. § 1313(a) (2012).

n48. Craig & Roberts, supra note 34, at 8.

n49. Oliver Stiefel, All Carrot and No Stick: Why Washington's Clean **Water** Act Assurances Violate State and Federal **Water** Quality Laws, 88 Wash. L. Rev. 683, 688 (2013).

n50. 40 C.F.R. § 131.11 (2003).

n51. Douglas R. Williams, When Voluntary, Incentive-Based Controls Fail: Structuring a Regulatory Response to Agricultural Nonpoint Source **Water** Pollution, 9 Wash. U. J.L. & Pol'y 21, 35 (2002).

n52. Kerr, supra note 40, at 1229. These criteria are "based upon biomonitoring methods." 40 C.F.R. § 131.11. Though the regulation does not specifically define biomonitoring, a United States Geological Survey publication compares it to the use of a canary in a coal mine: "if the canary died, the miners knew the air was [too] bad." Thomas D. Byl & George F. Smith, Biomonitoring Our Streams: What's It All About?, U.S. Geological Surv. (1994), http://tn.**water.**usgs.gov/pubs/OFR94-378/. Thus, use of this method may not result in regulation until after the harm is already done.

n53. Kerr, supra note 40, at 1229.

n54. Federal Numeric Nutrient Criteria: A Tragedy in Two Acts, Warren Envtl. Couns. LLP (Oct. 20, 2013), http://warrenglasslaw.com/federal-numeric-nutrient-criteria-a-tragedy-in-two-acts/; National Strategy for the Development of Regional Nutrient Criteria Factsheet, EPA (June 1998), http://www.epa.gov/nutrient-policy-data/ national-strategy-development-regional-nutrient-criteria-factsheet.

n55. Tzankova, supra note 46, at 717, 739.

n56. Mary L. Belefski & Larinda Tervelt Norton, Hypoxia in the Gulf of Mexico: A Historical and Policy Perspective, 12 Tul. Envtl. L.J. 331, 349 (1999).

n57. 33 U.S.C. § 1313(d) (2012).

n58. J.B. Ruhl, Farms, Their Environmental Harms, and Environmental Law, 27 Ecology L.Q. 263, 301 (2000).

n59. 33 U.S.C. § 1313(d).

n60. Robert W. Adler, Agriculture and **Water** Quality: A Climate-Integrated Perspective, 37 Vt. L. Rev. 847, 867 (2013).

n61. 33 U.S.C. § 1329.

n62. 319 Grant Program for States and Territories, EPA, http://www.epa.gov/polluted-runoff-nonpoint-source-pollution/ 319-grant-program-states-and-territories (last updated Feb. 2, 2016).

n63. 33 U.S.C. § 1329(h)(1).

n64. William L. Andreen & Shana Campbell Jones, The Clean **Water** Act: A Blueprint for Reform, Ctr. for Progressive Reform 3, 6 (July 2008), http://www.progressivereform.org/articles/ CWBlueprint802ES.pdf.

n65. Id.

n66. 33 U.S.C. § 1329(g)(1).

n67. Id.

n68. Id.; see also Jan G. Laitos & Heidi Ruckriegle, The Clean **Water** Act and the Challenge of Agricultural Pollution, 37 Vt. L. Rev. 1033, 1044 (2013) (noting that section 319 programs are generally optional for states).

n69. Williams, supra note 51, at 75.

n70. Jason Foscolo & Michael Zimmerman, Alternative Growth: Forsaking the False Economies of Industrial Agriculture, 25 Fordham Envtl. L. Rev. 316, 317 (2014).

n71. For example, in the 1960s, the average farmer produced enough food to feed approximately twenty-six people, but today a single farmer can feed 144 people. Agriculture Fact Sheet, Nat'l Ag Day, http://www.agday.org/media/factsheet.php (last visited Oct. 2, 2016).

n72. Edwin D. Ongley, Control of **Water** Pollution from Agriculture, FAO (1996), http://www.fao.org/docrep/w2598e/w2598e04.htm.

n73. See Fred Kirschenmann, A Brief History of Sustainable Agriculture, Sci. & Envt'l Health Network (Mar. 2004), http://www.sehn.org/Volume_9-2.html (explaining that awareness of industrial agriculture's impact on the environment didn't begin increasing until the 1970s and 1980s and documenting the expansion of the sustainable agriculture movement since its emergence).

n74. Foscolo & Zimmerman, supra note 70, at 321; see also Nat. Res. Def. Council, Inc. v. Train, 396 F. Supp. 1393, 1401 (D.D.C. 1975), aff'd sub nom. Nat. Res. Def. Council, Inc. v. Costle, 568 F.2d 1369 (D.C. Cir. 1977) (explaining that, in enacting the CWA, Congress did not exclude all agricultural activities but rather left it to the EPA to determine which activities should be considered point or nonpoint sources).

n75. Foscolo & Zimmerman, supra note 70, at 321-22.

n76. Barrett Kirwan & Jonathan Coppess, Exploring Environmental Regulation of Agriculture, Pol'y Matters (July 17, 2014), http://policymatters.illinois.edu/exploring-environmental-regulation-of-agriculture/. The CWA and the EPA did not define agricultural stormwater, and courts have struggled to find an appropriate definition. See Alt v. EPA, 979 F. Supp. 2d 701, 707 (N.D. W. Va. 2013).

n77. 33 U.S.C. § 1344(f)(1)(A) (2012); Ruhl, supra note 58, at 296-97.

n78. Foscolo & Zimmerman, supra note 70, at 317.

n79. See Ruhl, supra note 58, at 305-16.

n80. The term "Farm Bill" refers to a comprehensive piece of legislation, typically renewed every five years, "that guides and authorizes funding for most federal farm and food policies." Farm Bill FAQ, Food Res. & Action Ctr., http://frac.org/farm-bill-faq/ (last visited Oct. 2, 2016). For a general overview of the Farm Bill, see Renee Johnson & Jim Monke, Cong. Research Serv., RS22131, What Is The Farm Bill? (2014).

n81. Mary Jane Angelo, Corn, Carbon, and Conservation: Rethinking U.S. Agricultural Policy in a Changing Global Environment, 17 Geo. Mason L. Rev. 593, 623 (2010).

n82. Linda Breggin & D. Bruce Myers Jr., Subsidies with Responsibilities: Placing Stewardship and Disclosure Conditions on Government Payments to Large-Scale Commodity Crop Operations, 37 Harv. Envtl. L. Rev. 487, 519 (2013).

n83. Angelo, supra note 81, at 597.

n84. Id. at 638.

n85. Id. at 622.

n86. Id. at 596-97.

n87. Id. at 640.

n88. Joe Whitworth, Quantified: Redefining Conservation for the Next Economy 162 (2015).

n89. Breggin & Myers, supra note 82, at 487-90.

n90. Id. at 489.

n91. Id.

n92. Angelo, supra note 81, at 602-03; see also Erin M. Tegtmeier & Michael D. Duffy, External Costs of Agricultural Production in the United States, 2 Int'l J. Agric. Sustainability 1 (2004) (discussing the external costs of agricultural production in general).

n93. Breggin & Myers, supra note 82, at 519-20.

n94. Angelo, supra note 81, at 632.

n95. See id. at 601.

n96. 2015 Gulf of Mexico Dead Zone "Above Average,' supra note 7.

n97. The Facts About Nutrient Pollution, EPA (May 2012), http://midwestadvocates. org/assets/resources/nutrient_pollution_factsheet .pdf. The EPA even acknowledges "there are likely many more since not all **waters** have been monitored." Id.

n98. Dead Zone, Nat'l Geographic Soc'y, http://nationalgeographic.org/encyclopedia/dead-zone/ (last visited Oct. 2, 2016).

n99. Chesapeake Bay Program History, Chesapeake Bay Program, http://www.chesapeakebay.net/about/how/history (last visited Oct. 2, 2016).

n100. Id.

n101. Howard Ernst, More Willpower, Less Wishful Thinking Needed for Bay Cleanup, Bay J. (Jan. 1, 2006), http://www.bayjournal.com/article/more_willpower_ less_wishful_ thinking_needed_for_bay_cleanup.

n102. Exec. Order No. 13,508, 74 Fed. Reg. 23,099 (May 12, 2009).

n103. Am. Farm Bureau Fed'n v. EPA, 984 F. Supp. 2d. 289, 304 (M.D. Pa. 2013), aff'd, 792 F.3d 281 (3d. Cir. 2015), cert. denied, 136 S. Ct. 1246 (2016). These efforts initially began in October 2007 when the EPA and the Bay jurisdictions "reached consensus that EPA would establish a Bay TMDL." Id. at 302.

n104. Am. Farm Bureau Fed'n, 792 F.3d at 292.

n105. Id.

n106. Am. Farm Bureau Fed'n, 984 F. Supp. 2d at 298, 304.

n107. Id. at 323.

n108. Karl Blankenship, EPA, in Announcing New TMDL, Says It Will Finally Clean Up the Chesapeake Bay, Bay J. (Jan. 1, 2011), http://www.bayjournal.com/article/epa_in_announcing_ new_tmdl_says_it_will_finally_ clean_up_the_chesapeake_bay.

n109. Am. Farm Bureau Fed'n, 984 F. Supp. 2d at 307.

n110. Am. Farm Bureau Fed'n, 792 F.3d at 294.

n111. Id. at 297.

n112. Id. at 302-06.

n113. Id. at 294-95.

n114. Id. at 297-98, 309.

n115. Shana Campbell Jones, Making Regional and Local TMDLs Work: The Chesapeake Bay TMDL and Lessons from the Lynnhaven River, 38 Wm. & Mary Envtl. L. & Pol'y Rev. 277, 300 (2014).

n116. Rena Steinzor & Evan Isaacson, Countdown to 2017: Five Years in, Chesapeake Bay TMDL at Risk Without EPA Enforcement, Ctr. for Progressive Reform 1 (Feb. 2016), http://progressivereform.org/articles/Chesbay2017Countdown1601.pdf.

n117. Id. at 4.

n118. Id. at 2-8, 10, 15-16, 20.

n119. United States v. S. Fla. **Water** Mgmt. Dist., 847 F. Supp. 1567, 1569 (S.D. Fla. 1992), rev'd in part, 28 F.3d 1563 (11th Cir. 1994), cert. denied sub nom. W. Palm Beach Cty. Farm Bureau, Inc. v. United States, 514 U.S. 1107 (1995).

n120. Id.; David G. Guest, "This Time For Sure" - A Political and Legal History of **Water** Control Projects in Lake Okeechobee and the Everglades, 13 St. Thomas L. Rev. 645, 662-63 (2001).

n121. Miccosukee Tribe of Indians of Fla. v. United States, No. 04-21448-CIV, 2008 WL 2967654, at 42 (S.D. Fla. July 29, 2008).

n122. Sara Gonzalez-Rothi Kronenthal, The Ripple Effect: How a Lawsuit Seeking Cleaner **Water** May be Backfiring, 3 LSU J. Energy L. & Resources 1, 7 (2014).

n123. Fla. Wildlife Fed'n, Inc. v. Jackson, No. 4:08cv324-RH/WCS, 2009 WL 5217062, at 2 (N.D. Fla. Dec. 30, 2009).

n124. Id. at 1.

n125. Id. at 3.

n126. Richard Schwartz & David Chung, The Nutrient Wars, Envt'l F., Sept.-Oct. 2014, at 34, 36.

n127. Craig Pittman, EPA Tells Judge It Will Impose Stricter **Water** Pollution Standards on Florida, Tampa Bay Times (Nov. 30, 2012, 10:20 PM), http://www.tampabay.com/news/environment/**water**/ epa-tells-judge-it-will-impose-stricter-**water**-pollution-standards-on/1264144.

n128. Meline MacCurdy, EPA Faces Lawsuits Challenging Potentially Far-Reaching Rule Setting Numeric Nutrient Criteria in Florida **Waters,** Marten L. (Feb. 10, 2011), http://www.martenlaw.com/newsletter/20110210-florida-**water**-nutrient-criteria.

n129. Kerr, supra note 40, at 1237-38.

n130. Id. at 1238.

n131. Id. at 1237-38.

n132. See Letter from Herschel T. Vinyard, Jr., Sec'y, Fla. Dep't of Envtl. Prot., to Lisa P. Jackson, Adm'r, EPA (Apr. 22, 2011), https://www.epa.gov/sites/production/files/2015-07/documents/ fdep-petition-withdrawal-2011.pdf.

n133. Fla. Wildlife Fed'n, Inc. v. McCarthy, No. 4:08cv324-RH/CAS, 2014 WL 51360, at 1 (N.D. Fla. Jan. 7, 2014).

n134. Cynthia D. Norgart, Comment, Florida's Impaired **Waters** Rule: Is There a "Method" to the Madness?, 19 J. Land Use & Envtl. L. 347, 365 (2004).

n135. Houck, supra note 20, at 10438-39.

n136. Kronenthal, supra note 122, at 21.

n137. Avianne Tan, Here's What's Causing the Toxic Algae Blooms Infesting Florida's Coastlines and Waterways, ABC News (July 5, 2016, 6:38 PM), http://abcnews.go.com/US/causing-toxic-algae-blooms-infesting-floridas-coastlines-waterways/ story?id=40346683.

n138. **Water** Quality: Lake Erie **Water** Quality, Lake Erie Waterkeeper, http://www.lakeeriewaterkeeper.org/lake-erie/**water**-quality/ (last visited Oct. 2, 2016).

n139. See generally Jonathan H. Adler, Fables of the Cuyahoga: Reconstructing a History of Environmental Protection, 14 Fordham Envtl. L.J. 89 (2002) (discussing the need for federal environmental legislation).

n140. William A. Babcock, Lake Erie's Tarnished "Success Story,' Christian Sci. Monitor (Apr. 16, 1990), http://www.csmonitor.com/1990/0416/zerie.html.

n141. Great Lakes **Water** Quality Agreement, Can.-U.S., Apr. 15, 1972, 23 U.S.T. 301, superseded by Great Lakes **Water** Quality Agreement of 1978, Can.-U.S., Nov. 22, 1978, 30 U.S.T. 1383.

n142. Id. arts. II-III, Annexes 1-2.

n143. Id.; **Water** Quality: Lake Erie **Water** Quality, supra note 138.

n144. **Water** Quality: Lake Erie **Water** Quality, supra note 138.

n145. Eric K. Rasmussen, Recent Development, The 1978 Great Lakes **Water** Quality Agreement and Prospects for U.S.-Canada Pollution Control, 2 B.C. Int'l & Comp. L. Rev. 499, 506-09, 520 (1979).

n146. Ohio Lake Erie Phosphorus Task Force Final Report, Ohio Envtl. Protection Agency 11 (Apr. 2010), http://epa.ohio.gov/portals/35/lakeerie/ptaskforce/Task_Force_ Final_Report_April_2010.pdf.

n147. Id.

n148. Michael Wines, Behind Toledo's **Water** Crisis, a Long-Troubled Lake Erie, N.Y. Times (Aug. 4, 2014), http://www.nytimes.com/2014/08/05/us/lifting-ban-toledo-says-its-**water**-is-safe-to-drink-again.html. Harmful algal blooms are overgrowths of algae, often toxic, which can cause dead zones and can be caused or worsened by excessive nutrients. Harmful Algal Blooms, EPA, https://www.epa.gov/nutrientpollution/harmful-algal-blooms (last updated Mar. 3, 2016).

n149. Wines, supra note 148.

n150. Tom Jackson, On the Anniversary of the Toledo **Water** Crisis, Algae Returns, Sandusky Reg. (July 29, 2015, 11:01 PM), http://www.sanduskyregister.com/Environment/2015/07/29/On-the-anniversary-of-the-Toledo-**water**-crisis-algae-returns.

n151. Maria Gallucci, Lake Erie Algae Bloom Crisis Is Putting Pressure on Ohio, Farm States To Tackle Agricultural Pollution Problems, Int'l Bus. Times (Aug. 16, 2014, 7:00 AM), http://www.ibtimes.com/lake-erie-algae-bloom-crisis-putting-pressure-ohio-farm-states-tackle-agricultural-1660240.

n152. Pam Frost Gorder, Number of Severe Algal Blooms in Lake Erie To Double, Forecast Says, Sci. Daily (Dec. 16, 2015), http://www.sciencedaily.com/releases/2015/12/151216153152.htm.

n153. About the Gulf of Mexico Program (GMP), EPA, http://www.epa.gov/aboutepa/about-gulf-mexico-program-office-gmpo (last updated Apr. 18, 2016).

n154. Houck, supra note 20, at 10432.

n155. Schwartz & Chung, supra note 126, at 35-36.

n156. Id.

n157. Belefski & Norton, supra note 56, at 341.

n158. Charter of the Mississippi River/Gulf of Mexico Watershed Nutrient Task Force, EPA (May 1998), http://www.epa.gov/sites/production/files/2015-03/documents/2008_ 9_10_msbasin_tfcharter_revised.pdf.

n159. Mississippi River/Gulf of Mexico Watershed Nutrient Task Force: 2015 Report to Congress, EPA 9 (Aug. 2015), http://www.epa.gov/sites/production/files/2015-10/documents/htf_ report_to_congress_final_-_ 10.1.15.pdf.

n160. Id.

n161. Action Plan for Reducing, Mitigating, and Controlling Hypoxia in the Northern Gulf of Mexico, EPA 7-8 (Jan. 2001), https://www.epa.gov/sites/production/files/2015-03/documents/2001_ 04_04_msbasin_actionplan2001.pdf; Gulf Hypoxia Action Plan 2008 for Reducing, Mitigating, and Controlling Hypoxia in the Northern Gulf of Mexico and Improving **Water** Quality in the Mississippi River Basin, EPA 2 (2008), http://www. epa.gov/sites/production/files/2015-03/documents/2008_8_ 28_msbasin_ghap2008_update082608.pdf [hereinafter Gulf Hypoxia Action Plan 2008].

n162. Gulf Hypoxia Action Plan 2008, supra note 161, at 4, 10.

n163. Houck, supra note 20, at 10433.

n164. Plaintiffs' Memorandum of Law in Support of Their Motion for Summary Judgment, Gulf Restoration Network v. Jackson, 2012 WL 5947978 (E.D. La. Nov. 19, 2012) (No. 2:12-cv-00677).

n165. Id.

n166. Gulf Restoration Network v. Jackson, No. 12-677, 2013 WL 5328547, at 3 (E.D. La. Sept. 20, 2013), vacated and remanded by Gulf Restoration Network v. McCarthy, 783 F.3d 227 (5th Cir. 2015).

n167. Complaint for Declaratory and Injunctive Relief PP 41, 45, Gulf Restoration Network v. Jackson, 2012 WL 950694, (E.D. La. Mar. 13, 2012) (No. 12CV00677).

n168. Gulf Restoration Network, 2013 WL 5328547, at 2-4.

n169. Id. at 7.

n170. Gulf Restoration Network, 783 F.3d at 244.

n171. Id. at 237.

n172. Id. at 243-44 (quoting Massachusetts v. EPA, 549 U.S. 497, 533 (2007)).

n173. Id. at 244.

n174. Id.

n175. Lester Sotsky & Jeremy Karpatkin, Fifth Circuit to EPA: When Petitioners Knock, the Agency Does Not Have To Answer, Arnold & Porter (Apr. 14, 2015), http://www.arnoldporter.com/en/perspectives/publications/2015/04/ fifth-circuit-to-epa-when-petitioners-knock-the-__.

n176. Id.; see also Schwartz & Chung, supra note 126, at 38 ("[The] EPA need only repeat its 2011 analysis - coupled with a clear application of those approved administrative considerations - to pass muster.").

n177. See Kronenthal, supra note 122, at 23.

n178. Kati W. Migliaccio et al., Evolution of **Water** Quality Regulations in the United States and Florida, U. Fla. Inst. Food & Agric. Sci. 1, 3 (Feb. 2014), http://edis.ifas.ufl.edu/ae431.

n179. Mark W. Rosegrant et al., **Water** for Agriculture: Maintaining Food Security Under Growing Scarcity, 34 Ann. Rev. Env't & Resources 205, 209 (2009).

n180. Lou Ellen Ruesink, **Water:** Basin to Basin, Tex. **Water** Resources, Mar. 1978, at 1, 3; Michael Clark, Western **Water** Woes - Is Big Infrastructure the Way To Go?, Colum. U.: Earth Inst. (Sept. 6, 2011), http://blogs.ei.columbia.edu/2011/09/06/western-**water**-woes-is-big-infrastructure-the-way-to-go/.

n181. Kincaid, supra note 2; Rommwatt, supra note 6, at 3-4.

n182. Craig, supra note 29, at 19-23.

n183. S.R. Carpenter et al., Nonpoint Pollution of Surface **Waters** with Phosphorus and Nitrogen, 8 Ecological Applications 559, 560 (1998).

n184. Id.

n185. Id.

n186. Id. at 565.

n187. Brief of the States of Kansas, Indiana, Missouri, Alabama, Alaska, Arkansas, Florida, Georgia, Kentucky, Louisiana, Michigan, Montana, Nebraska, North Dakota, Oklahoma, South Carolina, South Dakota, Texas, Utah, West Virginia, and Wyoming as Amici Curiae in Support of Reversal at 1, Am. Farm Bureau Fed'n v. EPA, 792 F.3d 281 (3d. Cir. 2015), aff'g 984 F. Supp. 2d 289 (M.D. Pa. 2013), cert. denied, 136 S. Ct. 1246 (No. 13-4079).

n188. Id.

n189. Chanathip Pharino, Sustainable **Water** Quality Management Policy 81 (2007).

n190. See Steinzor & Isaacson, supra note 116, at 2-4, 7-8, 15-20.

n191. Id. at 1-4.

n192. Id. at 6-7, 11-17.

n193. Id. at 8.

n194. Fla. Wildlife Fed'n, Inc. v. Jackson, 853 F. Supp. 2d 1138, 1156-60 (N.D. Fla. 2012).

n195. See Pittman, supra note 127.

n196. See Letter from Michael H. Shapiro, Deputy Assistant Adm'r, EPA, to Kevin Reuther, Legal Dir., Minn. Ctr. for Envtl. Advocacy, and Albert Ettinger (July 29, 2011), https://www.epa.gov/sites/production/files/2015-01/documents/mississippi-river-petition-nutrients-letter.pdf [hereinafter Letter from Michael H. Shapiro].

n197. How Are Standards Developed?, EPA, https://www.epa.gov/standards-**water**-body-health/how-are-standards-developed (last updated Jan. 12, 2016).

n198. See Norgart, supra note 134, at 365.

n199. 33 U.S.C. § 1313(c)(4) (2012).

n200. See Letter from Michael H. Shapiro, supra note 196.

n201. See Kerr, supra note 40; supra text accompanying notes 128-132.

n202. 33 U.S.C. § 1329(g).

n203. See Laitos & Ruckriegle, supra note 68, at 1044.

n204. See, e.g., Ernst, supra note 101 and accompanying text (discussing the failure of the Bay program to reduce nutrient pollution).

n205. See Steinzor & Isaacson, supra note 116; see also supra text accompanying notes 191-194 (noting that enforcement and oversight are particularly difficult in cases of nonpoint source pollution).

n206. Jessica Dexter et al., Cultivating Clean **Water:** State-Based Regulation of Agricultural Runoff Pollution, Envtl. L. & Pol'y Ctr. 1, 2 (2010), http://elpc.org/wp-content/uploads/ 2010/03/ELPC-Cultivating-Clean-**Water**-Report.pdf.

n207. Breggin & Myers, supra note 82.

n208. Id. at 521-38.

n209. Id. at 522.

n210. Id.

n211. Travis Madsen et al., Growing Influence: The Political Power of Agribusiness and the Fouling of America's Waterways, Frontier Grp. 1, 4 (Feb. 2011), http://www. frontiergroup.org/sites/default/files/reports/Growing-Influence.pdf.

n212. Complaint PP 160-86, Bd. of **Water** Works Trs. of **Des Moines** v. Sac Cty. Bd. of Supervisors as Trs. of Drainage Dists., 2015 WL 1191173 (N.D. Iowa Mar. 16, 2015) (No. 5:15-cv-04020). The complaint also contains claims for violations of state law, nuisance, trespass, negligence, due process, and equal protection. Id. PP 187-282.

n213. Id. P 178.

n214. Id. P 158.

n215. Id. PP 106, 158.

n216. This question has been certified to the Iowa Supreme Court. Order Certifying Questions to the Iowa Supreme Court at 3, **Water** Works, 2015 WL 1191173 (No. 5:15-CV-04020).

n217. Complaint P 178, **Water** Works, 2015 WL 1191173 (No. 5:15-cv-04020).

n218. See, e.g., Jonathan Coppess, Thinking About the **Des Moines Water** Works Lawsuit and the History of Drainage, Pol'y Matters (Sept. 30, 2015), http://policymatters. illinois.edu/thinking-about-the-**des-moines-water**-works-lawsuit-and-the-history-of-drainage/ (describing how the lawsuit "has the potential to reverberate across the Corn Belt," impacting close to ten million acres that utilize tile drainage in Illinois alone).

n219. Mark Gannon, **Water** Works Lawsuit Started Overdue Discussion, **Des Moines** Reg. (Feb. 4, 2016, 3:02 PM), http://www.desmoinesregister.com/story/opinion/abetteriowa/2016/02/04/ **water**-works-lawsuit-started-overdue-discussion/79767154/.

n220. Id.

n221. Tom Philpott, Can This Genius Strategy Stop Big Ag from Dumping Fertilizer into Drinking **Water?**, Mother Jones (Sept.-Oct. 2015), http://www.motherjones.com/environment/2015/07/ **des-moines**-nitrate-**water**-lawsuit.

n222. See Nick Hytrek & Dave Dreeszen, Iowa Farmers Ponder Effects of **Des Moines Water** Works Lawsuit, AgWeb (May 9, 2015, 7:00 AM), http://www.agweb.com/article/iowa-farmers-ponder-effects-of-**des-moines-water**-works-lawsuit-naa-associated-press/.

n223. Donnelle Eller, Will **Des Moines Water** Lawsuit Change Farming Rules?, **Des Moines** Reg. (Jan. 19, 2015, 9:33 AM), http://www.desmoinesregister.com/story/money/agriculture/2015/01/18/ **water**-pollution-lawsuit/21929897/.

n224. Martin Nie, The Underappreciated Role of Regulatory Enforcement in Natural Resource Conservation, 41 Pol'y Sci. 139, 151 (2008).

n225. National Ag Day Focuses on Importance of Future Generations, Samuel Roberts Noble Found. (Mar. 13, 2015), http://www.noble.org/news/news-releases/2015/15-013/; see also Joint Econ. Comm. Democratic Staff, 113th Cong., The Economic Contribution of America's Farmers and the Importance of Agricultural Exports, U.S. Congress Joint Econ. Committee (Sept. 2013), http://www.jec.senate.gov/public/_cache/files/ 266a0bf3-5142-4545-b806-ef9fd78b9c2f/jec-agriculture-report.pdf (describing the importance of agriculture exports to the U.S. economy); Alison L. Deutsch, The 5 Industries Driving the U.S. Economy, Investopedia (Apr. 29, 2015, 10:09 AM), http://www. investopedia.com/articles/investing/042915/5-industries-driving-us-economy.asp (naming agriculture as one of the top businesses driving the U.S. economy).

n226. Eric Thomas Larson, Comment, Why Environmental Liability Regimes in the United States, the European Community, and Japan Have Grown Synonymous with the Polluter Pays Principle, 38 Vand. J. Transnat'l L. 541, 546-47 (2005).

n227. See Previewing the 114th Congress, Sidley (Nov. 7, 2014), http://www.sidley.com/news/11-07-2014_government_ strategies_update#Energy%20and% 20the%20Environment (predicting that revisions to environmental laws are unlikely and any such amendments will only address regulatory overreach); see also Charles L. Franklin & Tracy Hester, Environmental Action and the 114th Congress: Movement at the Margins, Trends, Jan.-Feb. 2015, at 1, 1 ("Close margins in both houses, ongoing budgetary pressures, and the historic levels of acrimony between the parties will likely make substantive legislation difficult to achieve ... .").

n228. See, e.g., Andreen, supra note 39, at 592 (discussing the success of applying "technology-based effluent limitations through the NPDES permit system").

n229. 33 U.S.C. § 1251 (2012).

n230. See, e.g., Ernst, supra note 101 and accompanying text (discussing the failure of the Bay program to reduce nutrient pollution).

n231. 2015 Gulf of Mexico Dead Zone "Above Average,' supra note 7.

Dan Jacobi, Dan[n1], and Caitlin Andersen[n2], 2016, Agriculture and the Law: Can the Legal Profession Power the Next Green Revolution? 21 Drake Journal of Agricultural Law 177.

TEXT:
[*177]

I. Introduction

It is a familiar set of statistics: By the year 2050, we will need to feed over another 2 billion people on the planet. [n3] Sub-Saharan Africa and South Asia will **[*178]** be responsible for 90 percent of the population increase. [n4] This increasingly urbanized populace will consume roughly 70 percent more food than today. [n5]

Moreover, agricultural productivity, as it is currently distributed around the world, does not align with demand. For many reasons (e.g., farm-to-market efficiency, cultural acceptability, and geopolitical factors), food should continue to be produced locally. Approximately 85 percent of the world's food is consumed either within 100 miles of where it is grown, within the national borders, or within the same eco-regional zone. [n6] At the same time, agricultural productivity today is lowest in the regions where our population is likely to grow the most.

A strong agricultural economy is the key to a peaceful society. Without a reliable supply of safe, affordable food, the future will be one of famine, disease, and disorder on a global scale. Former U.S. Senator Tom Daschle has characterized food security as one of the defining challenges facing mankind in the twenty-first century. [n7] For the world's farmers, this means essentially doubling agricultural productivity, without increasing the amount of arable land on the planet, while dealing with the increasing impact of global climate change.

II. How Are We Going to Meet the Challenge?

Farmers, ranchers, scientists, agronomists, engineers, educators, government officials, philanthropists, and others around the world are hard at work every day on solutions. We have seen the introduction of new technologies in the areas of pest management, irrigation, cultivation, and **water** management that have already increased productivity for farmers of all sizes in virtually all crop production.

In addition, the application of digital and satellite technology to farming is changing the way growers around the world decide what and when to plant, how to manage their fields, and when to harvest and market their crop. Even in highly developed farming operations, the use of this information can improve yields and reduce seed, fertilizer, and chemical inputs by fifteen15 percent. [n8]

[*179] It is encouraging that many of these technologies are "scale-neutral,' in that they offer benefits to small and large farms alike. Biotechnology in all of its forms (not limited to transgenic seed products), drought and disease resistant crop varieties, agronomic practices that enable reduced tillage and more efficient use of **water** and fertilizer, and technologies that better protect harvested crops from disease and spoilage are all good things for farmers regardless of the size of their operations. This can be seen by the increase in production of grains on approximately the same amount of land. In 2005, 2043.4 million metric tons (MMT) of grains were produced on 300.42 million (MM) hectares. [n9] However in 2015, 2509.9 MMT of grains were produced on 322.22 MM hectares. [n10] This is an 18 percent increase in production on only about a 6 percent increase in land area.

Clearly, it is in many ways the best of times for agriculture. At the same time, there are daunting challenges ahead, highlighted by the fact that the benefits of modern agriculture are not evenly distributed

around the world. The disparity is apparent in the global production of corn (maize), the largest grain crop by weight produced in the world. [n11] Today, farmers around the world produce around 38,105 million bushels or 988 million metric tons of corn, [n12] on approximately 179 MM hectares - an average yield of about six MT per hectare (MT/Ha). [n13]

More specifically, U.S. farmers now produce an average of over 160 bushels of corn per acre (10 MT/Ha). [n14] In Sub-Saharan Africa, on the other hand, maize farmers average some fifteen to thirty bushels per acre (1 MT/Ha). [n15] Maize yields in South Asia are better (around 3-5 MT/Ha in many areas) but still far short of the potential. [n16] This "productivity gap' is not new, and its significance in feeding the future population has been the focus of significant public and private investment for more than four decades. The first Green Revolution during the 1940s and 1950s brought improved varieties of wheat and new agronomic practices to many **[*180]** parts of the developing world. [n17] A new Green Revolution will be needed to solve the current productivity gap and sustainably feed 9 billion people in the future.

Clearly, if the world's average corn yields could be increased to the levels of the U.S., we would be well on the way toward doubling agricultural productivity. Viewed this way, the challenge may not be so much about finding new solutions as it is about adapting existing solutions to new geographies. Agricultural technologies and practices already exist that would raise yields in the developing world to levels comparable to the developed; most simply need to be adapted to local climates, agronomic conditions, and cultures.

Within the developed world, where agriculture is at its most productive, the challenges are different, with agriculture beginning to expand its focus from productivity to sustainability. Historically, U.S. farmers have been free to decide how best to conduct their operations, but as society's understanding of the environmental impacts of modern society in general and of agriculture, in particular, has increased, agricultural practices have come under heightened scrutiny by a variety of newly-interested stakeholders: federal, state, and local governments and a wide range of non-governmental organizations (NGO's), as well as consumers.

Going forward, it will not be enough for growers in places like the Corn Belt to continue to be the world's most productive - they will also need to find new, more sustainable ways to do it.

III. What legal issues must be addressed in developing markets?

Farmers in South Asia and Sub-Saharan Africa face a variety of economic, political, and cultural challenges. However, there exists at least four common factors for developing agricultural markets that must be addressed in order for agricultural productivity to increase: (1) land ownership rights; (2) legal system structure; (3) access to technology and information; (4) access to markets, both for farm inputs and outputs.

A. Land Ownership Rights

Land ownership creates the fundamental incentives necessary for farmers to invest in and preserve their farming operations. By way of background, two **[*181]** concepts must first be defined. Land tenure is a system of land ownership that refers to the person who holds the land and often is used to describe the relationship between landlord and tenant. [n18] Accompanying this is the concept of land registration where the holder of the land registers their ownership right with a government department or agency. [n19] However, in many countries, land ownership rights are limited or difficult to enforce. The first barriers to landownership rights are the land registration systems in many parts of the developing world. While nearly all of the countries in Sub-Saharan Africa have the legal framework to register land rights, only about 10 percent of occupied rural land is registered. [n20]

Two common reasons are cited to support this statistic. First, it has historically been the case that the dominant customary land tenure system provided enough security to incentivize members of the community to invest in their land and as such it was not necessary to invest in actual land registration programs. [n21] Second, in countries where independence was newly claimed, documenting of land rights often required surveying and mapping. [n22] This was seen as a feasible cost for high value land found in the urban areas but

was considered to be too high of an expense in rural areas where land values drop significantly. One hybrid model is "communal registration," where registered land is held in common amongst a number of community members, and the allocation and management of individual plots is left to community organizations, rather than individual members. [n23] This model allows for the elimination of costly overhead during the registration process. [n24] This communal holding of land allows for covering larger areas quickly during the registration process and thus enables the government to focus on issues of how to resolve community conflicts. [n25] Communities, such as those in Angola, the Democratic Republic of Congo, Ghana, Mozambique, Tanzania, and Zambia, with large areas of communal land are often targets for foreign investment and land grabs due to the historically unregistered nature of this land. [n26]

Further, communal registration can also have the effect of maintaining **[*182]** cultural practices and prejudices that do not contribute to greater agricultural productivity. For example, in many parts of the world 70 percent of the farmers are women, but landownership rights are still limited to men. [n27] There is progress being made on this front, and "enlightened' communal registration can actually be a force for positive change. Countries such as Ethiopia and Rwanda have set the standard for implementation of programs which elevate women's landownership rights to the same level as men and include provisions that establish inheritance rights as well. [n28] These legal provisions are often accompanied by educational programs that increase the productivity of women farmers [n29] Additional issues of land grabs, land vulnerability, insufficient land administration, corruption, as well as low capacity and high demand for legal professionals are continuing barriers to landownership rights. [n30] These issues result in a general lack of reliable, accessible, government-sanctioned administrative structures that allow individuals to document and transfer land efficiently. [n31] As the administration of registration is a costly, lengthy, and understaffed process, land remains unregistered and is then vulnerable to land grabs by investors who are subject to a weak level of governance, causing violations of local agro-investment principles and dispossession of local communities. Such a situation indicates a need for stronger legal systems to facilitate the registration of land so that land ownership rights may be preserved and enforced.

B. Legal System Structure

Additionally, the rule of law itself is unreliable in many of these countries, making it difficult to enter into the kinds of input supply and marketing agreements that farmers in developed markets may take for granted. For example, in Kenya, the land laws require the use of alternative dispute resolution "as far as possible" [n32] and encourages the settling of land disputes "through recognized local community initiatives," [n33] leading to resolution (or lack thereof) outside the legal system, which undoubtedly yields unpredictable results. [n34] Further, the severity of disputes based on land borders and the sale of goods varies widely - from simple arguments between neighbors to wars fought over land borders to pursuing tribal arbitration rather than judgment from a court. [n35] In the event that such disputes are sought to **[*183]** be settled in in a justice or court system, there are issues of accessibility, functionality, trustworthiness, and understanding. [n36] For residents of rural communities, the location of the courts in urban areas present issues of physical access. [n37] Access to the court system to enforce existing statutory rights can be an additional challenge, as courts are understaffed and under-resourced. [n38] For many, solving the conflict without legal assistance is timelier than attempting legal resolution as the courts in Sub-Saharan Africa experience a number of backlogs, which are only compounded by undertrained judges. [n39] There is also a concern of corruption in the legal system and a general level of societal suspicion of pursuing formal legal remedies. [n40] It is possible that this corruption and suspicion continues due to a lack of understanding regarding legal processes and options available to those who wish to protect their rights.

C. Access to Agricultural Technology and Agronomic Information

Further compounding the lack of reliable land ownership structures and access to functional legal systems, farmers in developing markets often do not have access to some of the modern technologies that farmers in the developed world have used for years, including improved seed, fertilizer, and mechanization. [n41] The

initial challenge is that the regulation and deployment of technology varies widely across the developing world, from the lack of a functioning, science-based regulatory system in many countries, to the accompanying absence of an enforceable scheme of intellectual property rights and protection. For example, genetically modified (Roundup Ready) soybeans, which are planted on over 90 percent of the U.S. soybean acres, [n42] are rarely found outside the U.S. and Brazil, despite their value. The regulatory processes for approving this technology and the intellectual property protection structures that would protect it, are not in place in many developing countries and thus, those technologies are not deployed to farmers. An additional barrier to access is the absence of agronomic support farmers need in order to understand and properly deploy modern agricultural **[*184]** technologies. Thus, there is a need for educational services to provide not only technology information but information on the legal issues surrounding the application of such technology, including stewardship of technologies such as insect resistance. The absence of sound agronomic advice leaves many farmers in the developing world unable to take full advantage of the potential of their land. Organizations such as the African Agricultural Technology Foundation, however, are beginning to fund research projects that are directed at the specific technology needs of Sub-Saharan Africa and act as a liaison between scientists and farmers so that technology may be implemented within rural communities. [n43] Specific projects that center on improvements to indigenous crops and the regulatory systems to protect such improvements may increase acceptance by tribal groups and a spark a movement toward implementation of technology. [n44] Further projects supported by USAID, private industry, and academia may seek to fill the gap in educational services provided to farmers in developing countries. [n45]

D. Access to Markets

Finally, as roughly 80% of farmers in Asia and Sub-Saharan Africa are "smallholders' with fewer than ten Ha's (twenty-five acres) of land, there are number of unique challenges associated with the size of these farms. [n46] For instance, as 75% of the world's food is supplied by only twelve plants [n47] and five animal species, the potential of market fluctuations disproportionately impacts smallholders, versus large-scale farms that have the capital to absorb such shocks. [n48] Moreover, smallholder farmers most likely lack the economic power to negotiate favorable pricing on inputs, finance the cost of those inputs until harvest, and store their harvest until the optimal time to market that harvest.

Smallholders, however, may enjoy unique opportunities. Specialty crops are defined as "fruits and vegetables, tree nuts, dried fruits, horticulture, and nursery crops (including floriculture)." [n49] These crops are used for food, medicinal **[*185]** purposes, and/or aesthetic gratification. [n50] There is increasing global demand for specialty crops as the developed world public explores new and unique sources for everything from fair trade-sourced coffee beans, to ancient grains such as quinoa, to herbal remedies used in homeopathic medicines. This global demand is creating a variety of potential high-value export markets for smallholders in addition to their more traditional local food markets.

A common solution to both the challenges and the opportunities faced by smallholders in the developing world is the formation of agricultural cooperatives: collectively-owned legal entities that allow smallholders to enjoy many of the benefits of larger operations: mechanization, bargaining power with input providers and output purchasers, warehousing, marketing capabilities, and agronomic support. This is a solution that throughout the 20th century in the United States proved critical in raising the bargaining power of individual farmers and helping them affordably access key inputs, equipment, and services. [n51] In developing countries, though, cooperatives may struggle to achieve broad acceptance without a clear legal framework providing for such entities. [n52]

IV. What are the legal issues facing farmers in the developed world?

It is tempting to focus solely on the relatively low productivity levels of **[*186]** farmers in the developing world, but there are also significant challenges facing farmers in the developed world in the 21st century. Even if one (incorrectly, in our view) assumed that the most advanced farmers needed only to maintain

current levels of productivity while the rest of the world catches up, there are a number of daunting challenges ahead. While the legal system in the United States is well established for supporting agriculture in a broad sense, there are aspects of the legal system that should be reexamined as agriculture continues to evolve. Succession planning in light of generational changes in rural America; science-based regulatory frameworks, as consumers demand additional food labeling; and land-use rights, as they intersect with a growing understanding of the environmental impact of agriculture, all represent areas of the law ripe for fresh thinking.

A. Generational Change is Underway in U.S. Agriculture

The average age of farmers in the United States today is fifty-eight years old. [n53] Since 2010, there has been an increase of 30 percent in farmers over the age of seventy, and a 20 percent decrease in farmers under the age of twenty-five. [n54] Not surprisingly, the demographics of legal practitioners in rural areas reflects this same dynamic. The average age in 2005 of the over 1 million attorneys in the United States was forty-nine years, while the average age of those practicing in rural areas was closer to retirement age. [n55] These statistics are accompanied by the fact that there are only 2 percent of small law practices in rural areas. [n56] With an aging population of both farmers and attorneys, there are several issues affecting both groups individually and jointly, starting with the fact that in Iowa alone, nearly 60 percent of farm ground is expected to change hands in the next twenty years. [n57] Land ownership is going to change, whether by inheritance, tenancy, or purchase. Clearly, there is a corresponding need for attorneys with an understanding of the formal and informal legal aspects of succession planning, lease agreements, and purchase of title to property.

[*187] The next generation of farmers is being cultivated and supported in many substantive ways. Programs such as the Beginning Farmer and Rancher Development Program of National Institute for Food and Agriculture within the USDA are directed at providing tools and education to those interested in farming or just getting started as a beginning farmer. [n58] Resources available through this program include learning how to plan, manage, market, and expand farms as well as finding financial support and opportunities. [n59] On the legal side, the Iowa State Bar Association has developed a Rural Practice Committee aimed at placing current law students with attorneys with the hope that they remain after graduation. [n60]

It is not uncommon that lease agreements or purchase agreements are oral contracts that are sealed by a handshake between neighbors. In Iowa, oral leases are still enforceable but not for a term exceeding one year. [n61] However, farm leases automatically renew unless there is a notice of termination served by September 1, prior to the end of the lease year and must fix the termination of the lease on the following March 1. [n62] The nuances of farm leasing and the parties involved are complicated and must be understood by new attorneys as they enter the so-called "rural practice."

Under the American Bar Association's Model Rules of Professional Conduct, attorneys who are solo practitioners are encouraged to prepare a plan that designates another competent attorney to "review client files, notify each client ... and determine if there is a need for immediate protective action" in the event of the solo practitioner's death or disability. [n63] As rural attorneys age, the body of agriculture-specific knowledge they've accumulated over their careers is at risk of being lost.

These challenges, of course, represent potential opportunities in rural communities, particularly in a time when the markets for attorneys in urban areas **[*188]** are more saturated. [n64] Prospective law students and new lawyers alike need to be made aware of the opportunities associated with the generational change in farming outlined above. Just as important, those lawyers and law students who take advantage of these opportunities should have the same kinds of resources available to them that their farmer clients have to ensure their success.

B. Access to Technology and Information

The rise in alternative energy and the demand for renewable fuels will also influence agriculture as new technologies will be developed to maximize the value of energy crops. For instance, corn stover can be used to produce cellulosic ethanol that can be incorporated into gasoline. [n65] As the efficiency of cellulosic ethanol production increases, the demand for corn stover as well as other cellulose-rich crops such as miscanthus and jatropha will most likely increase. Breeders will develop new varieties that optimize the balance of grain and stover in corn and maximize the production of cellulose in non-grain crops. New cultivation and harvesting technologies that enable interseeding of cellulose-rich crops could certainly follow. All of these developments will likley be accompanied by new regulatory schemes and intellectual property rights that will impact the ability of farmers to deploy them at a reasonable cost.

C. Access to Markets

Farmers in the U.S. depend on access to specific markets for their crops. Most U.S. farm acres are devoted to commodity grain production, both for domestic and export consumption; however, fruit and vegetables, as well as specialty crops such as sugar beets and organic food represent increasingly important markets for U.S. farm profitability. But the ability of farmers to sell into any market, whether commodity grains for export or organic fruits and vegetables for domestic consumption, depends on clear, science-based regulatory frameworks that enable farmers and consumers alike to get the value of the crops they produce and purchase.

Existing regulatory frameworks around the world are under significant stress with the introduction of new biotech traits and new combinations of existing traits. **[*189]** Internationally, developers of new seed-delivered technologies face a patchwork quilt of restrictions on the import of grain derived from those seeds. Even when a new seed trait is approved for cultivation and consumption in the U.S., it must be approved for import in the key export markets for U.S. grain. [n66] Those approvals are rarely issued in a coordinated fashion, leaving seed companies, growers, and grain processors in potentially untenable positions. [n67] Lawyers in the U.S. and abroad need to work closely with regulators and other stakeholders to create a more synchronous set of regulations that depend on consistent application of scientific principles, while respecting each country's sovereignty, so that U.S. growers can have consistent access to key export markets.

Domestically, organic farmers enjoy a significant premium for crops that can be marketed as "organic" or "non-GMO." The definition and implementation of those terms in modern agriculture, however, are a challenge. The USDA has a definition of "organic" that focuses on the process of production of the labeled product, not the content. [n68] The term "non-GMO" conveys a degree of comfort to certain consumers, but that comfort is not founded on any scientific data. [n69] Arriving at a scientifically accurate approach to helping consumers make informed choices about the food they consume is an ongoing challenge being taken up by the USDA. In response to the recent Vermont law mandating labeling of foods containing GMO products, Secretary of Agriculture Tom Vilsack has invited those in the food industry, consumer groups, and other stakeholders to meet with the purpose of developing a compromise and solution to the labeling issues surrounding GMOs. [n70] Whatever the outcome of those efforts, it will be up to lawyers to ensure that these diverse stakeholders' interests are all reflected in the resulting regulatory framework.

[*190]

D. Sustainability Needs and Implementation

Climate change and the accompanying new and unpredictable weather patterns are producing new challenges for farmers in the prime crop-growing parts of the Northern Hemisphere. Specifically the increased presence of greenhouse gases in the atmosphere creates radiative forcing effects that lead to an increase in the earth's temperature. [n71] Such an increase in temperature can lengthen growing seasons and change planting schedules and even cropping patterns. [n72] Temperature increase can also reduce yields, as new, warmer weather plant diseases, weeds, and insects begin to thrive in traditional row-crop climates. [n73] Further, the application of additional fertilizers, herbicides, and pesticides in the pursuit of maximized yields

can, over time, exacerbate changing atmospheric conditions. [n74] Agriculture is now widely regarded as one of the largest non-point sources for atmospheric and **water** pollution. [n75]

Not surprisingly, sustainability is becoming a key factor in U.S. farmers' ongoing freedom to operate. As **water** becomes a scarcer resource, as environmental impacts of inputs such as nitrogen fertilizer become better understood and as pests continue to evolve, the pressure is increasing on agriculture to not only continue to produce at current levels, but to do so with a reduced environmental footprint. The USDA and EPA advocate for a number of "best management practices," such as increased use of cover crops, reduced fertilizer application, implementation of buffer strips, contour and no-till plowing, and better manure management strategies. [n76] However, as we have seen in recent developments, external stakeholders are beginning to resort to the court system to **[*191]** compel changes in farm practices. The lawsuit recently filed in the U.S. District Court by the Board of **Water** Trustees for the City of **Des Moines,** asserting a citizen enforcement action under the Clean **Water** Act against three counties for their nitrate pollution discharge into the Raccoon River and failure to obtain a National Pollution Discharge Elimination System Permit, serves as an example of non-traditional entities intervening in agricultural decisions in the name of sustainability. [n77] Further, the proposed legislation of the Safe and Accurate Food Labeling Act of 2015 reflects an increased public demand for agricultural products to be produced with sustainable and transparent practices. [n78] This level of involvement in agricultural practices by such non-traditional groups certainly highlights the need for attorneys who understand the complex interactions between agriculture and the environment and those who are willing to moderate and mediate the discussion between stakeholders with diverse interests.

V. Conclusion

Each of the challenges outlined above represents a specific set of issues that must be addressed in the law, regardless of whether the country is developing or developed. For example:

1. There must be legal structures in place that provide for clear rights regarding land ownership, transfer, and inheritance. These rights must be available and enforceable without regard to gender, class, or political affiliation.

2. Farmers and others involved in agriculture need to be able to rely on the rule of law in entering into and enforcing contracts relevant to their operations.

3. The development of new technologies and the deployment of those technologies in the markets where they are needed most across global agricultural system, requires a strong system for protection of intellectual property, rather than a patchwork quilt of IP rights in agricultural markets around the world.

4. In a world of global markets for agricultural commodities, new technologies are subject to approval in countries where they will be cultivated, but also where the products of those technologies will be imported. A science-based regulatory system that is robust, **[*192]** predictable, and transparent to all stakeholders is essential to this process.

5. In countries where they do not already exist, legal structures need to be developed that enable farmers to form agricultural cooperatives for input financing and purchasing, warehousing and marketing their crops.

6. Regulation of farming practices must balance the needs of farmers to make the best agronomic decisions for their operations with the demands of broader society for environmental sensitivity.

Lawyers are uniquely qualified to develop the legal structures outlined above, to educate society and their clients about their legal rights and responsibilities under these structures, and ultimately, to ensure access to these rights for all. Lawyers can (and must) help develop the law, educate the public, and seek enforcement of legal rights in a variety of practice areas, including private practice firms, in-house legal departments, and government agencies, as well as in non-practicing roles as legislators, regulators, and businesspeople.

Law schools in the U.S. are an essential part of this process. Law schools must continue to develop curricula that address the entire spectrum of legal issues that will be faced by U.S. farmers in the next half-century. In addition, lawyers and potential lawyers around the world look to their colleagues in the U.S. to understand what kinds of legal structures they need to advocate for in order to help farmers in their own countries become more productive. U.S. law schools must continue to expand their offerings to students and practicing lawyers from around the world, including: regular ag-related seminars and CLE's; conferences on domestic and international legal issues; and exchange programs for faculty and students from around the world.

All lawyers in ag-law practices, lawyers working in government or agriculture business-related roles, and the faculty and staff of law schools with ag-law and related curricula have opportunities to be a part of driving the agenda outlined in this paper. Indeed, the challenge is so great, and the consequences of failure are so catastrophic, there is little choice whether to participate. If we are successful, however, the legal profession will be the driver of the next Green Revolution.

Legal Topics:

For related research and practice materials, see the following legal topics:
Contracts LawTypes of ContractsLease AgreementsOral AgreementsGovernmentsAgriculture & FoodProcessing, Storage & DistributionGovernmentsNative AmericansProperty Rights

FOOTNOTES:

n1. J.D., Drake LW "86; Fmr. Gen'l Counsel, VP for Europe, Asia, and Africa and Supply Chain, Pioneer Hi-Bred Int'l, Inc. (Ret.); Member, Drake University Board of Trustees.

n2. B.S. Chemical Engineering, University of Iowa "13; J.D. Candidate, Drake LW "16; Editor in Chief, Drake Journal of Agricultural Law 2015-2016. The authors would like to acknowledge the work of Professor Neil Hamilton, Dwight D. Opperman Chair of Law and Professor of Law & Director, Agricultural Law Center, over the past thirty-plus years, to highlight to legal issues critical to the success of farmers in the United States and around the world. In particular, Prof. Hamilton's article, The Role of the Law in Shaping the Future of American Agriculture, 38 Drake L.Rev. 573 (1988), discusses a number of similar agricultural issues and legal solutions. Additionally, the authors would like to thank Edmund Sease for his work and dedication to agricultural intellectual property issues as Interim Director of Drake University Law School's Global Intellectual Property Law Center during the 2015-2016 academic year.

n3. World Population Projected to Reach 9.6 Billion by 2050, UN Dep't Econ. & Soc. Affairs (June 13, 2013), https://www.un.org/development/desa/en/news/population/un-report-world-population-projected-to-reach-9-6-billion-by-2050.html.

n4. See Urbanization in Africa, African Dev. Bank Group (Dec. 13, 2012), http://www.afdb.org/en/blogs/afdb-championing-inclusive-growth-across-africa/post/urbanization-in-africa-10143/.

n5. Food & Agric. Org. of the UN, How to Feed the World 2050 at 2 (2009).

n6. ETC Group, Issue # 102, Who Will Feed Us? Questions for the Food and Climate Crises 1 (2009), http://www.etcgroup.org/files/ETC_Who_Will_Feed_Us.pdf.

n7. See Tom Daschle & Dan Glickman, On Food Security, Who Leads?, Aspen J. Ideas (May/June 2015), http: //aspen.us/journal/editions/mayjune-2015/food-security-who-leads.

n8. Lyndsey Gilpin, How Big Data is Going to Help Feed Nine Billion People by 2050, TechRepublic, http://www.techrepublic.com/article/how-big-data-is-going-to-help-feed-9-billion-people-by-2050/ (last visited Aug. 21, 2016).

n9. See Foreign Agric. Serv., USDA, WAP 01-07, World Agriculture Production, at tbl.01, 04 (2007), http://usda.mannlib.cornell.edu/usda/fas/worldag-production//2000s/2007/worldag-production-01-01-2007.pdf [hereinafter WAP 01-07].

n10. See Foreign Agric. Serv., USDA, WAP 6-16, World Agriculture Production, at tbl.01, 03 (2016), http://usda.mannlib.cornell.edu/usda/fas/worldag-production//2010s/2016/worldag-production-06-10-2016.pdf [hereinafter WAP 6-16].

n11. Id. at tbl.04

n12. World Corn Production 2015-2016, Nat'l Corn Growers Ass'n (Jan. 12, 2016), http://www.worldofcorn.com/#world-corn-production; Conversion Factors, U.S. Grains Council, http://www.grains.org/buyingselling/conversion-factors (last visited Aug. 19, 2016).

n13. Foreign Agric. Serv., USDA, WAP 7-16, World Agriculture Production, at tbl.04 (2016), http://apps.fas.usda.gov/psdonline/circulars/production.pdf.

n14. Id.

n15. Id.

n16. Id.

n17. Dr. Norman Borlaug, a native Iowan, is said to be the father of the "Green Revolution," which is the name given to this time period of improved crop management and introduction of new varieties in Mexico, and later Asia and Latin America. About Dr. Norman Borlaug, World Food Prize, http://www.worldfoodprize.org/en/dr_norman_e_borlaug/about_norman_borlaug/ (last visited Aug. 19, 2016).

n18. See Rural Dev. Div., Food & Agric. Org. U.N. [FAO], Land Tenure and Rural Development, at 7, ISBN 92-5-104846-0 (2002), ftp://ftp.fao.org/docrep/fao/005/y4307E/y4307E00.pdf.

n19. See generally Frank F.K. Byamugisha, securing Africa's Land for Shared Prosperity (The World Bank, ed. 2013).

n20. Id. at 55.

n21. Id. at 28-29.

n22. Id. at 29.

n23. Id. at 55.

n24. Id.

n25. Id.

n26. Id. at 34.

n27. See id. at 89.

n28. Id.

n29. Id.

n30. Id.

n31. Id.

n32. Id. at 23 (citing Constitution (2009) (Kenya)).

n33. Id. at 23 (citing Constitution (2010) (Kenya)).

n34. Id.

n35. See id. at 98.

n36. Id.

n37. Id.

n38. Id.

n39. Id. at 99-101.

n40. Id. at 98 - 99.

n41. Idah Sithole-Niang, Board Chair, African Agric. Tech. Found. (AATF), Presentation at Workshop on Promoting Agricultural Biotechnology for Sustainable Development in Africa: AATF - Facilitating Access to Agricultural Technology for Smallholder Farmers in Africa (Feb. 25-26, 2014).

n42. See Recent Trends in GE Adoption, USDA: Econ. Res. Serv., http://www.ers.usda.gov/data-products/adoption-of-genetically-engineered-crops-in-the-us/recent-trends-in-ge-adoption.aspx.

n43. Sithole-Niang, supra note 41.

n44. Id.

n45. Id.

n46. Food & Agric. Org. U.N. [FAO], Smallholders and Family Farmers, 1 (2012), http://www.fao.org/fileadmin/templates/nr/sustainability_pathways/docs/Factsheet_SMALLHOLDERS.pdf.

n47. Common plants that make this list include: plantains, yams, sorghum, sweet potatoes, soybeans, cassava, potatoes, rice, wheat and corn. Eric Goldschein, The 10 Most Important Crops in the World, Bus. Insider (Sept. 20, 2011 8: 26 PM), http://www.businessinsider.com/10-crops-that-feed-the-world-2011-9?op=1.

n48. Smallholders and Family Farmers, supra note 46, at 1 (stating animals listed often include cattle, pigs, sheep, goats, and chickens).

n49. What is a Specialty Crop?, USDA: Agric. Marketing Serv., http://www.ams.usda.gov/services/grants/scbgp/specialty-crop (last visited Aug. 19, 2016).

n50. Id.

n51. See About Co-ops, Nat'l Council of Farmers Coops., http://ncfc.org/about-co-ops/ (last visited Aug. 19, 2016).

n52. Id. The author further notes that for example, in Africa, as countries within the continent began to liberalize, many markets followed no rules, leaving rural communities crying for government support. In recent years, such support has increased, but the regulatory systems are not exhaustive and there is a continuing need for a regulatory system which is appropriate but allows for freedom of action amongst the cooperative members. The need for leaders within the cooperative who are entrepreneurial and seek to have a member driven and owned cooperative is real. For many cooperatives, there is a lack of incentives to attract such qualified leadership which strains the transparency, accountability, and member participation of the cooperative. Further there are challenges amongst the membership as there are more members who are riding on the coattails of the genuine members to receive the benefits of market access. Further the attracting of such genuine members is lacking, as is the member education and training. These members expect a high rate of return for the membership but this is challenged by market competition and lack of incentives for participating in a high value share ownership of the cooperative.

In order for these challenges to be met, the legal framework for cooperatives must be reviewed with guidance from the members so that the response to the needs of the membership can be achieved. Additionally, the government controls in place require adjustment and reduction so that resources can be utilized by the membership. Lessons should be taken from the addressing of these issues so that the next generation of cooperatives can be established and sustained within the developing world.

n53. Nat'l Agric. Stat. Serv., USDA, ACH 12-3, Farm Demographics: U.S. Farmers by Gender, Age, Race, Ethnicity, and More 2 (2014), https://www.agcensus.usda.gov/Publications/2012/Online_Resources/Highlights/Farm_Demographics/Highlights_Farm_Demographics.pdf.

n54. Id. at 3.

n55. Lorelei Laird, In rural America, There are Job Opportunities and a Need for Lawyers, ABA J. (Oct. 1, 2014 5:40 AM), http://www.abajournal.com/magazine/article/too_many_lawyers_not_here._in_rural_america_lawyers_are_few_and_far_between.

n56. Id.

n57. Donnelle Eller, An Estimated $ 150 Billion in Iowa Farmland Could Change Hands over Next Two Decades, **Des Moines** Reg. (Jan. 24, 2014 12: 31 PM), http://blogs.desmoinesregister.com/dmr/index.php/2014/01/24/an-estimated-150-billion-in-iowa-farmland-could-change-hands-over-next-two-decades.

n58. Beginning Farmers and Ranchers Development Program (BFRDP), USDA: Nat'l Inst. Food & Agric., https://nifa.usda.gov/program/beginning-farmer-and-rancher-development-program-bfrdp (last visited Aug. 19, 2016).

n59. Getting Started, USDA: New Farmers, https://newfarmers.usda.gov/new-farmers (last visited Aug. 19, 2016).

n60. ISBA Rural Practice Committee, Iowa St. B. Ass'n, http://www.iowabar.org/group/RuralPractice (last visited Aug. 19, 2016).

n61. Extension & Outreach, Iowa State Univ., File C2-06, Lease Termination and Other Legal Considerations for Lease Contracts 1 (2014), https://www.extension.iastate.edu/agdm/wholefarm/pdf/c2-06.pdf.

n62. Id.

n63. Model Rules of Prof'l Conduct r. 1.3 cmt. 5 (Am. Bar Ass'n 1983).

n64. See generally Am. Bar. Ass'n, ABA National Lawyer Population Survey (2015), http://www.americanbar.org/content/dam/aba/administrative/market_research/national-lawyer-population-by-state-2005-2015.authcheckdam.pdf (noting that the number of licensed attorneys in the United States has increased 17.7% in the past ten years).

n65. See DuPont Cellulosic Ethanol Facility, Cultivation Corridor, http://www.cultivationcorridor.org/dupont-cellulosic-ethanol-facility/ (last visited Aug. 19, 2016).

n66. See Grain Marketing and Export Approvals, Pioneer, https://www.pioneer.com/home/site/us/products/stewardship/grain-marketing/ (last visited Aug. 19, 2016).

n67. See e.g., the recent Syngenta class action suit, which arose out of the commercialization of Syngenta's insect control trait in corn, VIP-Terra, before it was approved for import into China.

n68. Organic Labeling, USDA: Agric. Marketing Serv., http://www.ams.usda.gov/rules-regulations/organic/labeling (last visited Aug. 19, 2016).

n69. Can GMOs Be Used in Organic Products?, USDA: Agric. Marketing Serv., http://www.ams.usda.gov/publications/content/can-gmos-be-used-organic-products (last visited Aug. 19, 2016).

n70. Christopher Doering, Vilsack Calls Opposing Sides of GMO Labeling Debate to the Table, **Des Moines** Reg. (Dec. 19, 2015 4:19 PM), http://www.desmoinesregister.com/story/money/agriculture/2015/12/18/vilsack-calls-opposing-sides-gmo-labeling-debate-table/77500910/.

n71. See Climate Forcings and Global Warming, NASA, http://earthobservatory.nasa.gov/Features/EnergyBalance/page7.php (last visited Aug. 19, 2016).

n72. See How Will Global Warming Change Earth?, NASA, http://earthobservatory.nasa.gov/Features/GlobalWarming/page6.php (last visited Aug. 19, 2016).

n73. See Sources of Greenhouse Gas Emissions, EPA, http://www3.epa.gov/climatechange/ghgemissions/sources/agriculture.html (last visited Aug. 19, 2016).

n74. Id.; see also Nonpoint Source: Agriculture, EPA, http://www.epa.gov/polluted-runoff-nonpoint-source-pollution/nonpoint-source-agriculture (last visited Aug. 19, 2016).

n75. See Werner Eugster & Nina Buchmann, Inst. of Agric. Scis., ETH, Greenhouses Gas Emissions from Agricultural Soils - A Global Perspective 7 (2011), http://www.fibl.org/fileadmin/documents/de/news/2012/calas/5_CaLas2011_Eugster-Buchmann.pdf; Polluted Runoff: Nonpoint Source Pollution, EPA, http://**water.**epa.gov/polwaste/nps/agriculture.cfm (Aug. 19, 2016).

n76. See generally A. Asseng et al., Rising Temperatures Reduce Global Wheat Production, 5 Nat. Climate Change 143 (2014), http://www.nature.com/nclimate/journal/v5/n2/full/nclimate2470.html.

n77. See generally Complaint at 1, Bd. of **Water** Works v. Sac Cnty. Bd. of Supervisors, No. 5: 15-cv-04020-MWB (N.D. Iowa 2015).

n78. Safe and Accurate Food Labeling Act of 2015, H.R. 1599, 114th Cong. (1st Sess. 2015).

+++

Johnston, Jesse, 2015, From the Farm to the Gulf: Managing Nutrient Runoff Through Numeric Nutrient Standards. 20 Drake Journal of Agricultural Law 259.

TEXT:
[*259]

The **waters** of the United States are impaired. [n1] Throughout the past four decades, state governments, public interest groups, farmers, and the EPA have engaged in negotiations with the goal of "restoring and maintaining the chemical, physical, and biological integrity of the Nation's **waters.**" [n2] Two of the most **[*260]** important parties to this discussion are the American farmer and those who represent the farmer's interests. [n3] The Clean **Water** Act (CWA) regulates a point source and a nonpoint source differently, with agriculture generally falling into the latter group. [n4] Nonpoint source pollution includes agricultural activity, such as "runoff from fields and crop ... lands," [n5] and is managed by state governments. [n6] Currently, Iowa is trying to improve its impaired **waters** and reduce the hypoxic zone in the Gulf of Mexico while balancing the agricultural interests that dominate the state. [n7] Iowa's plan to improve **water** quality - the Nutrient Reduction Strategy - has been endorsed by farm-advocacy groups and politicians, in part because it provides for the voluntary adoption of conservation practices. [n8] However, environmental groups have criticized Iowa's strategy because it does not go far enough to protect Iowa's **waters** and the Gulf of Mexico. [n9] Many of these environmental groups and other concerned citizens have called for numeric nutrient criteria (NNC) in Iowa as a way to measure and achieve stated goals for **[*261]** **water** quality. [n10] Is there an approach to protecting **water** quality that will allow farmers to continue to adopt conservation practices voluntarily and improve impaired **waters** with sufficient immediacy? How do numeric criteria affect current **water** restoration efforts? What would the implementation of NNC look like to stakeholders? By examining **water** restoration efforts in Texas, Chesapeake Bay, and Florida, as well as legal precedent involving **water** restoration, this Note will argue that numeric criteria are beneficial and should be adopted by the state before they are imposed upon the state. [n11]

Part I of this Note discusses the effects of agriculture on the Gulf and its tributaries and the efforts to address these problems. Part II focuses specifically on NNC: what such criteria would mean for **water** quality and how NNC works within the current **water** quality regulation scheme. Part III looks toward judicial decisions that have compelled establishment of quantitative goals associated with **water** restoration in other jurisdictions. Part IV offers a broad blueprint outlining implementation of state-wide adoption of NNC and corresponding nutrient management practices, in order to ensure continued autonomy in any **water** restoration efforts, with a focus on efforts in Iowa.

I. Nutrient Run-off: From the Farm to the Gulf

Spanning over 1.2 million square miles, thirty-one states, and hundreds of tributaries, the Mississippi Watershed proves to be a tie that binds. [n12] Forty-one percent of the Continental United States' **water** drains into the Mississippi River and ultimately into the Gulf of Mexico. [n13] Majestic in size and scope, millions of people rely on the **waters** of Mississippi watershed and the Gulf of Mexico for food, jobs, and recreation. [n14]

It is a far journey from a stream in rural Iowa to the Gulf of Mexico, but **[*262]** almost sixteen metric tons of nutrients from Iowa farm fields make this trip yearly. [n15] Some levels of polluting nutrients are naturally occurring. [n16] Some of the nutrients found polluting the **waters** come from urban areas. [n17] However, the bulk of the pollutants causing disequilibrium in the **waters** and in the Gulf come from farms. [n18] The Gulf ingests over 1.6 million metric tons of nutrient run-off yearly, mostly from the Mississippi, Ohio, Missouri, and Atchafalaya rivers and their tributaries. [n19] The suspect nutrients come in the form of nitrogen (or nitrates which form when nitrogen is solubilized in **water)** [n20] and phosphorus.

The Mississippi River and the Gulf of Mexico together are a sick eco-system; the Dead Zone is symptomatic of a metastasized disease. The term "Dead Zone" has come to describe the hypoxic zone [n21] found at the confluence of the Gulf of Mexico and the mouth of the Mississippi and Atchafalaya Rivers. [n22] The name is derived from the effects of nutrient-loading in the **water:** in July of 2013, there existed a 5,800 square mile area where there was not enough oxygen in the **water** to support aquatic life. [n23] Estimates suggest that about seventy percent of the nutrient loads that cause hypoxia come from agricultural runoff from the farmlands that comprise the abutting landscape of the Gulf's rivers and their **[*263]** tributaries. [n24] Illinois, Iowa, and Indiana contribute the most to nutrient run-off; Iowa's contribution is just above eleven percent of the total nitrogen loads in the Gulf. [n25] Nitrogen and phosphorus occur naturally, and atmospheric deposits and natural land account for nearly twenty percent of the nitrogen found in the Gulf of Mexico. [n26]

Iowa's **waters** are impaired by these nutrients. In Iowa's 2014 survey, the Department of Natural Resources found that 572 bodies of **water** are polluted and unsuitable for their designated uses. [n27] These bodies of **water** require the state of Iowa to develop total maximum daily loads (TMDLs) of pollutants for each of these bodies of **water.** [n28] Nitrate levels reached record highs in the **Des Moines** and the Raccoon Rivers in the fall of 2014 - far above the safe levels for drinking **water.** [n29] Removing nitrates from the **water** is costly, and this cost is passed on to the users. [n30] Addressing the nutrient loading in Iowa's **waters** will, in turn, positively affect the **water** restoration efforts occurring in the Gulf. The occurrence of the Dead Zone has created a renewed sense of immediacy for addressing this cross-jurisdictional problem.

The compelling reasons for ensuring clean **water** in our rivers and coastal regions are numerous. [n31] These range from economic benefits [n32] gained from **[*264]** healthy watersheds, to the health benefits and an enhanced quality of life that are associated with a sustainable ecosystem. [n33] The time and resources contributed by environmental groups and governing bodies to this cause also serve as evidence of the importance of clean **water.** This author believes that all stakeholders desire clean **water.**

II. Obstacles to **Water** Restoration Efforts

Several efforts have been made to improve the Gulf and its tributaries, but little actual progress has been seen. [n34] The CWA was passed first passed in 1948, with landmark amendments occurring in 1972. [n35] These

amendments created the CWA regulatory structure that is in operation today. However, for several of the reasons discussed below, the CWA has proven ineffective in restoring the **waters** of the U.S. single-handedly.

One reason cited for the lack of improvement is the apparatus by which the CWA regulates. [n36] The CWA regulates effluent limitations from a "point source" by requiring owners and operators to obtain a permit to discharge into a body of **water.** [n37] Much of the nutrients causing hypoxia are nonpoint sources of pollutants and thus beyond the delegation of power to the EPA under the CWA. [n38] Nutrient pollutants in the form of agricultural runoff are enforced through the various efforts of individual states and beyond the reach of federal regulations, [n39] even though agricultural activities in the Mississippi Watershed contribute 1.7 million tons (seventy percent) of nutrients found in the Gulf. [n40]

The fragmented regulations of nonpoint sources of pollution presents another **[*265]** obstacle to obtaining cleaner **waters** in the Mississippi Watershed because it requires a multi-jurisdictional approach to **water** cleanup. [n41] Coordination across the thirty-one basin states and with the EPA regions is necessary to concertedly reduce nutrient runoff in the Gulf. [n42] However, this degree of cooperation has proven difficult in implementation and administration, [n43] especially considering the large-scale effects of nitrification seen in the Gulf are "linked with inputs and processes in upstream regions several hundreds of miles away." [n44]

Correcting the nutrient loading can be expensive. Iowa has estimated that it will cost anywhere between $ 1.2 billion and $ 4 billion to reduce nutrient levels to achieve reduction objectives. [n45] Iowa's governor, Terry Branstad, has estimated the cost of implementing regulations in Iowa "range from $ 900 million to $ 2.4 billion annualized ... with required initial investments of $ 1 to $ 4.7 billion" to Iowa's corn and soybean farmers. [n46] Bill Northey, Iowa's Secretary of Agriculture, has requested $ 7.5 million from the state to fund **Water** Quality Initiative, in the 2016 and 2017 state budgets. [n47] This price tag is a difficult number to derive though, because the cost-benefit analysis that is easily employed in a private setting becomes a more elusive number when dealing with public goods. [n48] It is difficult to assign a value to many of the benefits associated with healthy **water,** like recreational enjoyment. Further, preventive practices that keep the **water** clean cost less in the long run than the remedial practices are employed to create the same **water** quality goal. [n49]

Unfortunately, the pervasive narrative is that the costs of environmental **[*266]** benefits are in direct conflict with farm benefits. [n50] This sentiment stands as another barrier between agricultural practices and **water** restoration. The belief that adoption of conservation practices is expensive and difficult will delay any efforts farmers engage in before making an on-farm change to a management practice. [n51] Reframing this narrative to reach the late adopters is more critical and urgent with the continuing degradation of the Gulf. [n52]

Farmer's opinions and understanding about **water** pollution and its causes matter when changes in on-farm behavior are to occur voluntarily - as called for in Iowa's Nutrient Reduction Strategy. [n53] The Iowa Farm Poll has concluded that farmers do not know enough about key practices that have the best potential for reducing nutrient runoff. [n54] However, farmers seek a majority of their information regarding best management practices from fertilizer dealers or crop consultants: sixty-seven percent of farmers would first consult their fertilizer dealers for nutrient management information and eighty percent-two percent of farmers would first consult their fertilizer dealers for information on the rate of application. [n55] This tendency for farmers to gather information from agribusiness dealers may have created a ""normalization' of fertilizer use (and overuse) over time as other methods of fertility management ... have declined." [n56] The Farm Poll suggests improvements are needed, and that those who provide products and advice regarding fertilizer products should accept some responsibility to meet voluntary nutrient reduction goals. [n57]

Finally, there may be institutional inertia at work. [n58] Scientific research has **[*267]** determined the best management practices and the development and implementation of policy are lagging because regulatory framework requires actual knowledge of current on-farm practices. [n59] This missing information impairs governments and institutions' ability to "strategically direct efforts." [n60] Policy decisions are slow to be enacted and enforced where policy-makers must regulate with a broad stroke.

The goal of the 1972 CWA was to be accomplished by the year 1985; over two decades later this mission is still unfulfilled. [n61] Awareness about nutrification is rising in the Mississippi River Basin, and stakeholders are taking action. Some groups have lobbied policy-makers to take the next step and adopt specific criteria for the nutrients causing **water** degradation. In order to maintain high **water** quality standards, nonpoint source pollution must be mitigated.

III. Numeric Nutrient Criteria

The EPA [n62] and environmental groups [n63] contend that numeric nutrient criteria (NNC) would be an important step toward a working solution for nonpoint source pollution. Farmer-advocates contend that voluntary adoption of best management practices, as promoted in the Iowa Nutrient Reduction Strategy, will make meaningful progress by providing for better coordination and synchronization of our current state and federal conservation programs. [n64] These groups further contend that NNC would be detrimental to progress because "the numeric **water** quality standard approach that results in labeling people, farmers and business as "polluters' has real financial consequences." [n65] What are NNC? How does NNC function within the regulatory scheme of the CWA? And what role do states play in establishing such criteria?

The CWA leaves individual states with the authority and responsibility to **[*268]** adopt **water** quality standards for its **water** bodies. [n66] All states must adopt standards that describe the desired condition of a **water** body. Standards consist of three principal elements:

(1) the "designated uses" of the state's **waters** (e.g., fishing, aquatic life, drinking **water)**;

(2) "criteria" specifying the amounts of various pollutants, in either numeric or narrative form, that may be present in those **waters** without impairing the designated uses; and

(3) antidegradation policies providing for protection of existing **water** uses and limitations on degradation of high quality **waters.** [n67]

A state's **water** quality standards articulate the "**water** quality criteria" necessary to protect those designated uses. [n68]

Criteria are defined as "elements of State **water** quality standards, expressed as constituent concentrations, levels, or narrative statements, representing a quality of **water** that supports a particular use." [n69] Presently, there are two systems for expressing the second element: numeric and narrative criteria. [n70] Narrative nutrient criteria are expressed qualitatively. For example, Iowa's existing narrative criteria state that all surface **waters** designated for general use "shall be free from substances, attributable to wastewater discharges or agricultural practices, in quantities which would produce undesirable or nuisance aquatic life." [n71]

Numeric criteria specify the "precise, measurable levels of particular chemicals or conditions allowable in a **water** body." [n72] Expressed numeric nutrient criteria provide specific levels of nitrogen and phosphorus (causal parameters) as well as criteria for resulting chlorophyll or turbidity (response parameters). [n73] For **[*269]** example, an expressed nutrient criteria may read TN = 0.56 mg/L; TP = 33 ?g/L; where the total nitrogen is not to exceed 0.56 milligrams per liter and the total phosphorus is not to exceed 33 micrograms per liter. [n74]

The EPA recognizes that numeric nutrient criteria (expressed quantitatively) are superior to narrative criteria because they:

"Provide measurable, objective baselines against which to measure environmental progress;"

“Facilitate the writing of NPDES permits;

"Make development of **water** quality targets in [Total Maximum Daily Loads] (TMDLs) faster and easier;

“Increase the effectiveness in evaluating success of nutrient runoff minimization;" and

“Provide broader partnerships to employ best management practices (BMPs), land stewardship, wetlands protection, voluntary collaboration, and urban storm **water** runoff control strategies. [n75]

Nutrient criteria, whether numeric or narrative, is a critical component in managing a state's nonpoint source pollution. Once a state has identified its impaired **waters,** [n76] then the state is required by the CWA to establish TMDLs, for each of the impaired bodies of **water.** [n77] A TMDL defines the maximum amount of a pollutant that a body of **water** can receive from both point and nonpoint sources. [n78] Through establishment of load allocations in the TMDL, states may restrict nonpoint source pollutants.

Expressed NNC does not, on its own authority, impose regulations on land-owners or farmers, nor compel action by nonpoint source polluters. [n79] NNC represent **[*270]** the goal for total nutrient content of a body of **water,** not a limit upon the amount of nutrients that any farmer can apply. [n80] TMDLs represent the limit of any pollutant that a body of **water** can ingest. [n81] TMDLs are the regulatory "hammer." [n82] In the Chesapeake Bay watershed, for example, the EPA has issued a TMDL for the Bay and for the entire watershed, which includes 92 individual tributary segments. [n83] The state must provide the EPA with Watershed Implementation Plans, which include intermittent benchmarks and permission for the EPA to use additional regulatory authority where these benchmarks are not met. [n84] TMDLs compel action by states and polluters within a designated watershed, and are heralded as the new approach needed for restoring impaired **waters:** TMDLs are able to utilize state laws and regulations that vest their authority from law other than the Clean **Water** Act, which may be a more desirable policy goal throughout the many jurisdictions. [n85] Further, TMDLs are scientifically supported where they set a goal for the largest receiving body of **water** and then work upstream to meet those goals. [n86]

A goal could singularly be what farmers need to be able to regulate their individual contributions to nutrient loading in **waters.** A western Iowa farmer and Environmental Protection Council Appointee, Ralph Lents, stated to a committee of Iowa legislators that "the ag community [is]...willing to step up and do something [about **water** quality], but they just need a direction of what needs to happen." [n87] Setting goals for watershed projects helps "individuals, programs, and projects establish a clear direction, identify results, and perform at a higher level than would otherwise be achieved." [n88] The majority of farmers support nutrient runoff controls, [n89] despite the rhetoric from farm-advocacy groups that suggest **[*271]** that farmers are opposed to amending **water** quality standards. [n90] Research demonstrates that involving stakeholders in the planning of watershed projects results in producer buy-in when compared with a top-down implementation regiment. [n91] Setting NNC will not hinder farm practices or inherently alter practices occurring on-farm, but such criteria could assist farmers in the planning and implementation of best management practices, and could provide a review process that is crucial for actual improvement in **water** quality.

The EPA endorses establishing NNC. In 2011, the EPA published "Recommended Elements of a State Framework for Managing Nitrogen and Phosphorus Pollution." [n92] One of the eight elements recommends that states develop a "work plan and phased schedule for N and P criteria development for classes of **waters** (e.g., lakes and reservoirs, or rivers and streams)." [n93] Currently, about half of the states have articulated NNC for at least one type of **water** body, or have passed legislation stating their intent to set NNC. [n94] Iowa is a major contributor of nutrients to the Gulf, [n95] and is one of the states that do not have a policy implementation plan in place for managing nutrient pollutions. [n96] The number of states with quantitative criteria could be increasing: environmental organizations and other affected business have begun asking for restrictions on nonpoint source pollution, [n97] albeit most states - including Iowa - have shirked quantification of **[*272]** goals for nutrient reduction.

IV. Iowa's Nutrient Reduction Strategy: Numeric Nutrient Criteria is Rejected

"When faced with two equally tough choices, most people choose the third choice: to not choose." -Jarod Kintz

In May 2013, Iowa published the statewide Nutrient Reduction Strategy. The taskforce relied on a strong relationship with Iowa State University [n98] to compile analysis of policy considerations and scientific assessments of nutrient-pollutants effect on the Gulf of Mexico. [n99] The document addresses the eight strategy elements recommended for consideration by the EPA to "emphasize state implementation of new and existing nutrient reduction practices and technologies for point and nonpoint nutrient sources," [n100] although some of these recommendations were dismissed as impractical for Iowa in the NRS. [n101] The NRS is comprised of three major sections: Policy Considerations and Strategy, Nonpoint Source Nutrient Reduction Science Assessment, and Point Source Nutrient Reduction Technology Assessment.

In order to address agriculture's effect on non-point source pollution, Iowa's NRS ultimately suggests "a combination of in-field and edge-of-field practices ...to reach desired load reductions from nonpoint sources." [n102] These suggestions are stressed as examples in the NRS document, and are "not specific recommendations." [n103] Two categories of practices are enumerated to support the reduction efforts: nitrogen reduction practices and phosphorus reduction practices. [n104] The final two-thirds of the NRS details the scientific methods used to determine which agricultural practices would be most effective while considering the cost of implementing such practices. [n105]

[*273] The first draft of Iowa's NRS was submitted for comments on November 19, 2012. [n106] Thereafter followed a two-month public comment period. [n107] The taskforce considered all feedback, and issued the final version of the NRS on May 29, 2013. [n108] The EPA also submitted comments to Mr. Gipp, Director of Iowa Department of Natural Resources (DNR) and Secretary Northey, Iowa Department of Agriculture and Land Stewardship (DALS) on January, 9, 2013. [n109]

The EPA has addressed shortcomings: under the "general comments" section of the letter submitted to Secretary Northey from Mr. Gipp, the EPA states that the section entitled "Numeric Nutrient Criteria Limitations does not reflect the EPA's current thinking about numeric criteria development and implementation." [n110] The EPA has been clear about the expectation for numeric nutrient standards as an integral part of a state's effort to comply with establishing and implementing **water** quality standards as required by federal statute. [n111]

Iowa's NRS utilizes a voluntary model for nonpoint source pollution supported by monetary subsidies to provide motivation for adoption with high fidelity and few complaints from farmers/landowners/land operators. [n112] The NRS states that establishing any numeric nutrient criteria would be a "costly regulatory burden" that would not necessarily recognize the progress that could be gained through the voluntary adoption of BMP's outlined in the NRS. [n113]

While this approach to **water** conservation may create more willing participants, it has insurmountable disadvantages: "it is very costly to taxpayers and ... in the decades that this model has been in use it has rarely achieved adoption at the scales sufficient enough to significantly improve **water** quality." [n114] This approach also overestimates the ability of point source polluters to reduce nutrient loads. The NRS seeks to achieve 29% load reduction in phosphorus and 41% load reduction in nitrogen runoff from the state of Iowa. [n115] However, without specifically identifying where these runoff reductions must occur, this goal **[*274]** may remain impossible to meet. [n116] While there can be voluntary avenues for stakeholders to achieve the stated goals, participation should not be optional. [n117]

There is additional information missing from Iowa's NRS: How will progress be monitored? What is the deadline for reduction goals to be met? What will happen if the goals are not met? [n118] Progress monitoring requires setting and measuring standards (including NNC), and where those are not met, then TMDLs of

pollutants are set for the impaired body of **water.** These policy pieces are missing from the NRS - it is good science but bad policy. [n119]

V. Gulf Restoration Network v. Jackson: Legal Implications

Even though Iowa's NRS shies away from adopting numeric nutrient criteria, these measurable standards may be eventual regulatory reality. In July of 2008, Mississippi River Collaborative groups filed a petition with the EPA requesting the agency use its authority under the CWA to establish NNC for the states in the Mississippi River Basin. [n120] In July of 2011, the EPA denied the petition for rulemaking. [n121] In September of 2013, Judge Zainey ordered the EPA to make a "necessity determination" as to whether **water** quality standards should be promulgated to protect the **waters** of the Gulf. [n122] The district court ordered the **[*275]** EPA to make a necessity determination for NNC despite the EPA's contention that it was ""not determining that [new standards] are not necessary to meet CWA requirements,' but rather it was "exercising its discretion to allocate its resources in a manner that supports targeted regional and state activities ..."' [n123] On appeal, however, a three-judge panel reversed the district court and held that the "EPA may decline to make a necessity determination if it provides an adequate explanation, grounded in the statute, for why it has elected not to do so." [n124] The case was remanded to the district court to decide whether the EPA's reason for not making a necessity determination was sufficiently grounded in the language of the CWA. [n125] The district court was to apply a highly deferential standard to their review of the EPA's conclusions in this matter. [n126]

Prior to the decision in Gulf Restoration Network v. Jackson, the EPA has asserted the importance of establishing NNC for the watersheds that flow into the Gulf. [n127] In a report dated August 26, 2009, the Office of the Inspector General stated that the EPA needs to accelerate the adoption of NNC, specifically noting the amount of time that has lapsed since the problem was identified in the Gulf and the lack of improvement toward any goal. [n128] In a memorandum dated March 16, 2011, the agency again noted that "it has long been EPA's position that numeric nutrient criteria targeted at different categories of **water** bodies and informed by scientific understand of the relationship between nutrient loadings and **water** quality impairment are ultimately necessary for effective state programs." [n129] The Hypoxia Task Force is one among many **water** restoration organizations that recognize numeric nutrient criteria to help reduce nutrient pollution, and are fully supported and promoted by the EPA. [n130]

Despite the EPA's support for development of NNC, the agency denied the 2008 petition for rulemaking believing:

[*276]

the most effective and sustainable way to address widespread and pervasive nutrient pollution in the [Mississippi-Atchafalaya River Basin] and elsewhere is to build on [existing] efforts and work cooperatively with states and tribes to strengthen nutrient management programs. This ... is preferable to undertaking an unprecedented and complex set of rulemaking to promulgate federal NNC for a large region. The development of NNC ... would be highly resource and time intensive. [n131]

In March of 2012, the Mississippi River Collaborative sued the EPA challenging the agency's denial of the petition on the grounds that the EPA's denial violated the Administrative Procedure Act (APA) for failure to provide a reason for the denial or, in the alternative, because the denial was contrary to the undisputed evidence provided in the Petition about numeric nutrient **water** quality. [n132] Even though the Court of Appeals has allowed the EPA to deny the petition to make the necessity determination, environmental groups believe this is still a "positive outcome because it has made it clear to the agency that whatever decision it makes has to be consistent with the Clean **Water** Act." [n133] The EPA had cited political and administrative constrains as reasons for denying the necessity determination, and the district court may not find these reasons to be supported by the text of the CWA. [n134]

The EPA Administrator is required to promulgate any revised or new standard in order to meet the goals of the CWA, [n135] but it is likely that the EPA will avoid using this tool at this time. Determining, promulgating, and enforcing NNC is a difficult undertaking for a national agency because the complexity of the biological and nutrient relationship varies so greatly from **water**-body to **water**-body. Even though the EPA has been allowed to avoid a necessity determination regarding NNC in the Gulf tributaries at this time, this lineage of cases does allow for the judiciary to review such agency decisions. [n136] If there is no progress made in reducing nitrification, environmental groups can continue legal assaults on the agency, and the EPA is subject to judicial review.

[*277]

A. The EPA Has the Authority to Establish Numeric Nutrient Standards: Florida Wildlife Federation v. Jackson

Florida has experienced the effects of a lawsuit similar to Gulf Restoration Network. In 2008, Florida Wildlife Federation, joined with four other environmental groups, [n137] filed a lawsuit against the EPA to require the agency to promulgate federal numeric nutrient **water** quality standards for Florida's **water.** [n138] The lawsuit was filed five years after the EPA's deadline requiring states to adopt NNC, and seven years after the Florida Department of Environmental Protection (FDEP) developed a plan with the EPA to establish numeric nutrient criteria. [n139] The plaintiffs relied on the CWA's statutory language, which allows a citizen suit against the Administrator to compel performance of a duty that the Act makes nondiscretionary. [n140] The plaintiff's argued that the EPA's Clean **Water** Action Plan [n141] "constituted a "determination' that Florida's narrative nutrient standard was inadequate, thus imposing on the Administrator the nondiscretionary duty to "promptly' publish proposed new standards, and the further nondiscretionary duty to adopt new standards within ninety days after the publication." [n142]

However, before the issue could be resolved before the court, "the Administrator made an explicit and unequivocal determination that the Florida narrative nutrient standard was inadequate and that a revised or new standard was necessary to meet the Clean **Water** Act's requirements." [n143] The EPA and the plaintiffs in the suit moved for a consent decree without input from the State of Florida. [n144]

The consent decree bound the EPA to promulgate numeric standards by January 2010 for Florida's lakes and flowing **waters.** [n145] Built into the decree was the option for Florida to propose its own numeric standards for Administrator approval, **[*278]** in lieu of the federal standards. [n146] Litigation was ongoing between the EPA, FDEP, and environmental groups, [n147] and in January of 2014, the decree was modified to require numeric criteria for lakes and springs "that mirrored the EPA's criteria." [n148] Further, the FDEP standards set for downstream were using nonnumeric criteria, but these criteria include numeric components. [n149]

Although the EPA has publically declared its reluctance to set such standards in the Mississippi Basin, if "substantial **water** quality degradation from nutrient over-enrichment remains a significant challenge in the State and one that is likely to worsen," [n150] the EPA must set nutrient criteria. [n151] Florida had invested "$ 20 million in collecting and analyzing data ... and ... has implemented some of the most progressive nutrient management strategies in the Nation;" [n152] yet, these facts did not abate the necessity of new standards and involvement of the EPA. The FDEP opposed the Agency's role in developing numeric standards, but when the dust settled, the state of Florida had quantifiable nutrient criteria for the majority of its streams, estuaries, and coastal **waters.** [n153]

B. The EPA Should Consider the **Water** Quality Standards Downstream: Arkansas v. Oklahoma

The Supreme Court has considered how far the EPA's reach can extend across state lines in Arkansas v. Oklahoma. [n154] In this case, a Fayetteville, Arkansas sewage treatment plant had obtained a NPDES permit from the EPA to emit effluent into streams that eventually discharge into the Illinois River, twenty-two miles upstream from the Arkansas-Oklahoma border. [n155] The EPA included a provision **[*279]** in the permit

allowed for a change in the permit should field studies indicate that the permit affected **water** quality standards in Oklahoma. [n156]

Indeed, this discharge affected the **water** quality of the Illinois River on the Oklahoma side, where the standards provided that "no degradation [of **water** quality] shall be allowed" in the upper Illinois River. [n157] Oklahoma filed a complaint, challenging the permit. [n158] The Administrative Law Judge that first heard the case affirmed the permit, finding that the discharge would not have an "undue impact" on Oklahoma's **waters,** and the effect must be more than the de minimis impact in this case. [n159] Both parties sought judicial review. [n160] The Supreme Court ultimately held that because the permit was issued at the federal level, the EPA's regulation requiring upstream states to abide by downstream standards was reasonable and a permissible exercise of statutory authority. [n161]

The implications from Arkansas could put undue pressures on point source polluters: nonpoint polluters do not need to apply for NPDES permits under the law. [n162] EPA's regulations provide that a NPDES permit shall not be issued "when the imposition of conditions cannot ensure compliance with the applicable **water** quality requirements of all affected States," [n163] and this provision applies despite whether the permit is issued by the EPA or the state. [n164] In states where there are inadequate nutrient criteria, and consequently where the TMDLs do not reflect nonpoint source pollution, polluters petitioning for NPDES permits can be excessively restricted where downstream states have set higher **water** quality standards. [n165] Governor Branstad of Iowa has discussed the high costs of NNC for farmers, but there is also a burden placed on point source polluters where agriculture's effects on **water**-quality continue to go unquantified. [n166] If the Gulf States set and seek to enforce **water** quality standards, those entities applying for and maintaining NPDES permits will unfairly bear the burden of nutrient reduction. [n167] **[*280]** In agriculturally dominated watersheds, "point sources contribute a relatively small percent of the overall nutrient load" - ten percent or less - and yet they are most heavily regulated. [n168]

C. American Farm Bureau Federation v. EPA: Chesapeake Bay Program Provides a Model for the Midwest

The Dead Zone plaguing the Gulf of Mexico is not an anomaly; the same questions about enforcement, efficacy, and the CWA have been debated in the Chesapeake Watershed for three decades. [n169] Chesapeake Bay provides a model for the Gulf and a legal framework for understanding what interest groups, states, and farmers can expect in the near future - "a glimpse of what is to come." [n170] The history of the Chesapeake Bay and efforts to improve the **water** quality is replete with federally determined **water** quality standards, cooperative federalism, agreements amongst key groups, and enforcement. [n171]

In American Farm Bureau Federation v. EPA, the plaintiffs [n172] claimed that the EPA acted unlawfully in setting and promulgating TMDLs because they impeded on the states' rights to implement a TMDL. [n173] The court held the EPA's efforts to be lawful: upstream regulations of the watershed, EPA's overriding of state decision with "backstop" adjustments, and sector and individual source allocations were among the regulations validated. [n174]

Included in the decision was a detailed outline of the coordinated and cooperative efforts between the EPA and the Chesapeake Bay Program (CBP). [n175] The CBP [n176] entered into an agreement in 2000 with the EPA and other Chesapeake **[*281]** partners. [n177] This agreement set one goal: "correcting nutrient and sediment related problems in the Chesapeake Bay and its tidal tributaries sufficiently to remove [those **waters**] from the list of impaired **waters** by 2010." [n178] A Memorandum of Understanding was later signed whereby the parties collectively agreed to work together to cooperatively achieve nutrient and sediment targets with the goal of removing the Bay and its tidal tributaries from the 303 (d) list. [n179] Thereafter in 2003, the seven Bay jurisdictions established cap loads for nitrogen, phosphorus, and sediment. [n180]

The Bay jurisdictions reevaluated their nutrient and sediment cap loads in 2007 as part of the agreement. [n181] The reevaluation revealed that there had been insufficient progress made toward improving **water** quality

to a level that indicated the Bay and its tidal tributaries were no longer impaired by the nutrients. [n182] It was at a meeting on October 1, 2007, where the Bay jurisdictions and the EPA agreed that the EPA would establish a Bay TMDL with a target date of 2025 for all necessary pollution control measures to be in place. [n183]

After the EPA put forth nutrient target loads for the major river basins within Bay Watershed, states were left to determine their own **Water** Improvement Plans (WIPS). [n184] Phase I directed the states to determine how the control measures will be implemented to achieve target loads. [n185] Phase II requested that the states further divide nonpoint source load allocations and any aggregate point source wasteload allocations among smaller geographic areas. [n186] Phase III asks for finalized WIPs to ensure achieved **water** quality standards by 2025. [n187]

[*282] American Farm Bureau Federation (AFBF) has appealed the case, contesting that the CWA limits the EPA's authority to establishment of TMDL - that the EPA has overreached with respect to the Chesapeake Bay restoration efforts. [n188] AFBF argues that states have illegally been stripped of their authority to determine how to meet the TMDL. [n189] The outcome of the district court ruling reinforces the EPA's authority to coordinate efforts of nutrient allocation between point sources and nonpoint sources. [n190] As evidenced by the amici curiae brief from an alliance of Midwestern states' attorney generals within the Mississippi watershed, jurisdictions in the Gulf watershed realize they too could be required to regulate NPS pollution from agriculture as a party to broader efforts to restore the Gulf of Mexico. [n191]

Efforts to decrease the Hypoxia Zone parallel the Chesapeake Bay Preservation Efforts, but organized Bay efforts began nearly a decade before organized Gulf efforts. [n192] This is significant because the progress made by the interested parties may act as a weather vane for efforts of the various groups involved with the **water** restoration efforts in the Gulf. The similarities between Chesapeake Bay restoration efforts and the Gulf of Mexico task force are too similar to ignore. [n193] The Hypoxia Task Force (HTF) is similar to the CBP, in that they are both multi-jurisdictional and represented by authorized decision-makers in their **[*283]** respective states. [n194] Further, the HTF has required participating states to create a plan to reduce nutrient levels in the Gulf of Mexico. [n195] Both the HTF and the CBP had slow starts: both programs failed to achieve significant gains in their preliminary efforts toward **water** restoration goals. [n196] The CBP agreed to allow the EPA to set the TMDLs (and corresponding load allocations) in order to meet the **water** quality standards in the Bay, whereas the HTF has not yet requested the federal agency to establish levels on behalf of the Gulf jurisdiction. [n197]

D. Application of Legal Precedent to the Mississippi/Afalaycha River Basin

Based on the legal actions in the Chesapeake Bay Watershed region and Florida, Iowa and other states in the Mississippi watershed may expect several major shifts in regulation and enforcement of the CWA in the next decade. The states in the Mississippi watershed can expect multi-state agreements to be binding. [n198] Also, there will be continued and even increased interaction between these interest groups, states, and the federal government in determining, setting, and monitoring state **water** quality standards. [n199]

The decisions in both Florida and the Chesapeake Bay foreshadow the events transpiring in the Mississippi watershed: the increasingly authoritative role of the EPA and society's growing concerns over nitrification in costal bodies of **water.** Presently, Iowa and other Midwestern states in the Mississippi watershed, find themselves at a crossroads. Politicians and farmer advocates argue that numeric nutrient standards would be costly to establish and enforce. [n200] Farmer's opinions are influential: in the Upper Mississippi River basin, farmers **[*284]** produce "half the nation's corn, 41 percent of the nation's soybean exports, and one-third of all the nation's hogs and pigs." [n201] Environmental groups maintain that numeric standards are the best possible means for achieving **water** quality standards, despite the costs of development and implementation. [n202] There are also costs to the residents and economy of the Gulf if nutrification isn't managed well enough to minimize and eliminate the Dead Zone. [n203] The question becomes how to find middle ground where **water** quality standards are progressively met while considering and addressing farmer's economic concerns associated with **water** restoration. One concern looming over the debate of

numeric nutrient standards is if numeric standards are required, who will set them? Policy-makers, NPDES permit holders, and farmers in these Midwestern states must realize the ramifications if they jettison the responsibility to establish NNC: that the standards may be set for them. [n204]

VI. Implementation of Numeric Nutrient Criteria (NNC) at the State Level

Whether by choice or by mandate, Iowa's future **water** restoration efforts may include NNC. [n205] While the policy debate is still centered on whether NNC **[*285]** should be instated or not, perhaps the more apropos conversation should be how Iowa, or other Gulf basin states, could implement NNC. Both policy and science are implicated by NNC. The science behind establishing NNC is complicated [n206] and will require an investment [n207] by stakeholders and citizens alike. The policy concerns would include funding for farmers and other point or nonpoint source polluters, implementation, and compliance. What effects would such measures have on farm work in the field? How would compliance and fidelity be monitored?

If NNC were adopted, one aspect of implementation may require farmers to develop and follow best-practice management plans that incorporate the scientifically backed farming methods - like those laid out in the Nutrient Reduction Strategy. [n208] A few states have begun to implement various programs to address **water** quality. In Minnesota, farmers are required to use a fifty-foot vegetative buffer between their crops and nearby streams. [n209] In Wisconsin, farmers develop and follow nutrient management plans that incorporate tolerable soil losses on cropped fields, use of the phosphorus index to calculate nutrient application, and restrictions on timing and location of nutrient applications. [n210] In Florida's Everglades Agricultural Area, farmers must first obtain permits that indicate compliance with conservation practices before growing row crops. [n211] Florida's approach is noteworthy for two reasons: farmers can tailor their permit by choosing from a variety of conservation practices, and progress is monitored by the **Water** Management Districts. [n212] Florida's rigorous monitoring system provides timely feedback as to the policy's effectiveness, and this has allowed farmers the gratification of knowing their efforts have worked. [n213]

[*286] Where science establishes the quantified NNC in a **water** quality standard for a given body of **water,** farmers within any given watershed in the Gulf basin could then implement from a suite of BMP to assist in meeting these goals. [n214] Farms could develop plans, similar to those in Wisconsin, so that each individual farm has a goal tied to a BMP. [n215] These plans could be developed with the assistance of county extension offices and the vast network of Conservation Districts across the state. [n216]

The Soil and **Water** Conservation Districts could offer a way to regulate and enforce nutrient management plans throughout the state. Soil and **Water** Conservation Districts (SWCD) are creatures of statute. [n217] There are 100 districts across the state of Iowa, organized conterminously with the counties across the state. [n218] Iowa has a consortium of 500 elected commissioners through the Conservation Districts of Iowa (CDI). [n219] The CDI's mission is to "inform, educate, and lead Iowans through our local soil and **water** conservation districts to promote conservation of natural resources." [n220] The CDI engages in on-the-ground conservation and conservation practice promoting, including working on increasing the amount of crop cover on Iowa farmland. [n221]

The CDI already has a system in place that could support the type of efforts necessary in supporting implementation and enforcement of NPS management. In order to design the most successful and comprehensive conservation management plans for **water** restoration, implementation plans must, among others:

1) Delineate Iowa's varied agroecoregions;

2) Identify the critical source areas and associated characteristics that pose high risks for nitrogen and phosphorus loss ... [Note: 3, 4, and 5 omitted.]

6) List suites of conservation practices designed to meet **water** quality standards and maintain the integrity of field-edge remedial practices during peak events;

7) Apply policies, education and programs that address social and economic **[*287]** concerns for the adoption and implementation of conservation practices; ...

9) Monitor **water** quality to document the performance of the implemented conservation practices, determine if **water** quality goals are being met and guide further actions if necessary. [n222]

This list of considerations is a part of the general mission of the CDI. The organization is divided into regions, and promoting a series of practices that work for soil and **water** conservation within each district overcomes the critics of NNS that argue that to set such standards would be implementation of a "one-size-fits-all" policy. [n223]

The primary mission of the CDI is to promote and increase knowledge surrounding best management practices in agriculture. [n224] SWCD generally have accomplished this goal through the "project powers" granted to the districts through the Standard State Soil Conservation Districts Law. [n225] At the inception of the conservation districts during the New Deal, however, it was conceived that the districts would also have enforcement authority. [n226] Some states adopted such regulatory authority, but very few districts have acted under the authorization. [n227] In fact, recommendations that the SWCDs utilize their enforcement authority in order to promote the goals of the CWA have gone unheeded for decades. [n228]

The power to enforce is crucial to ensure compliance. For example, in the late 1990's, fish kills in the Delmarva Peninsula were associated with a toxin from chicken manure, and as a result, Maryland, Delaware, and Virginia enacted mandatory nutrient management plans. [n229] The three states implemented different **[*288]** policies: Maryland required farmers to have a state-certified nutrient management plan within three years; Virginia enacted a "go slow" approach that only regulated a small sector of farmers and required little change in their activities; and Delaware took a comprehensive regulatory approach that was overseen by a commission comprised mainly of farmers. [n230] Social science researches found at first Delaware farmers complied at a substantial percentage while Maryland farmers were "digging in their heels." [n231] However, over the span of the next five years, Maryland's stricter approach achieved higher levels of compliance. [n232] Maryland sent warning letters and levied small fines to farmers who had not developed the nutrient management plan, and was able to obtain near-full compliance. [n233] Researchers ultimately recommend that in order to achieve the goals outlined for the Delmarva Peninsula, the participating states should "consider more frequent and effective farm inspections and significant fines to make noncompliance more costly than compliance." [n234]

Compliance with an individual's nutrient management plans could be overseen by the CDIs: in preparation, planning, and enforcement. This model has worked before: in the late 1980's, concentrated dairy farms in Texas severely threatened the **water** quality in particular watersheds. [n235] The Texas legislature implemented a "planned intervention" utilizing the Texas Soil and **Water** Conservation Commissions (TSWCC), the Texas Natural Resource Conservation Commission, and legislation which required the conservation districts to establish a "**water** quality management plan certification program" and to investigate any complaints related to agricultural nonpoint pollution. [n236] If there were a valid concern, then the TSWCC would reactively assist in developing a corrective action plan, and where there was no corrective action taken, the TSWCC would refer the offender to the Resource Conservation Commission, an organization that could, and did, levy fines when necessary. [n237]

Examples in other states demonstrate that the enforcement authority of **[*289]** conservation districts can be determinative. In Iowa, the CDIs have played a vital role in the past. There is a duty imported to land owners of real property where they are expected to "conserve the fertility, general usefulness, and value of the soil and soil resources of the state." [n238] Iowa's legislature has granted the CDIs the power to "conduct

surveys, investigations, and research relating to the character of soil erosion and erosion, floodwater, and sediment damages, and the preventive and control measures needed." [n239] The CDI has the authority to investigate practices used at an individual farm, and to be a party to litigation. [n240] This authority - the ability to enforce aspects of land use regulations - has the CDI poised to be an integral leader in **water** quality restoration.

The supportive organization structures are in place. Science studies are in and have reported the suite of effective nutrient reduction strategies. The SWCDs have access to farmers. Any policy step taken to fortify goals within these structures would be a step in good faith.

VII. Conclusion

Restoring the nation's biological, physical, and chemical integrity is a tall order requiring coordinated efforts among policy-makers, and a willingness to financially support best management practices. A question has been posed to the people of Iowa: "Do we have the courage and determination to work together as a functional society to confront and correct the causes of NPS pollution within our state?" [n241] Who will ultimately determine the **water** quality standards for our state? Will Iowa's leadership take the initiative to establish numeric nutrient standards, or will environmental groups seek to do so through judicial intervention? Will Iowa utilize the vast network of farmer-support unifying the State, or will this network enable individuals to side-step accountability? The information is clear: our inability to keep nutrients on the farm is significantly damaging coastal **waters,** interior streams, and lakes. Iowa's NRS offers practices, which will reduce nutrient loads if implemented with wide distribution and with fidelity. [n242] The research exists to support agricultural communities in adoptions of the best management practices offered by the NRS. [n243] However, the missing policy **[*290]** piece must also be put into place to achieve clean **waters.** Setting goals through NNC and farm-management plans would be a good-faith first step.

Legal Topics:

For related research and practice materials, see the following legal topics:
Environmental LawWater QualityClean Water ActNonpoint Source PollutionEnvironmental LawWater QualityClean Water ActWater Quality StandardsReal Property LawWater RightsNonconsumptive UsesGeneral Overview

FOOTNOTES:

n1. See Watershed Assessment, Tracking & Environmental Results: National Summary of Impaired **Waters** and TMDL Information, EPA, http://iaspub.epa.gov/waters10/attains_nation_ cy.control?p_report_type=T#status_of_data (last updated Sept. 22, 2015) [hereinafter Watershed Assessment].

n2. 33 U.S.C. § 1251(a) (2012); see, e.g., Michelle Perez & Sara Walker, Improving **Water** Quality: A Review of the Mississippi River Basin Healthy Watersheds Initiative (MRBI) to Target U.S. Farm Conservation Funds, 8-9 (World Res. Inst., Working Paper, 2014), available at http://www.wri.org/publication/MRBI (noting efforts and groups involved with the **water** quality of the Gulf of Mexico and its tributaries). See generally Partner Organizations, Chesapeake Bay Program, http://www.chesapeakebay.net/about/partners (last visited Jan. 19, 2015) [hereinafter Chesapeake Bay Program] (displaying efforts and groups involved with the Chesapeake Bay and its tributaries).

n3. See EPA et al., Clean **Water:** Foundation of healthy Communities and a Healthy Environment 3-4 (2011), available at http://www.whitehouse.gov/sites/default/files/microsites/ceq /clean_**water_**framework.pdf [hereinafter Clean **Water**].

n4. See 33 U.S.C. §§1311(a) & (b), 1314(f)(2)(A) (noting agricultural practices such as tiling and use of synthetic fertilizers are regulated as non-point sources while animal feeding operations are considered by most states to be point-source pollution); 40 C.F.R. § 122.23 (2015) (stating concentrated animal feeding operations (CAFOs) are point sources subject to state National Pollutant Discharge Elimination System (NPDES) programs).

n5. 33 U.S.C. § 1314(f)(2)(A).

n6. Id. § 1329(b).

n7. See Iowa Dep't. of Agric. and Land Stewardship et al., Iowa Nutrient Reduction Strategy: A Science and Technology-based Framework to Assess and Reduce Nutrients to Iowa **waters** and the Gulf of Mexico § 1, p. 9-10 (2013) [hereinafter Iowa Dep't of Agric.], available at

http://www.nutrientstrategy.iastate.edu/sites/default/files/ documents/NRSfull-130529.pdf (addressing the challenges of adopting the best management practices to address nonpoint source pollution from agriculture).

n8. See, e.g., Iowa Res. Coordinating Counsel, Iowa Nutrient Reduction Strategy app. at 2 (2014), available at http://www.nutrientstrategy.iastate.edu/sites/default/files/ documents/14-appendix.pdf ("The IFBF has at least 10 major policy statements in support of the Nutrient Reduction Strategy and voluntary soil and **water** conservation implementation.").

n9. See, e.g., New State Strategy on Iowa's Most Widespread **Water** Pollution Problem Cries Out for More Accountability, Greater Citizen Input, and Stronger Solutions, Iowa Envtl. Council Blog (Dec. 6, 2012), https://iaenvironment.wordpress.com/2012/12/06/new-state-strategy-on-iowas-most-widespread-**water**-pollution-problem-cries-out-for-more-accountability-greater-citizen-input-and-stronger-solutions/ (noting the Iowa Environmental Council points out that the NRS "fails to list either short-term or long-term goals for **water** quality improvements").

n10. See id. ("To motivate Iowans to invest in substantial and sustainable improvements in **water** quality, Iowa needs [numeric] goals, which are based on benefits to Iowa **waters.** The nutrient strategy evades this responsibility, promising only to "[evaluate] the need for nutrient **water** quality standards' in the future.").

n11. See, e.g., Perry Beeman, Top Ag Official: Voluntarily Cut Runoff Before Feds Take Action, **Des Moines** Reg., Dec. 5, 2012 [hereinafter Beeman, Top Ag Official] (There is concern that if farmers do not address the issue, they ""should expect regulation'" to be imposed).

n12. History of the Mississippi-Atchafalaya River Basin (MARB), Miss. River Gulf of Mexico Watershed Nutrient Task Force, **water.**epa.gov/type/watersheds/named/msbasin/marb.cfm (last visited Jan. 19, 2015).

n13. Nat'l Oceanic and Atmospheric Admin., U.S. Dep't of Commerce, NOAA Knows ... Dead Zones, Hypoxia in the Gulf of Mexico 1 (2009), available at www.noaa.gov/factsheets/new%20version/dead_zones.pdf [hereinafter NOAA Knows].

n14. See Nat'l Oceanic and Atmospheric Admin., The Gulf of Mexico at a Glance: A Second Glance (2011), available at http://stateofthecoast.noaa.gov/features/gulf-of-mexico-at-a-glance-2.pdf.

n15. See Bryan Walsh, This Year's Gulf of Mexico Dead Zone Could be the Biggest on Record, Time, June 19, 2013, http://science.time.com/2013/06/19/this-years-gulf-of-mexico-dead-zone-could-be-the-biggest-on-record/ (estimating the total nutrient load runoff into the Gulf of Mexico to be 153,000 metric tons).

n16. See U.S. EPA, 2000 National **Water** Quality Inventory Report 15 (2002).

n17. See id. at 14-15.

n18. See Miss. River Gulf of Mexico Watershed Nutrient Task Force, Reassessment 2013: Assessing Progress Made Since 2008 vi (2013) [hereinafter Reassessment 2013] (discusses agriculture's role in hypoxic zone in the Gulf of Mexico); Agriculture, Chesapeake Bay Program, http://www.chesapeakebay.net/issues/issue/agriculture (last visited Jan. 19, 2015) (noting that twenty-five percent of the Chesapeake's watershed is devoted to agriculture production and is the single largest source of nutrient and sediment pollution in the bay).

n19. Reassessment 2013, supra note 18, at iv, vii.

n20. Tom Isenhart & Matt Helmers, Iowa Nutrient Reduction Science Assessment, available at http://**water.**epa.gov/type/watersheds/named/msbasin/upload/De anLemke-MattHelmersIowaScienceAssessment.pdf (last visited Jan. 19, 2015).

n21. See NOAA Knows, supra note 13 (describing how hypoxia occurs when excessive amounts of nitrogen and phosphorus are discharged into the **water** and stimulate the growth of phytoplankton and zooplankton. When these algae die and decompose, oxygen is depleted from the **water.** When the dissolved oxygen concentration falls below 2mg/L, most marine organisms become physiologically stressed or cannot survive).

n22. Measuring the Hypoxic Zone, Miss. River Gulf of Mexico Watershed Nutrient Task Force, http://**water.**epa.gov/type/watersheds/named/msbasin/zone.cfm (last visited Jan. 19, 2015).

n23. Id.

[Note: n1 – n23 were reformatted to save space, but on reflection, that is nearly meaningless unless you are printing; in that case, use the original if you can. And, the wider spacing makes reading easier. You may wish to select all of footnotes and increase the font size. If you do not have access to the original, try Inter-Library Loan which often provides documents in pdf form.]

n24. NOAA Knows, supra note 13.

n25. Perry Beeman, Register Special Report: Runoff from Iowa Farms Growing Concern in Gulf, **Des Moines** Reg., Oct. 28, 2012, http://archive.desmoinesregister.com/article/20121028/NEWS/3 10280045/Runoff-from-Iowa-farms-growing-concern-Gulf.

n26. Id.

n27. See The Draft 2014 Iowa List of Clean **Water** Act Section 303(d) Impaired **Waters,** Iowa Dep't of Nat. Res. (Apr. 2015), http://www.iowadnr.gov/Environment/WaterQuality/WaterMonitor ing/ImpairedWaters.aspx.

n28. See id.

n29. Donelle Eller, Nitrate Levels Reach Record Highs in 2 D.M. Rivers, **Des Moines** Reg., Nov. 5, 2014, http://www.desmoinesregister.com/story/money/agriculture/201 4/12/04/high-nitrates-**des-moines**-19906717/.

n30. See Complaint at 17-18, Bd. of **Water** Works Tr. of the City of **Des Moines,** Iowa vs. Sac Cnty. Bd. of Supervisors, 5:15-cv-04020 (N.D. Iowa Mar. 16, 2015) (**Des Moines Water** Works nitrate removal facility cost $ 4.1 million to build and costs $ 7,000 per day to operate. In the summer of 2013, the **Des Moines Water** Works facility had to run the nitrate removal facility for 74 days and expended over $ 500,000 to treat the drinking **water** in **Des Moines)**.

n31. See EPA, The Economic Benefits of Protecting Healthy Watersheds (2012), available at http://**water.**epa.gov/polwaste/nps/watershed/upload/economic_benefits_factsheet3.pdf (including economic benefits as avoidance of future costs, conservation development in the residential sector, recreation and tourism, and property value premiums).

n32. Comm. on the Miss. River & the Clean **Water** Act, Nat'l Research Council, Mississippi River **Water** Quality and the Clean **Water** Act: Progress, Challenges and Opportunities 61 (2008) [hereinafter Comm. on the Miss. River]. For example, hypoxic conditions affect the growth, interactions, and reproductive capacity of the brown shrimp - the largest economic fishery in the northern Gulf of Mexico. Id.

n33. See Laura Dlugolecki, Economic Benefits of Protecting Healthy Watersheds: A Literature Review 29 (2012), available at http://www.watershedcounts.org/documents/Economic_Ben efits_of_Protecting_Healthy_Wate rsheds.pdf.

n34. See NOAA Knows, supra note 13.

n35. Summary of the Clean **Water** Act, EPA, http://www2.epa.gov/laws-regulations/summary-clean-**water**-act (last updated Mar. 13, 2015) [hereinafter Summary of the Clean **Water** Act].

n36. See 33 U.S.C. §§1251-1387 (2012).

n37. See id. §§1311(3)(a)-(b).

n38. See 40 C.F.R. § 122.3 (2015).

n39. 33 U.S.C § 1313(d)(1)(A) (requiring states to identify **waters** within its boundaries for which the effluent limitations are not stringent enough to achieve applicable **water** quality standards); 40 C.F.R. § 122.3 (agricultural storm **water** exemption).

n40. NOAA Knows, supra note 13.

n41. See Laura Kerr, Comment, Compelling a Nutrient Pollution Solution: How Nutrient Pollution Litigation is Redefining Cooperative Federalism Under the Clean **Water** Act, 44 Envtl. L. 1219, 1226 (2014).

n42. See generally id.

n43. See Oliver A. Houck, Cooperative Federalism, Nutrients, and the Clean **Water** Act: Three Cases Revisited, 44 Envtl. L. Rep. News & Analysis 10426, 10432-33 (2014).

n44. See Comm. on the Miss. River, supra note 32, at 190.

n45. Iowa Dep't of Agric., supra note 7, at § 1, p. 4.

n46. See Letter from Terry Branstad, Governor, State of Iowa, to Lisa Jackson, Adm'r, EPA (July 11, 2012) [hereinafter Letter from Terry Branstad] (on file with author).

n47. See Press Release, Nat'l Ass'n of State Dep'ts of Agric., Northey Requests $ 7.5 Million for **Water** Quality (Dec. 1, 2014), http://www.nasda.org/News/statePR/31017.aspx.

n48. See Bruce A. Babcock & Catherine L. Kling, Costs and Benefits of Fixing Gulf Hypoxia, 14 Iowa Agric. Rev., no. 4, 2008, at 8, 9, http://www.card.iastate.edu/iowa_ag_review/fal l_08/IAR.pdf.

n49. Dana L. Dinnes, Assessments of Practices to Reduce Nitrogen and Phosphorus Nonpoint Source Pollution of Iowa's Surface **Waters** 2 (Iowa DNR ed., 2004), available at http://www.iowadnr.gov/portals/idnr/uploads/**water**/nutri ents/files/nps_assessments.pdf.

n50. Jaqueline Comito, Solutions Have Benefits for All, The Gazette (Mar. 29, 2014, 3:00AM), http://thegazette.com/2014/02/02/solutions-have-benefits-for-all/ [hereinafter Comito, Solutions Have Benefits for All]; see Letter from Terry Branstad, supra note 46.

n51. See Am. Farmland Trust, The Adoption of Conservation Practices in Agriculture 2-3 (2013), available at https://www.farmland.org/publications (locate title hyperlink) [hereinafter Am. Farmland Trust] (discussing the logical sequence that a producer engages in when deciding to change an on-farm practice, specifically the second step where manager considers the data collection of the positive perceptions of practice; with these efforts, the narrative is one of high costs).

n52. See id.

n53. See Iowa Dep't of Agric., supra note 7.

n54. Iowa State Univ. Extension & Outreach, Iowa Farmers' Nitrogen Management Practices and Perspectives, Iowa Farm & Rural Life Poll, (2014), available at http://www.soc.iastate.edu/extension/ifrlp/PDF/PM3066.pdf [hereinafter Iowa Farm & Rural Life Poll].

n55. Id. at 5.

n56. Id. at 7.

n57. Id. at 8.

n58. Dead Zone Action Needed: EWG Remarks to Hypoxia Task Force, Envtl. Working Grp. (Sept. 24, 2009), http://www.ewg.org/nerws/testimony-official-correspondence/dead-zone-action-needed-eqg-remarks-hypoxia-task-force.

n59. Id.

n60. Id.

n61. See Clean **Water** Act, EPA Region 6 Office, http://www.epa.gov/region6/6en/w/cwa.htm (last updated Oct. 4, 2011).

n62. See EPA, National Strategy for the Development of Regional Nutrient Criteria 9-10 (1998), available at http://www2.epa.gov/sites/production/files/documents/nutrien t_strategy_1998.pdf.

n63. See Memorandum in Support of the Petition By Iowa Envtl. Council & Envtl. Law & Policy Ctr. for the Amendment of the Rules Relation to **Water** Quality Standards 8 (July 2008), http://www.iaenvironment.org/documents/2013/Lakes/EnclosureA .pdf.

n64. See Letter from Craig Hill, President, Iowa Farm Bureau Fed'n, to Bill Northey, Sec'y of Agric, State of Iowa (Jan. 7, 2013) reprinted and available at www.bleedingheartland.com/diary/5963/two-views-of-iowas-strategy-on-key-**water**-pollution-problem [hereinafter Letter from Craig Hill].

n65. Id.

n66. 33 U.S.C. § 1313(c)(2)(A) (2012).

n67. EPA, State Adoption of Numeric Nutrient Standards (1998-2008) 4 (2008), available at http://www2.epa.gov/sites/production/files/documents/nutrien t_report1998-2008.pdf [hereinafter State Adoption].

n68. 33 U.S.C. § 1313(c)(2)(A).

n69. 40 C.F.R. § 131.3(b) (2015).

n70. Mario Sengco, Standards and Health Protection Division, Webinar entitled Guiding Principles for Developing and Implementing a Numeric Nutrient Criterion that Integrates Causal and Response Parameters ("Bioconfirmation") (Sept. 19, 2013), available at http://www2.epa.gov/sites/production/files/2013-09/documents/guiding_webinar.pdf.

n71. Iowa Admin. Code r. 567-61.3(2)(e) (2015).

n72. Forms of Expression: Numeric and Narrative Criteria, EPA, http://**water**.epa.gov/learn/training/standardsacademy/mod3/pa ge6.cfm (last updated Mar. 6, 2012).

n73. Sengco, supra note 70; 40 C.F.R. § 131.11 (a)(1) (requiring that criteria "must be based on sound scientific rationale and must contain sufficient parameters or constituents to protect the designated use." A causal parameter identifies the nutrients that are the cause; the response parameter is an assessment of the nutrients. There may be several response parameters that can be identified prior to the assessment endpoint. For example, nitrogen and phosphorus concentration can lead to algal biomass, which dissolves oxygen, and results in floral and faunal community growth).

n74. Sengco, supra note 70.

n75. State Adoption, supra note 67.

n76. 33 U.S.C. § 1313(d)(1)(A) (2012) (The report of impaired **waters** submitted by the individual states to the EPA pursuant to 33 U.S.C. § 1313(d)(1)(A) is commonly known as the "303 (d)" list.).

n77. Id. § 1313(d)(1)(C); 40 C.F.R. § 130.7(c)(1); see Pronsolino v. Nastri, 291 F.3d 1123, 1141 (9th Cir. 2002) (holding that states must establish TMDLs for **waters** affected by nonpoint source pollution).

n78. 40 C.F.R. § 130.2 (the maximum amount of pollutants from point sources are referred to as waste load allocations and the maximum amount of pollutants are referred to as load allocations in a TMDL).

n79. See Office of Enforcement and Compliance Assurance, EPA, Clean **Water** Act Action Plan (2009), available at http://www2.epa.gov/sites/production/files/documents/actionp lan101409.pdf.

n80. See id.

n81. 40 C.F.R. § 130.2; See Complaint at 2, Gulf Restoration Network v. Jackson, No. 12-677 (D. La. Mar. 13, 2012).

n82. See Lara B. Fowler, et al., Addressing Death by a Thousand Cuts: Legal and Policy Innovations to Address Nonpoint Source Runoff, Choices, 3rd Quarter 2013 28(3), at 2, available at http://www.choicemagazine.org/magazine/pdf.cmsarticle_330.pdf.

n83. Id.

n84. Id.

n85. Id.

n86. Id.

n87. O. Kay Henderson, Governor's Appointee to EPC gets Quizzed on **Water** Quality, Radio Iowa (Mar. 20, 2015), http://www.radioiowa.com/?s=ralph+lents.

n88. Perez & Walker, supra note 2, at 11.

n89. J.G. Arbuckle Jr., Farmer Support for Extending Conservation Compliance Beyond Soil Erosion: Evidence from Iowa, 68 J. Soil & **Water** Conservation, 99, 99 (2013).

n90. See, e.g., Letter from Craig Hill, supra note 64. Craig Hill states that "the numeric **water** quality standards approach that results in labeling people, farmers, and businesses as "polluters' has real financial consequences ... These regulatory approaches have not been effective at reducing nutrient impairments, but have merely redefined the definition of pollution and labeled partners as "polluters."' Id.

n91. See Perez & Walker, supra note 2, at 8.

n92. Memorandum from Nancy Stoner, EPA Acting Assistant Adm'r, on Recommended Elements of a State Framework for Managing Nitrogen and Phosphorus Pollution (Mar. 16, 2011), http://**water.**epa.gov/scitech/swguidance/standards/criteria/nutrients/upload/memo_nitrogen_framework.pdf [hereinafter Memorandum from Nancy Stoner]. These recommendations included: (1) prioritizing watersheds; (2) set watershed load reduction goals; (3) ensure effectiveness of NPDES permits in targeted watersheds; (4) target agricultural areas; (5) address storm **water** and septic systems; (6) establish accountability and verification measures; (7) biannual and annual public reporting and; (8) develop schedule for NNC development. Id.

n93. Id.

n94. State Development of Numeric Criteria for Nitrogen and Phosphorus Pollution, EPA, http://cfpub.epa.gov/wqsits/nnc-development/ (last visited Jan. 19 2015) [hereinafter State Development of Numeric Criteria].

n95. See Press Release, U.S. Geological Survey, Agricultural Practices in 9 States Contribute Majority of Excessive Nutrients to the Northern Gulf of Mexico, (Jan. 29, 2008), http://www.usgs.gov/newsroom/article.asp?ID=1861#.VLBDh4vF_Ys.

n96. State Development of Numeric Criteria, supra note 94.

n97. See Complaint, supra, note 30.

n98. Letter from Karl Brooks, Reg'l Adm'r, EPA Region Seven, to Chuck Gipp, Director, Iowa Dept. of Natural Res., & Bill Northey, Sec'y, Iowa Dept. of Agric. & Land Stewardship (Jan. 9, 2013), http://www.epa.gov/region7/**water/**pdf/comment_letter_iowa_nutrient_reduction_strategy. pdf.

n99. See Iowa Dep't of Agric., supra note 7 at § 1, p. 6-18.

n100. Id. at § 1, p. 1.

n101. Id. at § 1, p. 8-9. For example, the report concludes that due to a lack of confidence in the EPA's conclusions and the costs of associated with nonpoint nutrient reduction technologies, NNC are not of enough value. Id.

n102. Id. at § 1, p. 11.

n103. Id. (emphasis in original).

n104. Id.

n105. Id. at §§2-3. These "best management practices" included in the report address nitrogen management, edge-of-field practices, and changes in land use.

n106. Id. at Executive Summary, p.1.

n107. Id.

n108. Id.

n109. Letter from Karl Brooks, supra note 98.

n110. Id.

n111. 33 U.S.C. § 1313(a) (2012).

n112. Dinnes, supra note 49, at 353. The voluntary model supported by monetary subsidies is contrasted with a performance-based model that requires the government or some other authoritative entity to require that the **water** quality standards are met, but allow the farmer/landowner the flexibility to choose and implement among a menu of conservation practices. Id.

n113. Iowa Dep't of Agric., supra note 7, at § 1, p. 14.

n114. Dinnes, supra note 49, at 353.

n115. Iowa Dep't of Agric., supra note 7, at § 1, p. 20.

n116. See Catherine Kling, State Level Efforts to Regulate Agricultural Sources of **Water** Quality Impairment, Choices, 3d Quarter 2013, at 1, available at http://www.choicesmagazine.org/magazine/pdf/cmsarticle_326.pdf

n117. See Jacqueline Comito, Op-Ed., "Voluntary" Shouldn't Mean Optional, (Aug. 18, 2013), available at http://www.extension.iastate.edu/ilf/sites/www.extensio n.iastate.edu/files/ilf/Op-ed_1_voluntary_shouldn't_mea n_optional.pdf (last visited Jan. 19, 2015) [hereinafter Comito, "Voluntary" Shouldn't Mean Optional] (maintaining that the NRS will not be successful unless it is approached as voluntary insofar as the flexibility with strategy and not whether to participate in the strategy).

n118. See Letter from Karl Brooks, supra note 98.

n119. Matthew Wilde, Wolf Outlines ISA's Commitment to **Water** Quality, Iowa Soybean Ass'n, http://www.iasoybeans.com/Waterquality/pdf/WolfoutlinesISA%2 7scommitment.pdf (last visited Jan. 19, 2015).

n120. Petition to EPA for Rulemaking under the Clean **Water** Act, Numeric **Water** Quality Standards for Nitrogen and Phosphorus and TMDLs for the Mississippi River and the Gulf of Mexico (2008) at 4-5, available at http://switchboard.nrdc.org/blogs/aalexander/Ex.%201,%20%20P etition%20(AR%207-81).pdf [hereinafter Petition to EPA]; see EPA Lawsuit, Miss. River Collaborative, http://www.msrivercollab.org/focus-areas/epa-lawsuit/ (last visited Jan.19, 2015).

n121. Letter from Michael H. Shapiro, Deputy Assistant Adm'r, EPA, to Kevin Reuther, Legal Dir., Minn. Ctr. for Envtl. Advocacy, and Albert Ettinger (July 29, 2011), http://**water.**epa.gov/scitech/swguidance/standards/upload/Res ponse-to-Mississippi-River-Petition-07-29-11.pdf [hereinafter Letter from Michael H. Shapiro].

n122. Gulf Restoration Network v. Jackson, Civ. Act. No. 12-677, 2013 WL 5328547, (E.D. La., Sept. 20, 2013), vacated, 783 F.2d 227 (5th Cir. 2015).

n123. Gulf Restoration Network v. McCarthy, 783 F.3d 227, 231(5th Cir. 2015).

n124. Id. at 242-43.

n125. Id. at 243.

n126. Id. at 243-44.

n127. See EPA Office of Inspector Gen., Evaluation Report: EPA Needs to Accelerate Adoption of Numeric Nutrient **Water** Quality Standards (2009), available at http://www.epa.gov/oig/reports/2009/20090826-09-P-0223.pdf.

n128. Id. at 3.

n129. Memorandum from Nancy Stoner, supra note 92.

n130. Miss. River Gulf of Mexico Watershed Nutrient Task Force, Looking Forward: The Strategy of the Federal Members of the Hypoxia Task Force 10 (2013), available at http://**water**.epa.gov/type/watersheds/named/msbasin/upload/hy poxia_annual_federal_strategy_50 8.pdf [hereinafter Looking Forward].

n131. Letter from Michael H. Shapiro, supra note 121.

n132. Complaint for Declaratory and Injunctive Relief at 2-3, Gulf Restoration Network v. Jackson, Case 2:12-cv-00677, (E.D. La. Mar. 13, 2012), 2012 WL 950694.

n133. Amena H. Saiyid, Mixed Results on Need for **Water** Standard to Curb Mississippi Runoff, Gulf Dead Zones, 83 U.S.L.Wk 1501, No.39, Apr. 14, 2015.

n134. Id.

n135. 33 U.S.C. § 1313(c)(4)(B) (2012).

n136. See Saiyid, supra note 133.

n137. Fla. Wildlife Fed'n v. Jackson, No. 4:08cv324-RH-WCS, 2009 LEXIS 123651, at 1 (N.D. Fla. Dec 30, 2009). The plaintiffs were the Florida Wildlife Federation, Inc., Sierra Club, Inc., Conservancy of Southwest Florida, Inc., Environmental Confederation of Southwest Florida, Inc., and St. Johns Riverkeepr, Inc. Id.

n138. Id. at 6-7.

n139. Id. at 5-6.

n140. 33 U.S.C § 1313(c)(4) (requiring the Administrator to prepare and publish revised proposed regulations or new **water** quality standards for navigable **waters** where the State's standards are inconsistent with the applicable requirements of the CWA); 33 U.S.C. § 1365(a)(2) (authorization of a citizen suit against the Administrator where there is alleged a failure of the Administrator to perform any non discretionary duty).

n141. See Press Release, EPA, Clean **Water** Action Plan (Feb. 19, 1998), http://www2.epa.gov/aboutepa/president-clinton-announces-clean-**water**-action-plan.

n142. Fla. Wildlife Fed'n, 2009 LEXIS 123651, at 3.

n143. Id. at 7. The determination was made in a letter dated January 14, 2009, signed by the Administrator's designee. Id.

n144. See id. at 8.

n145. See id.

n146. Id. at 9.

n147. See Florida NNC Background: EPA and FDEP Agreement to Protect Statewide **Waters** from Nutrient Pollution, EPA, http://www2.epa.gov/aboutepa/florida-nnc-background (last updated Feb. 23, 2015) (stating the FDEP has adopted and EPA has approved NNC for over 185,000 lakes, all springs, and several major estuaries and coastal **waters)**.

n148. See Order Modifying Consent Decree at 11, Fla. Wildlife Fed'n v. McCarthy, 4:08cv324-RH/CAS (N.D. Fla. Jan. 7, 2014), 2014 WL 51360, at 4 [hereinafter Order Modifying Consent Decree].

n149. See id.

n150. Letter from Benjamin H. Grumbles, Assistant Adm'r, EPA, to Michael Sole, Sec'y, Fla. Dep't of Envtl. Prot. (Jan. 14, 2009), http://**water.**epa.gov/lawsregs/lawsguidance/cwa/upload/2009_01_16_standards_rules_fl-determination20090114.pdf [hereinafter Letter from Benjamin H. Grumbles].

n151. 33 U.S.C. § 1313(c)(4)(B) (2012).

n152. Letter from Benjamin H. Grumbles, supra note 150.

n153. See Order Modifying Consent Decree, supra note 148.

n154. See Ark. v. Okla., 503 U.S. 91 (1992) (Court heard arguments regarding transboundary pollution issues.).

n155. Id. at 95.

n156. Id.

n157. Id. at 95, n.2. Oklahoma designated this portion of the Illinois River as "scenic," which implicates the state's "anti-degradation" standard. Id.

n158. Id. at 95.

n159. Id. at 96.

n160. Id. at 97.

n161. Id. at 105-06. Certiorari was granted by the Supreme Court to address the Court of Appeals holding that the CWA itself required compliance by Arkansas of Oklahoma's **water** quality standards. Id. The Supreme Court found it unnecessary to decide whether the CWA did require that discharge from one state comply with **water** quality standards of another, but held that the statute does not limit the EPA's authority. Id.

n162. See 33 U.S.C. § 1342(f) (2012).

n163. 40 C.F.R. § 122.44(d) (2015).

n164. See id. § 123.25.

n165. Id. § 122.44(d).

n166. See Letter from Terry Branstad, supra note 46.

n167. See Kling, supra note 116, at 3.

n168. Id. at 1-2.

n169. Am. Farm Bureau Fed'n v. EPA, 984 F.Supp.2d 289, 299 (M.D. Pa. 2013).

n170. Fowler, supra note 82.

n171. See Am. Farm Bureau Fed'n, 984 F. Supp. 2d at 299-303.

n172. Id. at 294. American Farm Bureau Federation and the Pennsylvania Farm Bureau brought the original complaint. Id. They were joined later by a large delegation of agricultural heavy-hitters, including: the National Pork Producers Council, the National Corn Growers Association, the National Chicken Council, the U.S. Poultry and Egg Association, and the National Turkey Federation. Id.

n173. Id. at 294-95.

n174. Id. at 314, 322, 330, 344.

n175. Id. at 299-303. Congress established the CBP when it amended Section 117 of the CWA; the CBP was directed to, among other things, coordinate state and federal efforts to improve **water** quality. 33 U.S.C. § 1267 (2012).

n176. Frequently Asked Questions about the Bay TMDL, EPA, http://www.epa.gov/reg3wapd/tmdl/ChesapeakeBay/FrequentlyAskedQuestions.html (last visited Jan. 19, 2015). The states involved include Delaware, the District of Columbia, Maryland, New York, Pennsylvania, Virginia, and West Virginia. Id.

n177. Am. Farm Bureau Fed'n, 984 F. Supp. 2d at 299.

n178. Chesapeake Bay Program, Chesapeake 2000 6 (2000), available at http://www.chesapeakebay.net/documents/cbp_12081 .pdf.

n179. Am. Farm Bureau Fed'n, 984 F. Supp. 2d at 301.

n180. Id. The court opinion discussed Pennsylvania's Chesapeake Bay Tributary Strategy as an example of the planned efforts. Id. To specifically address NPS pollution from agriculturally related activities, Pennsylvania's plan was to enact extensive new farm management regulations through the ACRE initiative (preserving Agriculture, Communities, and Rural Environments), expanded the Conservation Reserve Enhancement Program (CREP), increased forested buffers and wetlands, and secured conservation easements for riparian buffers. Id. The total estimated cost for the plan was $ 703,318,063. Id.

n181. Id. at 302.

n182. Id.

n183. Id.

n184. Letter from William C. Early, Acting Reg'l Admin., EPA, to the Honorable L. Preston Bryant, Jr., Va. Sec'y of Natural Res., at 2 (Nov. 4, 2009), http://www.epa.gov/reg3wapd/pdf/pdf_chesbay/tmdl_implementation_letter_110409.pdf.

n185. Id. at 4.

n186. Id.

n187. Id.

n188. Brief for the States of Kansas, Indiana, et al. as Amici Curiae in Support of Reversal at 2, Am. Farm Bureau Fed'n v. EPA, No. 13-4079, (M.D.Pa Feb. 3. 2014), 2014 WL 505475, at 2 [hereinafter Brief for the States].

n189. Id. at 7.

n190. See Am. Farm Bureau Fed'n, 984 F. Supp. 2d at 289.

n191. See Brief for the States, supra note 188.

n192. Am. Farm Bureau Fed'n, 984 F. Supp. 2d at 299-303. Chesapeake Bay Program preservation efforts began in 1982 after a five-year study found excess nutrient phosphorus and nitrogen in the Bay. See Task Force History and Reassessment, Miss. River Gulf of Mex. Watershed Nutrient Task Force, http://**water.**epa.gov/type/watersheds/named/msbasin/history.c fm. In 1987, the regional partners entered into a multi-jurisdictional agreement to reduce nutrients in the Bay. Id. This agreement was amended again in 1992, 1997, 2000, and 2007. Id. The EPA was involved throughout the process. Id. Compare with efforts made by the Mississippi River Gulf of Mexico Nutrient Task

Force, which commenced in 1997 with the emission of understanding and reducing the Hypoxia Zone. Id. The Hypoxia Task Force is multi-jurisdictional, where the states in the watershed have agreed to action plans in 2001, amendment in 2008, and assessed in 2013. Id.

n193. See, e.g., Brief for the States, supra note 188, at 19-20. Amicus brief from an alliance of state attorney generals voicing their concerns that the District Court's approval of the "Chesapeake Bay TMDL also opens the door for EPA to dictate land-use management decisions across the country," with the fear being that the EPA could "control - and potentially debilitate - [agricultural], all under the auspices of setting "the total maximum daily load' for pollutants entering the Mississippi River." Id.

n194. See Chesapeake Bay Program, supra note 2; Hypoxia Task Force Members, EPA, http://**water.**epa.gov/type/watersheds/named/msbasin/members.c fm (last updated Sept. 25, 2015).

n195. Hypoxia Task Force, Moving Forward on Gulf Hypoxia Annual Report 2011 3 (2011), available at http://**water.**epa.gov/type/watersheds/named/msbasin/uplo ad/Hypoxia_Task_Force_Annual_Rep ort_2011.pdf.

n196. See Am. Farm Bureau Fed'n, 984 F. Supp. 2d at 300; Hypoxia Task Force, supra note 195, at 6.

n197. Hypoxia Task Force, supra note 195, at 10.

n198. See Am. Farm Bureau Fed'n, 984 F.Supp.2d at 301 (Judge Rambo went into great detail regarding the multi-jurisdictional approach and agreements made along the way to support the conclusion that the EPA worked cooperatively with the states to develop the TMDLs for the Bay States).

n199. See, e.g., Hypoxia Task Force, supra note 195.

n200. See Brief for the States, supra note 188, at 27 (amicus brief filed by allegiance of state attorneys general arguing that to impose TMDLs in tributaries costs tens of billions of dollars); see also Iowa Dep't of Agric., supra note 8, at 7-9 (noting the complexities associated with establishing and enforcing nutrient criteria where NPS cause the most pollution).

n201. Terry J. Satterlee et al., Nutrients in the Heartland: Regulatory & Legal Issues Surrounding the Mighty Mississippi, 27 Nat. Resources & Env't, no. 4, 2013, at 1, available at http://www.americanbar.org/publications/natural_ resources_environment/2012_13/spring_20 13/nutrients_in_the_heartland_re gulatory_and_legal_issues_surrou nding_the_mighty_mississippi.html.

n202. See Gulf Restoration Network v. Jackson, Civ. Act. No. 12-677, 2013 WL 5328547, (E.D. La., Sept. 20, 2013), vacated, 783 F.2d 227 (5th Cir. 2015), at 2.

n203. Nat'l Oceanic & Atmospheric Admin., Gulf of Mexico Regional Summary 115-17 (2012), available at http://www.st.nmfs.noaa.gov/Assets/economics/documents/ feus/2011/FEUS2011%20-%20Gulf%20of%20Mexico.pdf [hereinafter Gulf of Mexico Regional Summary]. Consider that in 2011, commercial fishermen in the Gulf of Mexico Region landed 1.8 billion pounds of finfish and shellfish, earning $ 818 million in landings revenue. Id. An average of twenty-three million recreational fishing trips are taken annually to the Gulf of Mexico, which creates jobs and accounts for durable equipment expenditures, totaling recreational spending around 9.8 billion in 2011. Id. This economy depends on the health of the **waters** of the Gulf of Mexico, and while the costs may be higher to the farmer in Iowa to assist in reduction of nutrification, the costs of doing nothing will be felt much more in the Gulf. Id.; See also Robert J. Diaz & Andrew Solow, Nat'l Ctr. for Coastal Ocean Science, Ecological and Economic Consequences of Hypoxia 3-4 (1999).

n204. See Comito, "Voluntary" Shouldn't Mean Optional, supra note 117 ("If the NRS fails to achieve its stated nutrient load reduction goals, it is likely that regulations will replace the voluntary methods currently available.").

n205. 33 U.S.C. § 1313(e) (2012); see also Am. Farm Bureau Fed'n v. EPA, 984 F.Supp.2d 289, 299 (M.D. Pa. 2013)(stating that the EPA does not have authority to dictate what measures a state must take to mitigate pollution from any particular nonpoint source).

n206. See Sengco, supra note 70 (noting that in order to establish a NNC, there must be sufficient data to establish both a causal parameter (like nitrogen and phosphorus) and a response parameter (endpoint assessment) and because bodies of **water** can respond differently, there is a large amount of data to be gathered and analyzed).

n207. Letter from Terry Branstad, supra note 46 (Iowa's governor, Terry Branstad, has estimated the cost of implementing regulations in Iowa "range from $ 900 million to 2.4 billion annualized ... with required initial investments of $ 1 to $ 4.7 billion" to Iowa's corn and soybean farmers.).

n208. See Iowa Dep't of Agric., supra note 7, at §§2, 3.

n209. Minn R. 6120.3300(7)(B) (2015).

n210. Wis. Admin. Code N.R. § § 151.01-.09 (2013).

n211. See Fla. Stat. § 373.4592 (2014).

n212. See id.; see, e.g., S. Fla. **Water** Mgmt. Dist., Restoration Strategies Science Plan (2013), available at http://www.sfwmd.gov/portal/page/portal/xrepository/sfwmd_repository_pdf/rs_waterquality_pla n_042712_final.pdf.

n213. See Kling, supra note 116, at 3.

n214. Id.

n215. See Wis. Admin. Code N.R. § § 151.01-.09 (2013).

n216. See Larry C. Frarey et al., Conservation Districts as the Foundation for Watershed-Based Programs to Prevent and Abate Polluted Agricultural Runoff, 18 Hamline L.R. 151, 152, 173-74 (1994).

n217. See Soil Conservation and Domestic Allotment Act of 1936, Pub. L. No. 74-461, 49 Stat. 1148, 1148 (1936); Iowa Code § 161A.5 (2015).

n218. See About CDI, Conservation Dist. of Iowa, http://cdiowa.org/conservation-districts-of-iowa/aboutcdi (last visited Jan. 19, 2015) [hereinafter About CDI].

n219. Id.

n220. Id.

n221. See Programs, Conservation Dist. of Iowa, http://cdiowa.org/conservation-districts-of-iowa/programs (last visited Jan. 19, 2015).

n222. Dinnes, supra note 49, at 5.

n223. See About CDI, supra note 218; see. e.g., Brittany Borghi, Farmers Can Better Prevent Nutrient Runoff Based on Land Characteristics, Iowa Now (Feb. 17, 2015, 11:44 AM), http://now.uiowa.edu/2015/02/farmers-can-better-prevent-nutrient-runoff-based-land-characteristics (expressing concerns by some of a "one-size-fits-all" approach to regulations). See generally Iowa Nutrient Reduction Strategy, Iowa State Univ., Public Comments - Nov. 2012-Jan. 2013, available at http://www.nutrientstrategy.iastate.edu/sites/default/files/documents/all.pdf.

n224. See Iowa Dep't of Agric. & Land Stewardship, Become a Soil & **Water** Conservation District Commissioner (2012), available at http://www.iowaagriculture.gov/soil/SWCDCommissionerBrochure 3.pdf.

n225. See Jess Phelps, Note, A Vision of the New Deal Unfulfilled? Soil and **Water** Conservation Districts and Land Use Regulation, 11 Drake J. Agric L. 353, 361 (2006).

n226. See id. at 363.

n227. Mary M. Garner, Regulatory Programs for Nonpoint Pollution Control: The Role of Conservation Districts, J. Soil & **Water** Conservation 199, 202 (Sept.-Oct. 1977).

n228. Id.

n229. See Michelle Perez, Regulating Farmers: Lessons Learned from the Delmarva Peninsula, Choices, 3d Quarter 2011, available at http://www.choicesmagazine.org/choices-magazine/theme-articles/innovating-policy-for-chesapeake-bay-restoration/regulating-farmers-lessons-learned-from-the-delmarva-peninsula.

n230. Id. at 2.

n231. Id. at 3.

n232. Id.

n233. Id.

n234. Id.

n235. See Frarey et al., supra note 216, at 162.

n236. Id. at 162-64.

n237. See id. at 163-65. The Texas Natural Resource Conversation Commission levied over $ 490,000 in fines before the amended "planned intervention" took place, which "engendered bitterness and charges of inconsistent enforcement from the regulated community." Id. The "planned intervention" legislation sought to add the conservation districts as an intermediary step to help garner higher compliance and better relationships between farmers and the regulating agency. Id.

n238. Iowa Code § 161A.43 (2015).

n239. Iowa Code § 161A.7(1)(a).

n240. See Woodbury County Soil Conservation Dist. v. Ortner, 279 N.W.2d 276 (Iowa 1979) (holding that the statute governing the rules and regulations under which the soil conservation districts operate is reasonably related to carrying out the announced legislative purpose of soil control, and a proper exercise of police power, even though it may impose an extra financial burden on some parties).

n241. Dinnes, supra note 49, at 7.

n242. See Iowa Dep't of Agric., supra note 7, at §§2.1-2.3.

n243. See Am. Farmland Trust, supra note 51 (discussing the six stages that producers commonly go through when adopting a practice).

+++

Janet E. Milne, 2015, Storms Ahead: Climate Change Adaptation Calls for Resilient Funding. 36 Vermont Law Review 819.

TEXT:
[*819] INTRODUCTION

The challenges of reducing greenhouse gas emissions have dominated international negotiations and national debates about climate change, often leaving the issue of adaptation to climate change in the shadows. The focus on mitigation is understandable, given the urgent need to take measures now to avoid greater future damage coupled with the fact that adaptation to climate change is a long-term undertaking with tangible, immediate demands on society that are now starting to emerge. Nevertheless, society is beginning to feel the impacts of climate change, underscoring the need to **[*820]** think more seriously about how to prepare for and minimize those impacts [n1] and how to finance the measures that society should take. As a recent United States assessment found, "[d]espite emerging efforts, the pace and extent of adaptation activities are not proportional to the risks to people, property, infrastructure, and ecosystems from climate change." [n2]

This Article examines the role of environmental tax policy in addressing climate change adaptation, using the United States as a case study. To provide a concrete setting, it focuses on the challenges of adapting to extreme weather events. [n3] It draws in particular on the adaptation implications of Hurricane Sandy, which devastated the eastern United States in October 2012, flooded New York City's subways and airports, left 8.5 million people without power, [n4] and prompted the United States Congress to appropriate $ 51 billion in disaster funding. [n5] Whether or not the storm was linked directly to climate change, it illustrates the tremendous costs of extreme weather, the need to invest in resilience, and the challenges of financing efforts that will restore communities and protect them from future damage.

After exploring the gap between adaptation costs and funding in general (Part I) and in the case of Hurricane Sandy in particular (Part II), this Article considers how environmentally related taxes might help fill the gap between the costs of adaptation in the face of extreme weather events and available public resources (Part III). It highlights the need to earmark revenue for adaptation to ensure that adequate funds are available for short-term responses and long-term investments, and it explores, on an illustrative basis, several types of taxes that might generate new, dedicated revenue streams. Although countries with developed economies may be in a stronger position to find resources to build resilience than those with emerging economies, this case study underscores the fiscal challenge that **[*821]** faces even developed economies and the potential role of environmentally related taxes in meeting that challenge.

I. THE GAP BETWEEN ADAPTATION COSTS AND RESOURCES

Both internationally and in the United States, reports acknowledge the difficulty of projecting the costs of adaptation and yet, even in the absence of hard numbers, recognize the lack of adequate financial resources to meet those needs. However, there is relatively little discussion about what types of new revenue might fill the gap between adaptation needs and currently available resources apart from international negotiations over the obligations of developed economies to help fund adaptation measures for developing countries. [n6]

Adaptation, defined as the "process of adjustment to actual or expected climate and its effects," [n7] will inevitably impose costs on society. Some adaptation costs will take the form of investments to reduce or avoid the adverse impacts of climate change (resilience costs), and some will involve the costs of responding to the impacts of climate change (reactive adaptation), such as the cost of disaster relief after climate-induced extreme weather events. [n8]

The global costs, however, remain difficult to quantify. [n9] A World Bank report projected annual global adaptation costs ranging from $ 70 billion to over $ 100 billion by 2050, but a recent Intergovernmental Panel on Climate Change ("IPCC") report on adaptation expressed low confidence in these **[*822]** and other numbers and noted the challenges facing cost studies. [n10] It identified the lack of full coverage of the adaptation costs of extreme weather events as one source of low confidence. [n11]

Even in the face of uncertain costs, authorities recognize a gap between anticipated costs and financial resources. In its recent survey of adaptation efforts, the IPCC found with high confidence that progress is being made on embedding adaptation into planning processes but that implementation is more limited, [n12] in part due to the lack of financial resources. [n13] While noting the shortcomings in data about the costs of adaptation, it projected with medium confidence a gap between global adaptation needs and available funding. [n14] Other reports also cite the lack of financial resources to address adaptation. [n15]

Despite acknowledgments of the cost-resource gap and suggestions that adaptation may yield benefits that are quadruple the cost, [n16] there seems to be relatively little overt discussion about how to raise the revenue that the public sector inevitably will need to play its role in addressing the consequences of climate change. The European Union has suggested that member states could commit part of the revenue from auctioning greenhouse gas emissions allowances to fund adaptation. [n17] On the whole, however, adaptation funding proposals have focused primarily on the international discussions about developed economies' obligations to finance adaptation in countries with developing economies that have occurred under the umbrella of the United Nations Framework Convention on Climate Change ("UNFCCC"). [n18] An Organisation for Economic Co-operation **[*823]** and Development ("OECD") report cites several possible reasons why many OECD countries do not identify funding sources or the scale of funding required: funding numbers will emerge later in the planning process; speculations about cost may complicate discussions; attention to cost may make it more difficult to agree on policy objectives; and/or the issue is not raised because public funding is limited. [n19] While some reports look to economic instruments for their ability to create incentives for adaptation, such as pricing systems for **water** that encourage conservation in the face of climate-related shortages, [n20] they generally do not focus on economic instruments' potential to finance governmental adaptation measures.

The situation in the United States provides a concrete example of the IPCC's findings about the status of adaptation efforts and the lack of financing. Adaptation efforts in the United States are "in a nascent stage." [n21] In recent years, the federal government has included adaptation in its climate change agenda, but at most levels of government, the efforts are generally related more to the initial planning steps than to implementation. [n22] An analysis of the conservatively estimated $ 77 billion in federal funding for climate change initiatives between fiscal year 2008 and fiscal year 2014 tentatively concluded that most federal agencies were devoting a low level of effort to adaptation and that their efforts typically were incremental additions to existing programs. [n23]

President Barack Obama has elevated the visibility of adaptation, giving it a place of note in *The President's Climate Action Plan* released in **[*824]** 2013. [n24] Pursuant to the plan, the President directed federal agencies to engage in a number of adaptation activities and to consider the costs and benefits of improving adaptation and resilience with respect to their suppliers and capital investments in infrastructure. [n25] He created the Council on Climate Change Preparedness and Resilience to facilitate interagency efforts and work with state, local, and tribal governments. [n26] He also formed the State, Local, and Tribal Leaders Task Force on Climate Preparedness and Resilience to recommend how the federal government might better

address climate impacts. [n27] Both task forces reflect the federal recognition that adaptation requires actions at all levels of government [n28] and that coordination is needed.

The current federal approach has been largely numberless. It is not built on comprehensive estimates of the economic and fiscal impacts of climate change or projections of the amount that governments in the United States will need to spend in order to implement adaptation measures. *The Third National Climate Assessment*, a federal report released in spring 2014, [n29] conveys a message that echoes the IPCC study mentioned above. [n30] It notes the lack of estimates of the total economic damage from climate change, [n31] and it recognizes the need for research to identify the costs of adaptation measures; [n32] but even without this information, it identifies "limited funding" as one of the barriers in its "key messages." [n33] The federal government's 2014 UNFCCC *Climate Action Report* catalogues a sampling of adaptation actions at federal, state, and local levels of government, [n34] but it also does not indicate funding levels beyond a discussion of U.S. **[*825]** international funding commitments, [n35] nor does it discuss any new mechanisms to finance new adaptation activities.

However, the Obama administration is moving toward a higher level of specificity, starting with a focus on the federal fiscal risks of inaction and the need for specific federal resilience programs. The Government Accountability Office in 2013 included the impacts of climate change on its list of areas where the federal government faces high fiscal risk. [n36] In September 2014 the Director of the Office of Management and Budget accentuated the costs of climate change as a major threat to the federal budget and the American economy, focusing on the costs of coastal storms, wildfires, and droughts. [n37] In February 2015 the White House budget proposal for fiscal year 2016 contained for the first time an assessment of the federal budget's exposure to climate risks [n38] and described a portfolio of initiatives to start addressing resilience, [n39] significantly underscoring the issue in the budget context and attaching numbers to the costs of requested programs.

In sum, from both the broad international perspective and the narrower U.S. perspective, there is a common recognition that, despite ambiguities about the cost of climate change and the cost of mitigation, society faces a gap between the needs that are emerging and the funding available. The challenge of how to fill that gap looms large.

To place adaptation funding challenges in a specific context, this Article considers the fiscal implications of the adaptation demands of extreme weather events [n40]--both in terms of reactive adaptation and **[*826]** building resilience--and, in particular, hurricanes. It draws on Hurricane Sandy, which devastated the eastern United States in 2012, as a specific case study. Although Hurricane Sandy has not been causally linked to climate change, [n41] it has been used as an example of the events that lie ahead [n42] and as a case study for how climate-related sea level rise exacerbates the frequency and severity of extreme weather events. [n43] The need to adapt to climate change permeates the report issued by the federally created Hurricane Sandy Rebuilding Task Force. [n44] The report mentioned President Obama's *Climate Action Plan* twenty-six times as it laid out plans for rebuilding after the storm and preparing for future resilience. [n45]

Extreme weather events provide a useful, concrete setting for considering the adaptation funding issues because the events are very specific and leave behind very tangible impacts with which the public and private sectors must contend. As the IPCC noted in its report, adaptation to climate change impacts depends on the specific context and place, [n46] so the issues of need and fiscal responses, including the potential role for taxation, cannot be divorced from context. Nevertheless, exploring one particular set of adaptation needs and potential solutions can help illustrate the challenges we face in financing adaptation more generally.

II. HURRICANE SANDY: AMICROCOSM OF THE FUNDING GAP

Hurricane Sandy provides a vivid example of the challenges that governments at all levels confront when extreme weather wreaks its damage. The human, economic, and fiscal tolls are substantial and long-term. **[*827]** Even after significant governmental responses, the process of rebuilding continues today [n47] and needs remain unmet. [n48]

A. The Storm

Hurricanes in the North Atlantic have increased in frequency, duration, and intensity over the past thirty years, in part due to warmer ocean surface temperatures, which in turn result from atmospheric warming driven by increased greenhouse gas emissions. [n49] One U.S. study projects an annual cost of $ 35 billion for hurricanes and other coastal storms along the east coast and the Gulf of Mexico over the next fifteen years, taking into account higher sea levels and storm surges. [n50] Hurricane Sandy was the most recent major hurricane.

The deadliest hurricane to hit the east coast since 1972, [n51] Hurricane Sandy originated in the Caribbean and traveled north up the Atlantic Ocean, making landfall in New Jersey on October 29, 2012. [n52] Although it did not consistently sustain hurricane status and was a post-tropical cyclone once it made landfall, Sandy still covered 1.8 million square miles and its tropical force winds spanned 1,000 miles, [n53] earning its description as one of the largest Atlantic storms ever recorded. [n54] It impacted twenty-four states. [n55] In blizzard conditions, two to three feet of snow covered parts of western Maryland, Virginia, North Carolina, and Tennessee a few hours after landfall hundreds of miles north. [n56] Closer to the mid-Atlantic coast, twelve **[*828]** inches of rain caused rivers and streams to flood. [n57] The combination of astronomical high tides--some of the highest of the year--and Sandy's high winds generated a storm surge along much of the east coast. [n58] But the hardest hit areas were the coast of New Jersey, the most densely populated state in the country, and metropolitan New York, home to 19 million people and the source of 9.5% of the country's GDP. [n59] The most intense storm surge of ocean **water** occurred in the metropolitan New York area. [n60] At the Battery at the southern end of Manhattan, nine feet of **water** covered lowlying areas. [n61]

The storm left devastation in its wake. It directly caused seventy-two deaths in the United States (forty-eight in New York [n62] and forty-one from the storm surge [n63]) and at least seventy-five indirect deaths due to conditions during the evacuation and cleanup stages. [n64] The storm damaged an estimated 650,000 houses and cut off power for 8.5 million customers, primarily from fallen trees. [n65]

In New Jersey and New York, flooding was a key cause of damage. Vivid images and statistics abound, with only a few mentioned here. In coastal New Jersey, the storm surge flooded entire communities, sweeping houses off foundations and carrying boats and cars inland, [n66] and left some communities without power for months. [n67] The storm surge flooded 17% of New York City's landmass. [n68] In New York City, the storm inundated over 23,000 businesses and nonprofit organizations, which employed 245,000 people and ranged from small businesses to major corporations, [n69] as well as 88,700 buildings and more than 300,000 residential units. [n70] Ten percent of the city's population lived in the inundation area, where 80% of the housing **[*829]** was built before 1980--before the building code required consideration of flooding. [n71] The morning after landfall, over half the country's daily public transit riders found themselves with no service--the worst public transit disaster in national history. [n72] Passenger train service along the northeast corridor did not return to full normal function for three weeks. [n73] The New York City subway system, which closed from October 28 (in anticipation of the storm) to November 1, experienced flooding in eight tunnels. [n74] Failures of wastewater treatment plants due to damage or loss of electricity sent billions of gallons of sewage into waterways. [n75] Hospitals were damaged or affected; schools closed; and people were dislocated from their communities and jobs. [n76] Immediately after the hurricane, over 23,000 people sought housing in temporary shelters. [n77]

Estimates of damage from Hurricane Sandy vary, depending perhaps on how one counts costs and on the knowledge available at any given time. According to one federal study, damage from the storm exceeded $ 50 billion. [n78] In November 2012 New Jersey Governor Chris Christie estimated that repair and recovery would cost $ 36.9 billion for his state alone, and New York Governor Andrew Cuomo estimated $ 42 billion, for a total of $ 78.9 billion. [n79] These amounts included $ 7.4 billion [n80] and $ 9 billion [n81] for New Jersey and New York respectively to build resilience against future storms. [n82] One study projected economic damage to the New York/New **[*830]** Jersey region between $ 30 billion and $ 50 billion, [n83] although according to another study, long-term construction may yield net gains due to the positive effects for the construction

industry if all the damage is repaired. [n84] A 2014 study examined various resilience scenarios and projected that New York and New Jersey would need to spend between $ 12 billion and $ 24 billion to protect against flooding, depending on the assumptions. [n85]

B. The Governmental Response Framework

The events surrounding Hurricane Sandy illustrate the various types of government responses--both in terms of reactive adaptation (emergency response and recovery) and building resilience for the future--and the allocation of responsibilities and therefore costs among different levels of government. Although responsibility for handling disasters usually starts at the local level, the National Response Framework recognizes that response is often a partnership among communities, nongovernmental organizations, state governments, and the federal government. [n86] The federal government serves as a significant backstop to provide important forms of assistance [n87] and over the years has borne an increasing portion of the financial responsibility for coastal storms. [n88] The governor of a state may request the President to declare a disaster if the governor believes that the circumstances are "beyond the capabilities" of the state and local governments and that federal assistance is therefore necessary. [n89] In the wake of Hurricane Sandy, President Obama issued disaster declarations in twelve states plus the District of Columbia. [n90] The declaration of a disaster allows the federal government to provide relief. [n91]

[*831] After a disaster declaration, the Federal Emergency Management Agency (FEMA) can draw on the Disaster Relief Fund. [n92] Through the Fund, FEMA can provide individual assistance (for example, to help individuals when a storm damages or destroys residences by offering temporary shelter, repairs, and rebuilding assistance), public assistance (for example, to repair damage to public infrastructure or help government remove debris impairing public rights-of-way), and hazard mitigation assistance (to fund projects that will reduce the risk of future damage, such as retrofitting properties or buying out at-risk properties). [n93] Other federal agencies also can provide financial assistance. These include the Small Business Administration, the Department of Transportation through its Emergency Relief Program, and the Department of Housing and Urban Development through its Community Development Block Grant Program. [n94] Rules govern the extent to which federal funding requires some state or local cost-sharing, but the federal government's financial role is significant. [n95]

The federal government also steps in to provide personnel in the event of a disaster. For example, in the immediate response to Hurricane Sandy, the U.S. Army Corps of Engineers removed 150 million gallons of **water** from tunnels and subway systems in the greater metropolitan New York area (the equivalent of 227 Olympic-sized pools), [n96] and 17,000 federal responders, including more than 5,000 FEMA employees, addressed storm issues. [n97] In the longer term, FEMA was still staffing recovery offices in New York and New Jersey as of February 2015. [n98]

The storm spawned special commissions to help mobilize government efforts. Given the amount of damage from the storm, President Obama in December 2012 established the Hurricane Sandy Rebuilding Task Force, [n99] composed of representatives of a wide range of federal agencies and led by **[*832]** the Secretary of the Department of Housing and Urban Development. [n100] The task force was charged with helping to coordinate the rebuilding efforts, improving regional resiliency, and presenting a long-term rebuilding plan. [n101] The plan, issued in August 2013, contains a wide array of recommendations. [n102] Two months after the storm, New York City created its Special Initiative for Rebuilding and Resiliency, which presented a plan for short- and long-term recovery in June 2013. [n103] Also relevant to long-term adaptation, the State of New York had previously created a task force to address the problem of rising sea levels, which issued a report in late 2010 containing a variety of recommendations. [n104]

In sum, as illustrated by Hurricane Sandy, adaptation involves multilevel governmental responses, both in terms of reactive adaptation and building resilience. A major event focuses attention on the need for action at all levels. Within this framework, however, significant funding gaps remain.

C. The Insurance Gap for Property Damage

As indicated above, Hurricane Sandy left New York and New Jersey with the task of recovering from damage and with costs in the $ 50 billion to $ 70 billion range. Insurance coverage did not adequately cover the private sector costs for property damage, causing the private sector to look for relief from the public sector. Globally, insurance tends to fall far short of covering losses from extreme weather events: Insurance covered only about one-quarter of the total costs of extreme weather events around the world between 1980 and 2004 ($ 1.4 trillion). [n105] Coverage was higher for Hurricane Sandy but still fell short of what was needed to compensate for the losses. According to Swiss Re's 2013 estimates, about half of the $ 70 billion in economic losses from Sandy was covered by insurance. [n106] Private **[*833]** insurance picked up the tab for $ 20 to $ 25 billion, and between $ 10 to $ 15 billion fell on the Federal National Flood Insurance Program (NFIP). [n107]

Perhaps not surprisingly, large commercial firms were better protected than smaller firms and households. Based on a post-Sandy study of New York City, very large commercial firms tend to obtain comprehensive private insurance coverage, including flood insurance coverage. [n108] The private insurance market generally offers more selective coverage to other types of property owners. [n109] For homeowners and small businesses, the primary potential source of coverage for flood insurance is through the Federal NFIP. [n110]

Started in 1968, [n111] NFIP provides insurance for policyholders who own property in flood-prone areas, including property in the high-risk area where the risk of flooding is 1% (the 100-year flood plain). [n112] Communities may elect to participate, in which case their residents are eligible for insurance, provided that the community follows specific land use guidelines designed to reduce risk. [n113] Purchase of insurance is not mandatory unless the property owner obtains a mortgage from a federally regulated lender or receives federal disaster relief funding for rebuilding a damaged property. [n114] NFIP also finances mitigation measures, particularly for repetitive-loss properties, by helping to cover the cost of raising, moving, or taking down buildings, [n115] a program that can be very important to building resilience. **[*834]** These mitigation measures serve NFIP's financial interests. Repetitive loss properties constitute 1% of the insured properties but generate 30% of NFIP's insured losses. [n116]

Although flood insurance coverage was available through NFIP, New York City estimates that less than 20% of the residential buildings that were inundated in the storm were covered by NFIP policies. [n117] The coverage was low for several reasons. Half of the homes lay outside of the 100-year floodplain identified on FEMA's outdated maps [n118] and were not on notice of risk. The inundated area exceeded the floodplain marked on FEMA's maps by 53%. [n119] For the half within the mapped flood zone, numerous properties did not have mortgages requiring NFIP coverage or did not comply with the insurance requirement for federally backed mortgages. [n120] In terms of commercial structures, only 1,400 NFIP policies were in effect for commercial properties even though over 26,000 small businesses were inundated. [n121] Even for properties covered by insurance, NFIP caps the benefits and limits the coverage for certain elements, such as basements, which were hit hard by Sandy's flooding. [n122] Hence, in both the private insurance market and through NFIP, insurance did not adequately cover the costs of private losses. Those losses then must either fall on the private sector as uncompensated losses or fall on the public sector when the government offers assistance.

[*835] Moreover, NFIP insurance premiums have not been adequate to fund NFIP's growing nationwide coverage obligations with recent extreme weather events, causing the federal government to step in to fill the gap by authorizing NFIP to borrow from the Treasury. In recent years NFIP has been financially unsustainable due to subsidized insurance premium rates and a rising number of claims. [n123] Properties in high-risk areas that were built before the first flood risk maps are eligible for subsidized insurance rates, [n124] and the number of subsidized policies has risen due to increased participation and better enforcement of mandatory mortgage requirements. [n125] In addition, major flooding in 2005 caused heavy claims records. As of early 2013, the program had acquired $ 18 billion in debt from the Treasury, in large part due to claims from the massive Hurricane Katrina that devastated New Orleans and the Gulf Coast in 2005. [n126] It then faced an additional projected $ 12 to $ 15 billion in NFIP claims from Hurricane Sandy. [n127] Thus, even when

property owners obtain flood insurance, NFIP has not allocated the full cost of insurance to those who assume the risk of living in the floodplain. [n128] To ensure that NFIP would be able to pay its anticipated claims post-Sandy, Congress, in January 2013, authorized an additional $ 9.7 billion in NFIP's borrowing authority. [n129]

[*836] *D. Government Funding Gaps*

The significant gap between insurance coverage and the need to repair and rebuild areas affected by Hurricane Sandy put pressure on the federal government for financial assistance. [n130] FEMA's Disaster Relief Fund and other federal programs had to step in to provide relief, transferring the financial pressure from the private sector and from state and local governments to the federal government and its taxpayers. [n131] But existing federal resources were not adequate to address the magnitude of the shortterm response and long-term recovery and resilience. [n132] Congressional action was necessary to authorize additional funds.

In December 2012, the White House requested that Congress appropriate $ 60.4 billion in supplemental funding in response to Hurricane Sandy [n133] and, in doing so, clearly linked the relief programs with climate change and adaptation. The request sought funding in part "[t]o build a more resilient Nation prepared to face both current and future challenges, including a changing climate," [n134] and it proposed allocating $ 13 billion (over 20%) to programs that would mitigate the effect of future disasters, [n135] indicating a clear presidential emphasis on resilience.

In January 2013, Congress passed a supplemental appropriation of $ 50.7 billion largely for post-Sandy response and resilience. [n136] Although allocated to twenty-one federal agencies, [n137] the lion's share of the funding went to the Department of Housing and Urban Development's Community Development Fund ($ 16 billion) for unmet housing, economic development, and infrastructure needs; to FEMA for the Disaster Relief Fund ($ 11.5 billion); to the Department of Transportation's Federal Transit Administration for the Public Transportation Relief Program ($ 10.9 billion); and to the Army Corps of Engineers for construction ($ 3.5 billion) and flood control and coastal emergencies ($ 1 billion), [n138] totaling **[*837]** approximately $ 43 billion. [n139] To create a sense of fiscal scale, Congress approved on average $ 1.1 billion between 1989 and 2010 in routine appropriations for the Disaster Relief Fund, but Congress appropriated $ 116 billion during the same period in emergency supplemental appropriations for the Fund in response to specific disasters. [n140] The pattern of business with extreme weather has been to respond to specific crises after the event on a debt-financed basis, not to build funds in anticipation.

The recovery and resilience plans that state and local governments presented to demonstrate their need for federal funds provide snapshots of the multi-faceted state and local efforts underway and the yawning chasms of their unmet needs. [n141] Particularly at a time when many communities suffered from weakened tax bases as a result of the storm, [n142] the federal government played a crucial role. Under the "routine" disaster framework, the federal government would have responded through its disaster relief programs. With a storm of Sandy's magnitude hitting densely populated areas, however, the state and local governments looked more desperately to the federal government, and the federal government had to take emergency measures to provide significant funding for short- and long-term needs. Even still, a gap remains.

New York City's recovery and resilience plan illustrates the financial scope of the task, the extent to which the city relies on federal funding to achieve its goals, and the remaining gap. The 2013 plan, *A Stronger, More Resilient New York*, contains a wide array of measures to rebuild and to **[*838]** make the city more resilient to climate change in the future. [n143] Estimating the cost of projects that can be completed within ten years, the plan concluded that the public cost will be approximately $ 19.5 billion--$ 14 billion for resiliency investments and $ 5.5 billion for private and public housing recovery, business recovery, and the city agencies' costs of immediate response to the storm. [n144] It estimated that the federal government will fund $ 8.8 billion, the city will finance $ 5.5 billion through its capital budget (plus $ 40 million (with philanthropies) for small businesses and mold removal programs), and utility ratepayers will fund about $ 1

billion of the improvements. [n145] Closing the remaining gap, estimated at $ 4.5 billion, will require other strategies, including the possibility of seeking an additional supplemental appropriation from Congress. [n146]

Thus, Hurricane Sandy illustrates how an extreme weather event creates the immediate need for emergency response, and it demonstrates the magnitude of the long-term investments in recovery and resilience. At the same time, it shows that insurance does not adequately cover private property damage. With pressure on government to protect the immediate public health, safety, and welfare, and to finance repairs to both public sector and private sector property, state and local governments look intensely to the federal government for human and financial assistance. Yet the federal government is not immediately equipped to respond in full magnitude but must instead dig deep into its pocket (and therefore the federal taxpayers' pockets) to produce special appropriations. Even with those appropriations, gaps remain and state and local governments continue to seek other sources of revenue, including the federal government. With repeated events of this nature, governments at all levels increasingly need to think about their fiscal capacity to respond--and potential sources of new revenue.

Hurricane Sandy also stands as a stark reminder of the need to invest in building resilience *before* extreme weather events wreak their havoc. Communities need to prepare themselves in advance of disaster in order to reduce the harm to people and property and the financial, human, and ecological cost of that damage. Adaptation involves not only reactive **[*839]** adaptation through response but also building resilience over the long term in anticipation of the consequences of climate change.

III. THE SEARCH FOR NEW REVENUE TO FILL THE GAPS

A. A Disquieting Quiet on the New Revenues Front

In the face of the United States' increasing needs to address adaptation, both in its reactive and prospective senses, there are still relatively few concrete proposals for funding sources actively on the table, and there is no coherent national strategy for funding. The following examples of adaptation discussions illustrate the sparse proposals for new sources of revenue, even after the loud wakeup call that Sandy and other storms have sounded.

The State, Local and Tribal Leaders Task Force on Climate Preparedness and Resilience, created by executive order in November 2013 [n147] pursuant to President Obama's *Climate Action Plan*, [n148] was charged with recommending how the federal programs can increase their attention to resilience and support state, local, and tribal efforts. [n149] However, its charge did not explicitly address the issue of the need to find new or larger sources of revenue to fund programs. The Task Force's November 2014 report highlighted a number of initiatives, such as regulatory reforms, better governmental coordination, technical assistance, and increased attention to resilience in the course of making expenditure decisions. [n150] Financing issues maintained a very low profile. Perhaps not surprisingly, in light of the Task Force's charge, the report did not discuss the need for new sources of federal tax revenue that could assist state, local, and tribal governments. It instead framed the federal government's role in finding new revenue in terms of its potential to serve as an incubator of ideas. Without supplying details, it recommended that the government explore and pilot "innovative financing strategies," citing as examples public-private partnerships, bonds, and special districts that could finance investments that would yield lower **[*840]** insurance premiums in the future, as well as the possibility of private sector funding for resilience investments. [n151]

In the context of Hurricane Sandy, publicly available governmental analyses of new funding sources appear to be limited. The sixty-nine recommendations in the federal Hurricane Sandy Rebuilding Task Force's 2013 report focused largely on ways to harness existing federal programs to improve recovery and long-term resiliency efforts and improve coordination among federal, state, and local governments. [n152] Although the report generally did not highlight the need for new funding sources or propose any new federal funding, it showed some interest in exploring other revenue sources, citing the Task Force's efforts to help states consider how to finance resilience for energy infrastructure through customer fees or other revenue

streams, the possibility of using public-private partnerships to leverage federal rebuilding funds, and the potential for an increased role of philanthropies and other non-profit organizations in rebuilding efforts. [n153]

New York State's 2010 pre-Sandy report on the need to address rising sea levels recommended that the State explore mechanisms to fund adaptation. It suggested potential tax or fee approaches, such as taxes on new construction of buildings with values of $ 1 million or more, a "coastal users' tax" on hotels and vacation rental properties, and increased or new permitting fees on construction in the coastal risk management zone, as well as non-tax mechanisms and further pursuit of federal funding. [n154] The stated two-year timeframe for this exploration has now passed, and it does not appear that these suggestions have been enacted or officially proposed. A post-Sandy New York State commission charged with studying the resilience of the State's infrastructure recognized the need for funding but did not target a specific source of revenue, instead recommending that the **[*841]** State identify "the widest possible range of revenue sources, including Federal grants, taxes, user fees, and targeted programs." [n155]

New York City's 2013 post-Sandy resiliency plan contemplated the possibility of applying a modest per-square-foot assessment to buildings in the financial district to finance a flood protection system consisting of permanent landscaping and deployable floodwalls, but it concluded that the likely opposition would render the concept "relatively speculative." [n156] It also urged New York to consider an advocacy group's proposal for a toll system for access to the central business district. [n157] Although that idea predated Sandy and related primarily to transit issues, the report noted the policy nexus between vehicle usage and climate change mitigation and suggested the toll could help fund resiliency. [n158] The city's subsequent April 2014 report on rebuilding and resilience efforts post-Sandy stated that the Office of Recovery and Resiliency would "explor[e] alternative financing mechanisms for recovery and resiliency investments" but provided no elaboration. [n159]

To a significant extent, the paucity of specific, legislatively active proposals for new sources of state or local revenue is understandable. Raising new revenue is difficult in the contentious, anti-tax environment that has dominated U.S. political discussions in recent years, an environment exacerbated by a sluggish economy sensitive to price increases. In addition, the $ 50 billion supplemental appropriation by Congress following Hurricane Sandy helped satisfy a number of immediate needs, and revenues from that appropriation are still working their way through the spending pipeline.

[*842] Nonetheless, it is important to heed Hurricane Sandy's lessons about the magnitude of the need for revenue to respond and build resiliency, and to start seriously exploring mechanisms that can help ensure adequate funding for climate change adaptation in the future. Revenue from new taxes is obviously not the only path toward achieving adaptation goals. For example, regulations can demand higher standards for construction practices; government may require recipients of federal funds to follow certain adaptation-friendly practices; and government can raise general tax rates or issue bonds to provide the funds needed to invest in disaster response and more resilient infrastructure. This Article, however, focuses on the potential role of new environmental taxes and fees that could help finance adaptation beyond current levels of funding. It cannot claim to provide a comprehensive set of proposals but instead is designed to present some specific ideas to illustrate the types of policy and design considerations that might influence the development of a more comprehensive funding plan.

B. Principles Guiding the Design of New Revenue Streams for Adaptation

Before delving into possible measures that could fund adaptation, it is useful to think briefly about propositions or principles that might guide the choice and design of specific tax measures and the choice of the level of government at which they will operate. Every new tax (or fee) proposal requires decisions about what to tax, who should pay the tax, and where the revenue should be directed. Those decisions define the character of the tax.

1. Earmark the Revenue

The first proposition for purposes of this Article is that government needs new streams of tax revenue that are dedicated solely to adaptation programs, regardless whether they are aimed toward reactive adaptation or building resiliency. [n160] As a preliminary matter, one should note that a tax instrument designed for earmarking is in large part driven by its revenue-raising function, unlike a classic Pigouvian environmental tax, which **[*843]** obtains its *raison d'etre* from the behavioral impact of the tax itself. [n161] The tax rate will depend primarily on the amount of revenue needed, not the cost of the taxed activity's externalities. This is not to say that the tax rate may not also influence behavior as a co-benefit; the behavioral impact will depend on how high the tax rate is.

The Hurricane Sandy case study illustrates the need for substantial amounts of new revenue to meet adaptation needs, but it also suggests that government could benefit from having earmarked funds on hand to respond immediately to disasters and to build resiliency in the longer term. Earmarked funds would allow government to avoid the potential pitfalls of the normal, annual budgetary process. Although the earmarking technique is controversial in the public finance field because it can limit budgetary flexibility and build entrenched fiefdoms, [n162] earmarking may offer a significant benefit both when government faces a high risk of unpredictable, costly events that will demand a time-sensitive response and when government needs to start setting aside assets for large, future investments.

In terms of the immediate demands after a disaster, Hurricane Sandy demonstrates the need to have ready access to funds to ensure a timely response and the difficulty in meeting this need through routine budgetary processes--both reasons for earmarking tax revenue. The federal government has a long history of under-funding disaster relief as part of the routine budgetary process. FEMA's annual appropriations for its Disaster Relief Fund in the normal budgetary course between 2001 and 2011 ranged from $ 800 million in 2003 to a high of $ 2.2 billion in 2002. [n163] Yet demand for greater federal disaster relief had been increasing during that period as the number of natural disasters escalated. [n164] As a result, Congress had to issue supplemental appropriations to respond to demand in all but two years and even enacted three supplemental appropriations in 2005 and again in **[*844]** 2008. [n165] Between 2001 and 2011, Congress authorized over $ 80 billion in supplemental funding for the Disaster Relief Fund, including $ 43 billion in 2005 when storms punished the Gulf of Mexico. [n166]

This shift away from the routine appropriations process is understandable, given the desire to adjust the size of the relief to the unpredictable magnitude and timing of disasters. [n167] However, Hurricane Sandy illustrates how supplemental post-disaster relief can fall prey to larger, contemporaneous political issues. President Obama's $ 60.4 billion supplemental appropriation proposal, submitted in early December 2012, was caught in the political crossfire over limits on federal spending and the looming fiscal cliff that had brought Democrats and Republicans to loggerheads. [n168] A modified $ 50.7 billion proposal finally passed Congress on January 27, 2013, ninety-one days after Sandy hit. [n169] The emergency relief approach also tends to rely on deficit financing, [n170] further heightening the tensions over whether to authorize relief. A reliable, earmarked revenue stream would allow government to build a reserve in anticipation of future needs, bypass the political brinksmanship and potential delays of emergency legislation, and avoid the risk of using deficit financing to fund the needs. [n171]

The principle of earmarking new revenues is not limited to meeting the demands for immediate response to disaster: Government needs dedicated funding to build resilience on a prospective basis, even in the absence of dramatic events. The benefits of adaptation reportedly are four times the cost, suggesting that long-term investment in resilience is money well spent. [n172] However, the rationale for earmarking funds for long-term **[*845]** investments in climate resilience differs from that for saving for immediate disaster response. Building new public physical infrastructure or fortifying existing infrastructure, such as roads, bridges, seawalls, or stormwater management facilities, will often require significant governmental investment. At a time when national infrastructure is already in need of major improvements, [n173] adaptation to climate change only increases the urgency and the cost. New streams of dedicated revenue can help ensure that governments build the funding necessary to accomplish these purposes in the long term. Otherwise,

short-term demands that are immediately pressing and apparent may trump long-term needs, leaving the latter under-funded. [n174]

Although one should always be healthily wary of building dedicated funds that can subvert the normal, democratic budgeting process, unpredictable emergency needs and high-cost, long-term investments can justify earmarking. This Article does not delve into the important substantive and procedural issues of how to administer disbursements from earmarked funds, but that omission is not meant to diminish the significance of those issues.

2. Try to Place the Burden on the Polluter or Beneficiary, Even If Imperfectly

A second proposition is that the burden for adaptation measures should fall, as much as possible, on the polluters who contribute to the need for adaptation and/or are the beneficiaries of adaptation. As discussed below, **[*846]** and as others have concluded, [n175] it can be difficult to precisely match polluters or beneficiaries with the adaptation problems. The need for adaptation in large part arises from the polluters of the past, many now long gone and who were spread around the globe. The present and future beneficiaries may not always be easy to identify, [n176] and choosing beneficiaries raises significant equity issues. [n177] However, some rough justice correlation may help build a stronger rationale for a new tax and help justify the dedication of the revenue. The alternative is to place the burden on taxpayers as a whole through a general tax and--under the earmarking rationale--to dedicate some portion of the general revenue to adaptation. Diverting a stream of general tax revenue into an earmarked fund, however, tends to run counter to tax traditions in the United States. [n178]

Linking the adaptation payment obligation, where possible, to a class of polluters or beneficiaries is likely to mean that the tax base (what is being taxed) will bear environmentally related features. If the polluters are paying for adaptation, the tax should be keyed to the polluting activities. If the beneficiaries are paying for the value they receive from the adaptation activity, the payment is likely to be based on an inherently environmental benefit.

This proposition does not preclude using general revenues for adaptation purposes. For example, it may be entirely appropriate to fund some amount of federal disaster relief from the general budget, as has happened in the past. The nation as a whole has a commitment to take care of its own in times of severe need, so base-level emergency funding from the general budget can be justified. As argued above, however, the magnitude and potential unpredictability of disasters relating to climate change and the cost of building resiliency warrant special measures that the general budget may not be able to sustain.

[*847] 3. Match the Funding Responsibility for Adaptation to the Appropriate Level of Government

When thinking about new taxes, a basic design question is which level of government should impose the tax. One ideally would match the type of public interest at stake for any given adaptation goal with the level of government. [n179] The type of public interest relevant to adaptation taxes is reflected in how the revenue would be spent. For example, the cost of building the resilience of local infrastructure might best be paired with local taxes, consistent with the U.S. tradition of using local taxes to finance local **water** and local road systems. The cost of fortifying assets of national significance, such as the integrity of the interstate highway system and the electricity grid, may warrant federal funding (in keeping with the longstanding practice of using federal taxes on gasoline to help fund the highway system).

Admittedly, it can be difficult to neatly separate federal, state, and local public interests. Some ostensibly localized interests, such as the uninterrupted functioning of Wall Street for the sake of New York City's economy, have significant national implications. A seawall that can protect New York City against flooding has direct local benefits, but it also protects the economy of the region and the well-being of major national institutions and markets. [n180] Hence, matching the type of public interest to the level of government provides only rough guidance subject to wide discretion.

History also creates presumptions about which level of government will assume responsibility for the costs. As illustrated by the Hurricane Sandy case study, the federal government played a major role in providing immediate disaster relief--a role that presumably will only expand as climate change provokes more extreme weather events. Given this tradition, it seems unlikely in the near term that this responsibility will entirely shift back to state and local governments, rendering it necessary to find new sources of revenue for federal disaster relief. Nor should the responsibility necessarily move away from the federal government. As suggested above, **[*848]** the federal government has an enlightened self-interest in assisting in times of significant need even if the effects are localized.

The nature of the tax base may also influence the choice of the level of government. For example, if the tax is directed at emissions from industries that operate nationwide, a federal tax may be more appropriate as a matter of environmental and economic policy. If the targeted activities are more local in nature, a state or local tax may be more suitable. Relatedly, certain levels of government traditionally have relied more heavily on certain types of tax bases than others, creating a tradition that can inform the use of new environmentally related taxes. For example, local governments rely heavily on local property taxes to fund municipal services, given the local nature of the tax base and the direct correlation between real property and the benefits that municipal services provide.

The remainder of this Article explores four possible sources of increased revenue. The proposals below are offered as a means of considering, on an illustrative basis, how taxes can fund adaptation and how the propositions outlined above might apply. They do not purport to create a detailed policy agenda but rather to inspire other thoughts about measures that might fill the gap between adaptation needs and resources. Nor are they filtered through the screen of political reality. However, it is important nonetheless to start thinking about how to conduct the search for new revenue.

C. An Exploration of Potential Adaptation Taxes

1. Carbon Taxes

Given that the need for climate change adaptation is driven in large part by greenhouse gas emissions, it is logical to consider imposing part of the cost of adaptation on those emissions under a "polluter-pays" approach. As others have noted, a carbon tax does not perfectly match the tax base and taxpayers with the use of the revenue--funding adaptation. The cost ideally would be imposed largely on past emissions, which are the source of current and future adaptation needs, but it is both administratively and politically challenging to impose liability retroactively. [n181] However, present and future emissions will continue to contribute to the need for adaptation.

One practical solution is to forgive the sins of the past but impose a tax on the emitters of the present and future, particularly given that many **[*849]** emitters (including all of us during our lives) have also contributed to the emissions in the past. By dedicating the revenue to adaptation purposes through an earmarked fund, present and future emitters can build an adaptation endowment that will help address the needs of the future. Apart from not imposing retroactive liability, a tight policy correlation exists between the pricing mechanism and the use of the revenue. If the sole purpose of the tax is to fund adaptation needs, the tax rate would be set according to estimates of need, not according to Pigouvian internalization principles, but a tax of any magnitude might nonetheless serve mitigation as well as adaptation goals. To provide a sense of scale of the potential revenue, a tax of just $ 5 per ton of greenhouse gas emissions, adjusted upward slightly each year, would generate about $ 200 billion in the first ten years. [n182]

The co-existence of regulatory regimes that limit greenhouse gas emissions does not preclude the additional imposition of a carbon tax inspired by adaptation needs. [n183] Because regulations do not create a ban on emissions, it is appropriate to impose a tax on the remaining emissions to recognize their environmental consequences and their contribution to the need to adapt in the future. [n184] An adaptation carbon tax could also be one component of a larger carbon tax.

Such a tax is suited to the federal level. As illustrated above, the federal government needs revenue to fund national interests in disaster relief and to build the resilience of infrastructure of national significance. It makes sense to link this revenue need to a carbon tax; emissions occur and **[*850]** travel nationwide. [n185] Using a federal carbon tax to generate revenue would create a more uniform price signal than would state-specific emissions taxes. Moreover, taxing emissions nationally provides a relatively equitable distribution of the burden of adaptation across the nation. Although it is possible that a carbon-intensive region might pay a share of the tax that does not align perfectly with the benefits it will receive from the use of the revenue, the consequences of the emissions reach far beyond that region. In addition, the regional equity issues may diminish when one considers the full range of adaptation challenges, including river flooding and tornadoes in the Midwest and forest fires in the West. [n186]

The idea of attaching a price to greenhouse gas emissions that can help fund adaptation is not novel. The European Union's Emissions Trading Scheme for greenhouse gas emissions has moved toward increased auctioning of emissions allowances, and the European Union has indicated that member states should use at least half of the revenue for climate change purposes, including adaptation. [n187] In the United States, a bill calling for a federal "carbon pollution fee" would dedicate the revenue from fees on imported carbon-intensive goods (in effect, the revenue from a border tax adjustment) in large part to state and local adaptation programs. [n188] Although emissions are global in nature, this proposal's matching of international emissions with domestic adaptation shifts the adaptation cost overseas, creating a somewhat awkward policy nexus. As another example, an advocacy organization that grew out of Hurricane Sandy's effects on New Jersey has called for Congress to create an Extreme Weather Relief and Protection Fund financed through carbon pricing, although it has not specified any details about the pricing mechanism. [n189] However, it is time to start considering the concept in the United States on a more mainstream basis.

While defining the specific uses of a new federal fund for adaptation and designing its administrative structure lie beyond the scope of this Article, two general points are worth considering. First, the dedicated **[*851]** revenue stream could address both the immediate response to extreme weather, supplementing existing programs, and longer-term recovery and resilience programs, perhaps building new initiatives.

Second, although a federal adaptation fund could be available in large part for direct spending programs, it could also be used to finance programs that leverage other dollars, such as through the creation of an infrastructure bank. An infrastructure bank could provide a pool of capital that regional, state, and local interests could draw upon to invest in resiliency infrastructure projects. This approach would give the federal government an appropriate role as a source of capital, while not saddling it with the ultimate cost of the projects, which might be more appropriately borne by non-federal entities.

The infrastructure bank concept is gaining momentum. The European Investment Bank is already funding **water** and transportation adaptation projects in Europe and elsewhere, such as a flood barrier to protect St. Petersburg [n190] and resilient transportation infrastructure in the Port of Rotterdam. [n191] In the United States, President Obama has proposed a national infrastructure bank for a wide range of federal and regional infrastructure projects to address the needs of **water,** transportation, and energy infrastructure. [n192] Although not yet explicitly encompassing adaptation, the proposal could handily be used to incorporate resiliency projects. New Jersey recently created an energy resilience infrastructure bank using federal funding for Hurricane Sandy relief, [n193] and New York **[*852]** Governor Cuomo has announced his intention to establish an infrastructure bank. [n194] Regardless of the level of government that creates and holds the bank, the infrastructure bank concept would be well-suited to funding projects that will generate their own stream of revenue, such as through tolls or consumer fees, to repay the bank over the course of time.

2. Dark Cloud Taxes

The American and global economies are undergoing a technological revolution in which communications and the means of doing business are increasingly dependent on electronic, Internet-based resources. For example, the "cloud," recently novel, is growing fast. "'Most enterprises no longer look at

[the] cloud as an if,' said Tom Kershaw, director of Google's cloud platform, 'They look at it as a when.'" [n195] Cloud services encompass data centers, networks that connect the data centers to consumers, and the consumers' end-user devices. [n196] They have been defined as services "provided to computers and other end-user devices as a utility over a **[*853]** network, using shared infrastructure that includes data centers, hardware, software and other infrastructure." [n197] By providing on-demand access to computer resources over an external network, cloud services are a significant step away from the tradition of maintaining IT services installed and managed on site. [n198] By 2012, the New York Stock Exchange used a third-party data center to handle and store the 2,000 gigabytes (or four trillion bytes) of data it generates each day, [n199] and by 2013, the majority of businesses in the United States used shared or private clouds for their digital needs. [n200]

E-sports represent just one example of the rampant growth in consumer-oriented products that rely on cloud services. In October 2013, a streamed e-tournament of League of Legends drew 8.5 million simultaneous online viewers, equivalent to the viewers of the decisive game in the Stanley Cup hockey competition. [n201] Twitch, a video-streaming company that gamers use, was founded in 2011 and bought by Amazon in 2014 for almost $ 1 billion. [n202] With 55 million unique users in July 2014, Twitch was the fourth-largest user of Internet bandwidth in the United States and had invested in at least fifteen data centers. [n203] In terms of email alone, a 2014 report found that every sixty seconds, 204 million emails are exchanged globally. [n204] And retail sales increasingly occur over the Internet. The same 2014 report stated that Amazon sells $ 272,000 of merchandise every minute through its virtual salesroom. [n205]

[*854] Cloud services may seem invisible to businesses and consumers, who are often unaware that they are even using the cloud, [n206] but the cloud nonetheless leaves an environmental footprint. One study reports, for example, that transporting one gigabyte of data over a network requires the energy contained in one pound of coal. [n207] To create a sense of scale, one wireless provider estimates that two gigabytes a month allows a user to spend fifteen minutes a day streaming music and ten minutes a day watching a video. [n208] Greenpeace has found that, "[i]f the cloud were a country, it would have the fifth largest electricity demand in the world." [n209] In 2013, U.S. data centers, which constitute just one element of the cloud in one country, consumed 91 billion kilowatt-hours of electricity--enough to power all the households in New York City for two years. [n210] While major cloud companies such as Amazon, Apple, and Google have committed to increasing their use of renewable energy sources, [n211] they represent only a very small percentage of global data center capacity. [n212]

It is difficult to precisely assess the emissions profile of the cloud. [n213] Federally mandated reporting requirements fall on the primary emitters, such as power plants and manufacturers, [n214] although voluntary protocols are being developed to help those who choose to identify the emissions **[*855]** associated with data centers, networks, and consumer devices. [n215] However, even if the cloud's emissions are indirect, it may still be advisable to hold cloud services and their users responsible for those emissions.

This Article does not explore the question whether electronic ways of doing business leave a smaller carbon footprint than traditional methods. That question involves complex calculations. For example, using the cloud to listen to one song requires less energy than the manufacture and shipping of a CD, but streaming a high-definition movie one time requires more energy than making and distributing a DVD. [n216] This Article instead accepts the premise that e-services are part of the global economic and social fabric and are here to stay, regardless of the relative carbon merits of a traditional economy and the new digital economy of cloud-based services. The analytical baseline is not the emissions associated with the old economy but rather expectations for the new economy. This Article also assumes that cloud services will only increase in the years to come, given the growing appetite for instant communications. As one researcher noted, "'[t]hat's what's driving that massive growth--the end-user expectation of anything, anytime, anywhere.'" [n217] More efficient computing capabilities only increase the level of traffic. [n218]

Why not tax the externalities of the new, digital way of doing business from the start, both to start building the endowment that will help society adapt to future environmental consequences and to inform behavior? Instead of responding to the impacts of fully developed industries after the fact, as would happen

with a traditional carbon tax on industry, policymakers could plan prospectively and design policies that would impose responsibility from the point of technological infancy; they could consider what this Article will dub "dark cloud taxes."

Dark cloud taxes could impose on present and future polluters their share of adaptation costs. As in the case of the carbon tax discussion above, the match is not perfect. Some adaptation is attributable to the generations of emissions that resulted from the "old" economy, but that flaw in alignment should not excuse contributions from new polluters for their share of present and future responsibility.

Dark cloud taxes logically would fall within the domain of the federal government. The ability of states to tax the cloud is riddled with legal **[*856]** complexities, [n219] but more fundamentally, federal taxes synchronize with the boundary-less nature of cloud services and the advisability of having a consistent, nationwide approach to the cloud. Moreover, the boundary-less cloud logically could contribute to some of the geographically expansive adaptation problems. For example, revenue might be especially appropriate for federal investments in building the resilience of the electricity and telecommunications grids, upon which the cloud is so dependent. Dark cloud taxes may, in some instances, thus serve to implement both a polluter-pays approach and a beneficiary-pays approach.

Dark cloud taxes might target different components of cloud services in different ways. For example, data centers could be taxed based on the carbon profile of their energy consumption, thus imposing a higher tax on centers heavily dependent on electricity produced from coal than on those that draw more on renewable energy. This form of dark cloud tax would link directly to the environmental consequences of increased dependence on data centers. It could not only secure funding for long-term adaptation needs but also raise awareness of data centers' emissions profiles, influence choices about energy sources, and highlight the need for greater energy efficiency. [n220]

Alternatively, purchasers of network services could be subject to a tax correlated to usage as a proxy for emissions. This approach would target the actual carbon footprint less precisely, given the potential difficulty of precisely matching upstream actual emissions profiles with consumers' actual downstream network usage. However, until such time as clean energy sources predominantly fuel the cloud, it could provide some rough justice allocation of future adaptation costs. Although some might perceive a tax as imposing an inappropriate burden on access to an important engine of communication and the economy, [n221] the tax would assign responsibility **[*857]** for emissions and send an educational signal that might encourage energy conservation and reliance on renewable resources.

Either approach would serve as a surrogate for a carbon tax on the primary emitters. As a result, dark cloud taxes would remain viable only if the government does not fully execute the adaptation carbon tax option described above--or if a broader carbon tax or some other carbon pricing mechanism does not fully internalize environmental costs of climate change, including adaptation.

It is important also to note that this dark cloud tax concept is fundamentally different from other cloud tax issues that have been discussed in policy and academic circles, such as whether states should tax network services or products sold over the Internet and how to tax income generated by cloud services for income tax purposes. [n222] Those tax issues do not rest on the cloud's environmental footprint; the distinguishing feature of the dark cloud tax concept is that it focuses on the environmental implications of the cloud.

While this Article can only introduce the general concept of environmental cloud taxes on a preliminary, tentative basis, the next step would be to explore design details. One of the critical issues for further analysis is which services and products would be taxed. There is, of course, the foundational question whether to focus on data centers or network services, but other issues exist as well. For example, would a tax be limited to cloud services or also include non-cloud data centers and internal networks--and how do tax and environmental policy rationales influence those decisions? [n223] Emissions accounting protocols under development may help inform the development of design details, both in terms of identifying the most environmentally appropriate tax base (what would be taxed) and **[*858]** administratively feasible points of

taxation. [n224] There is also the possibility that dark cloud taxes might be integrated into a broader tax linked to other features of the cloud, such as e-waste and the need to fund cybersecurity measures.

For purposes of this Article, however, the basic point is that policymakers could consider the idea of taxing a burgeoning activity that will generate additional emissions in the future and contribute to adaptation demands. Dark cloud taxes could generate earmarked revenue to help cover those costs. In addition to funding adaptation, the mere imposition of the taxes could help change behavior. The taxes could create a financial incentive for data centers to focus on the carbon profile of electric utilities and energy efficiency, not just on the cost of electricity. [n225] Importantly, they could also raise consumer awareness that the cloud is neither invisible nor clean as our electronic appetite grows. Accelerated usage will add environmental costs, many of which will be borne by the generations of the future.

3. Adaptation Fees or Taxes on Impervious Surfaces

One of the consequences of extreme storm events is heightened levels of intense precipitation and resulting flooding. Impervious surfaces accelerate the amount of stormwater runoff because they reduce the landscape's natural ability to absorb rainfall, and they contribute to flash flooding. [n226] According to one report, an acre of parking lot generates sixteen times more runoff than an acre of meadow. [n227] As a result, adaptation to climate change calls for coping with increased runoff, reducing the amount of impervious surfaces, and using green infrastructure measures to improve the landscape's ability to assimilate precipitation and runoff. A tax or fee on impervious surfaces could both provide funding to finance gray and green infrastructure measures and create an incentive to minimize impervious surfaces.

[*859] Although the ultimate polluters are those who generate the greenhouse gas emissions that provoke the need for adaptation, landowners and managers who rely heavily on impervious surfaces are also implicated in that they contribute to the need for adaptation. They are also the beneficiaries of government services that deal with the consequences of their pollution. Hence, fees or taxes on impervious surfaces link to the polluter-pays and beneficiary-pays principles and reduce the need to place costs on the general public.

For several decades, the United States has regulated stormwater runoff to control flooding [n228] and more recently to protect **water** quality under the federal Clean **Water** Act. [n229] In the context of climate change adaptation, the focus is more directly on **water** quantity than **water** quality, but increased flows of stormwater inevitably invoke issues of **water** quality as well. Heavy downpours can overwhelm wastewater systems, causing flooding and the release of untreated stormwater and wastewater into **water** bodies. [n230] Although the federal government can incorporate stormwater quantity considerations into its Clean **Water** Act programs and funding mechanisms, [n231] climate change is very likely to exacerbate the gap between currently available funding for **water** infrastructure projects and future needs. [n232] Furthermore, the responsibility for implementing stormwater **[*860]** control measures rests largely with the states and therefore with local governments. [n233] The increased level of funding that will be necessary and the emphasis on local-level control over stormwater management each create a logical match between local responsibilities and local funding mechanisms, such as fees or taxes.

A large number of local governmental bodies or **water** authorities around the United States--over 1,400 in 2013--are already using fees on impervious surfaces to help finance stormwater control measures under a system called "stormwater utilities." [n234] The "utility," which is usually more in the nature of a financing mechanism than a service-providing utility, collects the fees and disperses the revenue for stormwater programs. [n235] For example, the State of Maryland recently required counties and municipalities subject to the Clean **Water** Act's stormwater discharge requirements to impose a fee on impervious surfaces, the revenue from which must be dedicated to the implementation of stormwater management plans. [n236] The legislation allows each governmental body to design the structure and rate of the fee, including relief when landowners implement advanced stormwater management practices or use stormwater management facilities. [n237]

Nationwide, about 80% of the stormwater utilities base their fees on units of impervious area (known as "Equivalent Residential Units"), creating a "you pave, you pay" system that operates regardless of the

relative proportion of impervious and pervious surfaces on the property. [n238] Others base the fee on the percentage of impervious area relative to the whole (known as the "Intensity of Development" system) or on the basis of runoff from both impervious and pervious areas, with lower rates for the pervious areas (known as the "Equivalent Hydraulic Area"). [n239] As of 2013, **[*861]** the three states hit hardest by Hurricane Sandy--New York, New Jersey, and Connecticut--did not have any fee-based stormwater utilities. [n240]

The stormwater utility concept could be readily expanded to cover the need to adapt to higher levels of stormwater associated with climate change. Existing stormwater utilities could adjust their rates to provide the financing necessary to invest in higher levels of protection against runoff, and local or county governments without existing programs could institute fees, provided they either have or obtain the state legal authority to impose fees. Such an approach would maximize the co-benefits of improving **water** quality and coping with current and increased quantities of stormwater. It could also change behavior by creating a financial incentive for landowners to both minimize impervious surfaces and invest in green infrastructure or stormwater reduction measures. One would, of course, need to coordinate the fees with other programs that create incentives. For example, New York City offers a one-year property tax abatement for the construction of a green roof. [n241] If New York City were to create a stormwater utility and impose a fee on impervious surfaces, it might instead want to provide a feereduction for green roofs.

The revenue from fees or taxes on impervious surfaces could be used to invest in measures that help control flooding and reduce runoff, including investments in green infrastructure. If structured as a fee, the relationship between the cost imposed on properties and the mitigation or treatment benefit provided by the use of the funds would need to be sufficiently reasonable to avoid a legal challenge that the fee is instead a tax. [n242] A local jurisdiction would, of course, need to be sure that it has the legal authority to impose these measures.

One might also consider the use of this technique at levels of government higher than the municipal or county level. For example, it might be possible to create a stormwater utility on a multi-jurisdictional watershed basis, provided that upstream payers receive some benefit from downstream investments if the utility imposes a fee. In addition, one would **[*862]** consider the relationship to existing environmental regulatory regimes. Where environmental regulatory regimes create regional **water** quality standards, such as in the multi-state Chesapeake Bay area, [n243] a regional or state-level approach might be attractive. Expanding the use of fees or taxes on impervious surfaces is not necessarily politically easy. As Maryland found, it is easy for opponents to call the fees a "rain tax," [n244] artfully invoking both antipathy toward taxes and the thought that people are paying for something that falls from the heavens over which they have no control.

4. Real Estate Transfer Taxes

Another source of revenue for climate change adaptation might be real estate transfer taxes. Real estate transfers in themselves do not generate greenhouse gas emissions, but they arguably bear some links to the need for extreme weather adaptation measures. As indicated in the discussion of impervious surfaces, the built environment contributes to stormwater runoff, creating secondary polluter status. It also can place people in locations where they are at risk of flooding or storm surges, where they may be beneficiaries in need of assistance. Even transfers of undeveloped land can embody a linkage because transfers often lead to new development. Although modest increases in real estate transfer taxes are not likely to significantly change behavior, [n245] they can provide funding to help finance ameliorating adaptation measures. For example, they could help fund stormwater control programs under the polluter-pays approach, such as the purchase of open space or financing of green streets, or measures that would protect vulnerable areas against storm surges under the beneficiary-pays approach, such as **water** walls or restoring natural shorelines.

As in the case of stormwater utilities, some jurisdictions in the United States have a history of using real estate transfer taxes to fund environmental purposes. The State of New York, for example, imposes a $ 2 tax on every $ 500 of sales price, [n246] the proceeds of which are deposited in **[*863]** its Environmental Protection Fund. [n247] Money in the Fund is allocated by the annual state budget to a variety of purposes

including open space protection. [n248] In 2014, over 100 environmental groups asked the State to increase allocations to the Fund to help "'municipalities to become more resilient and reduce risks from storm impacts.'" [n249] When authorized by state legislation, local communities can also impose dedicated transfer taxes, as has happened in the Peconic Bay area of Long Island, New York. [n250] Using the funds specifically for adaptation purposes may require revisions in the enabling legislation. [n251]

Investment of the revenue in adaptation can also produce co-benefits. For example, using funds to protect open space that can help reduce stormwater runoff or protect populations from storm surges and flooding can yield other ecological benefits, such as habitat preservation and protection of groundwater recharge areas. At the same time, the investment decisions should consider the role of other programs. For example, local funds that might be used to move current development out of the floodplain should be coordinated with FEMA's Hazard Mitigation Fund, which can help finance the removal of vulnerable structures from high-risk flooding areas.

Real estate transfer taxes are not the only way to associate the costs of adaptation with the development that exacerbates the need for adaptation or that needs protection from climate change impacts. Stormwater utilities could achieve some of the same goals, as described above. Exaction fees imposed at the time of new development can contribute to necessary green and gray public infrastructure, although those fees do not apply to existing development. Local governments also have the opportunity to create special assessment districts, which can impose the cost of new, protective infrastructure on those directly benefiting. [n252] Real estate transfer taxes, however, offer the benefit of generally occurring when money is changing hands in the course of transactions. They may also provide greater **[*864]** flexibility over the use of the revenue than the tighter burden-to-benefit linkage underlying exactions and special assessment districts.

It is appropriate to consider the use of real estate transfer taxes at the state and local level, rather than at the federal level. While the federal government and many states tax the gains generated by the sale of property, states have traditionally maintained control over real estate transfer taxes, applying a percentage tax to the sales price. Adjusting real estate transfer tax rates and purposes to address adaptation would follow this traditional allocation of taxation practices. As the New York transfer taxes illustrate, the taxes could operate at the state or local levels, subject to how taxing authority is distributed in any particular state. State or regional level taxes create the opportunity to coordinate adaptation funding goals on a broader watershed perspective than municipal taxes might allow.

5. A Brief Synthesis

The following chart captures some of the analytical highlights of these proposals.

Table 1: Possible Adaptation Taxes for Extreme Weather Events (Storms)

Tax	Level of government	Linkage between adaptation needs and taxpayer/tax base
Carbon tax	Federal	Present and future emitters pay for collective sins of the past, assume responsibility for their emissions, and invest in future resilience
Dark cloud taxes	Dark cloud taxes	Present and future emitters contribute to future adaptation needs from start of new technology's growth
Impervious	Local or	Contributors to runoff pay

Tax	Level of government	Linkage between adaptation needs and taxpayer/tax base
surface taxes and fees	regional	for measures to reduce or control
Real estate transfer taxes	State, regional, local	Built environment contributes to exposure to climate change risks

Tax	Use of revenue
Carbon tax	Immediate disaster relief; infrastructure investments of national significance; funding for infrastructure bank
Dark cloud taxes	Investments in e-related adaptation measures, such as resilience of grid
Impervious surface taxes and fees	Resilience of local **water** systems; investments in green infrastructure
Real estate transfer taxes	Investments in defensive systems; relocation projects; land conservation

[*865] The suggestions above serve as examples of possible fiscal instruments that could fund adaptation. They share similarities but also illustrate differences. They all bear some attributes of a polluter-pays and/or a beneficiary-pays approach, linking either responsibility or benefit to the obligation to pay. They all fall short of pure cost-internalization standards under a Pigouvian ideal. Therefore they may not influence behavior in the optimal fashion under economic theory, but they nonetheless can send an informational message about the linkage between human activities and climate change that may help change attitudes in a more subtle fashion. They all create dedicated funding sources that would be used for adaptation. In doing so, they offer the policymakers and administrators who design the programs flexibility to determine the most cost-effective and prudent forms of adaptation investments--although the details of implementation lie beyond the scope of this Article. They differ in terms of the level of government at which they would operate, determined in accordance with the level of government most involved with the adaptation activities on which the new revenue would be spent and in light of traditional and legal differentiations of taxing authority among different levels of government. The carbon and cloud taxes would constitute new taxes; the taxes or fees on impervious surfaces and real estate transactions build on systems that already exist and therefore may be politically easier to implement.

Each of these proposals and others that might be included in Table 1 must be judged against a much more sophisticated matrix of funding alternatives than this Article allows. Such a matrix would start with a

more detailed analysis of the existing funding programs for various types of adaptation measures at all levels of government in order to identify the existing policy infrastructure and gaps in both coverage and levels of funding. It would incorporate the full range of government financing options, such as current-year financing through the use of general revenue, bond financing, grants from various levels of government, and resources from the philanthropic sector: The merits of new fiscal instruments that finance dedicated funds must be examined against the alternatives. The matrix would also include ways in which governments can prepare for adaptation without direct spending, such as use of their regulatory power and, in particular, their land use planning authority.

A fundamental part of the analysis of alternatives inevitably will involve the question whether it is appropriate to create new streams of revenue for a dedicated purpose--adaptation. A dedicated revenue source will at least partially remove adaptation from the political jockeying that inherently accompanies the annual budget-making process at all levels of government when multiple priorities must compete for limited dollars. That **[*866]** removal may be particularly important for adaptation measures, given the public health and safety at stake and the need for investments that may be disproportionately large in relation to normal budgetary demands. However, the creation of dedicated funds of any magnitude represents a substantial reorientation of customary governmental budgetary procedures. It also brings center-front the policy question of how a society with limited dollars should allocate its resources between mitigation and adaptation. This Article has argued that governments need to start setting aside funds for increased investment in adaptation, but it recognizes that adaptation alone is not sufficient. The matrix for considering policy instruments that promote adaptation must also include current and potential climate change mitigation measures. Those measures will not only affect the analysis of future adaptation needs but also allocation of costs across the public and private sectors of society. The question of who should pay for adaptation, and how much, cannot be divorced from the question of who bears the cost of mitigation.

CONCLUSION

As Hurricane Sandy illustrates, extreme weather poses tremendous fiscal challenges for federal, state, and local governments. With relatively few dedicated funds on hand, they must scramble to try to meet the immediate need to respond and rebuild. The insurance market offers only limited assistance in covering losses. Governments also need the resources to invest in building resilience against future threats even if they have not yet experienced disaster. Governments at all levels should look for new sources of tax revenue to dedicate to adaptation to extreme weather events--and to the full range of adaptation needs. Hurricane Sandy serves as a microcosm of a much larger universe of adaptation needs.

The tax and fee proposals portrayed above are far from an all-inclusive list of the potential to use environmentally related taxes or fees to provide funding for climate change adaptation. They serve only to illustrate the potential role of green taxes and some of the conceptual issues that might arise. The particular taxes that one might use for any particular adaptation need will depend on the type of adaptation action, an assessment of who most logically should bear the cost, and the appropriate level of government that should serve as the tax collector and dispenser of funds. There is no one right set of answers, given the breadth of policy and political questions involved. However, the time has arrived to start seriously considering the funding options in light of the significant gaps we face between the need for adaptation and the resources currently at hand.

Legal Topics:

For related research and practice materials, see the following legal topics:
Energy & Utilities LawElectric Power IndustryState RegulationGeneral OverviewEnvironmental LawClimate ChangeReal Property LawZoning & Land UseBuilding & Housing Codes

FOOTNOTES:

n1 There is a direct relationship between mitigation and adaptation, given that the degree of mitigation will affect the level of climate change impacts and therefore the extent of adaptation. In addition, some mitigation measures, such as land use practices, can also serve adaptation purposes. However, this Article focuses solely on the adaptation side of the equation.

n2 Rosina Bierbaum et al., *Adaptation*, *in* U.S. GLOBAL CHANGE RESEARCH PROGRAM, CLIMATE CHANGE IMPACTS IN THE UNITED STATES: THE THIRD NATIONAL CLIMATE ASSESSMENT 671, 687 (Jerry M. Melillo et al. eds., 2014), *available at* http://downloads.globalchange.gov/usimpacts/pdfs/climate-impacts-report.pdf.

n3 According to a recent European study, extreme weather events also are very likely to trigger adaptation actions, putting them center-front in the adaptation discussion. EUROPEAN ENV'T AGENCY, NATIONAL ADAPTATION POLICY PROCESSES IN EUROPEAN COUNTRIES--2014, at 23, 24 fig.2.1, 34 (2014).

n4 NOAA, U.S. DEP'T OF COMMERCE, HURRICANE/POST-TROPICAL CYCLONE SANDY, OCTOBER 22-29, 2012, at iv (2013), *available at* http://www.nws.noaa.gov/os/assessments/pdfs/Sandy13.pdf.

n5 *See infra* Part II.D.

n6 Two existing international programs are the Green Climate Fund and the Climate Investment Funds. For an overview of each, see generally RICHARD K. LATTANZIO, CONG. RESEARCH SERV., R41889, INTERNATIONAL CLIMATE CHANGE FINANCING: THE GREEN CLIMATE FUND (GCF) (2014) [hereinafter GREEN CLIMATE FUND], *available at* http://fpc.state.gov/documents/organization/235012.pdf, and RICHARD K. LATTANZIO, CONG. RESEARCH SERV., R41302, INTERNATIONAL CLIMATE CHANGE FINANCING: THE CLIMATE INVESTMENT FUNDS (CIFS) (2013) [hereinafter CLIMATE INVESTMENT FUNDS], *available at* http://fpc.state.gov/documents/organization/210682.pdf.

n7 C.B. Field et al., *Summary for Policymakers*, *in* INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE (IPCC), CLIMATE CHANGE 2014: IMPACTS, ADAPTATION, AND VULNERABILITY, PART A: GLOBAL AND SECTORAL ASPECTS 1, 5 (C.B. Field et al. eds., 2014).

n8 John Handmer et al., *Changes in Impacts of Climate Extremes: Human Systems and Ecosystems*, *in* IPCC, MANAGING THE RISKS OF EXTREME WEATHER EVENTS AND DISASTERS TO ADVANCE CLIMATE CHANGE ADAPTATION 231, 264-65 (C.B. Field et al. eds., 2012), *available at* https://www.ipcc.ch/pdf/special-reports/srex/SREX_FD_SPM_final.pdf. Note that some definitions of resilience include both pre-disaster mitigation and post-disaster recovery. *E.g.*, NAT'L RESEARCH COUNCIL, REDUCING COASTAL RISK ON THE EAST AND GULF COASTS 19-20 (2014), *available at* http://www.nap.edu/download.php?record_id=1881.

n9 It is difficult to estimate the costs of the impacts of climate change for a variety of reasons. Douglas J. Arent et al., *Key Economic Sectors and Services, in* IPCC, CLIMATE CHANGE 2014: IMPACTS, ADAPTATION, AND VULNERABILITY, PART A: GLOBAL AND SECTORAL ASPECTS 659, 663 (C.B. Field et al. eds., 2014), *available at* http://ipcc-wg2.gov/AR5/.

n10 Muyeye Chambwera et al., *Economics of Adaptation, in* IPCC, CLIMATE CHANGE 2014: IMPACTS, ADAPTATION, AND VULNERABILITY, PART A: GLOBAL AND SECTORAL ASPECTS 945, 959 (C.B. Field et al. eds., 2014), *available at* http://ipcc-wg2.gov/AR5/.

n11 *Id.* For a discussion of studies of adaptation costs for extreme climate events and disasters and the uncertainties in assessing costs, see Handmer et al., *supra* note 8, at 273-74.

n12 Field et al., *supra* note 7, at 8.

n13 *Id.* at 26.

n14 *Id.* at 28.

n15 *See, e.g.*, Bierbaum et al., *supra* note 2, at 671 (citing "limited funding" as a key barrier to implementing adaptation); EUROPEAN ENV'T AGENCY, *supra* note 3, at 25 (citing "lack of financial/human resources" as one of "three most commonly reported barriers").

n16 ANDRIES HOF ET AL., PBL NETHERLANDS ENVTL. ASSESSMENT AGENCY, COSTS AND BENEFITS OF CLIMATE CHANGE ADAPTATION AND MITIGATION: AN ASSESSMENT ON DIFFERENT REGIONAL SCALES 14 (2014), *available at* http://www.pbl.nl/sites/default/files/cms/publicaties/PBL_2014_Costs_and_benefits_of_climate_change_adaption_and_mitigation_1198.pdf .

n17 Directive 2009/29/EC of the European Parliament and of the Council of 23 April 2009 Amending Directive 2003/87/EC So As to Improve and Extend the Greenhouse Gas Emissions Allowance Trading Scheme of the Community, 2009 O.J. (L 140) 63, 71-72, *available at* http://faolex.fao.org/docs/pdf/eur88008.pdf.

n18 GREEN CLIMATE FUND, *supra* note 6, at 1; CLIMATE INVESTMENT FUNDS, *supra* note 6, at 1.

n19 M. Mullan et al., *National Adaptation Planning: Lessons from OECD Countries* 61 (OECD Environment, Working Paper No. 54, 2013), *available at* http://www.oecd-ilibrary.org/docserver/download/5k483jpfpsq1.pdf?expires=1421596783&id=id&accname=guest&checksum=235FEBF46FDDBD2727F78F064183069A.

n20 *See, e.g.*, Chambwera et al., *supra* note 10, at 964; Samuel Fankhauser et al., *Economic and Policy Instruments to Promote Adaptation, in* ORG. FOR ECON. COOPERATION & DEV., ECONOMIC ASPECTS OF ADAPTATION TO CLIMATE CHANGE: COSTS, BENEFITS AND POLICY INSTRUMENTS 85, 85-133 (Shardul Agrawala & Samuel Fankhauser eds., 2008), *available at* http://www.riesgoycambioclimatico.org/biblioteca/archivos/DC1082.pdf (focusing on three economic implements and their ability to incent adaptive behavior).

n21 Bierbaum et al., *supra* note 2, at 687.

n22 *Id.* at 671.

n23 JANE A. LEGGETT ET AL., CONG. RESEARCH SERV., R43227, FEDERAL CLIMATE CHANGE FUNDING FROM FY2008 TO FY2014, at 12 (2013), *available at* http://fas.org/sgp/crs/misc/R43227.pdf. Only the Department of the Interior explicitly reported its adaptation expenditures, making it difficult to calculate government-wide adaptation spending, and even the Department of Interior's adaptation expenses amounted to under 1% of the climate change spending for all agencies in fiscal year 2013. *Id.*

n24 THE WHITE HOUSE, EXEC. OFFICE OF THE PRESIDENT, THE PRESIDENT'S CLIMATE ACTION PLAN 12 (2013) [hereinafter PRESIDENT'S CLIMATE ACTION PLAN], *available at* http://www.whitehouse.gov/sites/default/files/image/president27sclimateactionplan.pdf.

n25 Exec. Order No. 13,653, §§ 2, 5, 3 C.F.R. 330, 331, 333 (2014). Federal agencies have been charged since 2009 with developing adaptation assessments. Exec. Order No. 13,514, § 8(i), 3 C.F.R. 248, 255 (2010).

n26 Exec. Order No. 13,653 § 6(a), (e), 3 C.F.R. 334, 335 (2014).

n27 *Id.* § 7.

n28 U.S. DEP'T OF STATE, UNITED STATES CLIMATE ACTION REPORT 2014, at 160 (2014) [hereinafter U.S. CLIMATE ACTION REPORT 2014], *available at* http://www.state.gov/documents/organization/219038.pdf.

n29 U.S. GLOBAL CHANGE RESEARCH PROGRAM, CLIMATE CHANGE IMPACTS IN THE UNITED STATES: THE THIRD NATIONAL CLIMATE ASSESSMENT (Jerry M. Melillo et al. eds., 2014) [hereinafter THIRD NATIONAL CLIMATE ASSESSMENT], *available at* http://downloads.globalchange.gov/usimpacts/pdfs/climate-impacts-report.pdf.

n30 *See supra* notes 9-10 and accompanying text.

n31 THIRD NATIONAL CLIMATE ASSESSMENT, *supra* note 29, app. 6 at 826.

n32 Bierbaum et al., *supra* note 2, at 687.

n33 *Id.* at 671.

n34 U.S. CLIMATE ACTION REPORT 2014, *supra* note 28, at 160-70; *see also* Bierbaum et al., *supra* note 2, at 672-80 (cataloging federal, state, tribal, and local adaptation measures).

n35 U.S. CLIMATE ACTION REPORT 2014, *supra* note 28, at 19-28, 173-94.

n36 U.S. GOV'T ACCOUNTABILITY OFFICE, GAO-13-283, HIGH-RISK SERIES: AN UPDATE 61-74 (2013), *available at* http://www.gao.gov/assets/660/652133.pdf.

n37 Lori Montgomery, *Forget the National Debt. The New Budget Threat Is Climate Change*, WASH. POST (Sept. 19, 2014), http://www.washingtonpost.com/blogs/wonkblog/wp/2014/09/19/forgetthe-national-debt-the-new-budget-threat-is-climate-change/.

n38 *See* OFFICE OF MGMT. & BUDGET, EXEC. OFFICE OF THE PRESIDENT, BUDGET OF THE UNITED STATES GOVERNMENT, FISCAL YEAR 2016, at 23-24 (2015) [hereinafter 2016 BUDGET], *available at* https://www.whitehouse.gov/omb/budget/Overview (citing, *inter alia*, that climate-related extreme weather events and fires cost the federal government $ 300 billion over the past decade); OFFICE OF MGMT. & BUDGET, EXEC. OFFICE OF THE PRESIDENT, FISCAL YEAR 2016 ANALYTICAL PERSPECTIVES OF THE U.S. GOVERNMENT 353-57 (2015) (elaborating on the federal government's exposure to climate risks), *available at* https://www.whitehouse.gov/omb/budget/Analytical_Perspectives.

n39 *See* 2016 BUDGET, *supra* note 38, at 19-25 (outlining the White House's proposals for federal programs to increase resilience).

n40 A "climate extreme," which includes extreme weather or climate events, is "[t]he occurrence of a value of a weather or climate variable above (or below) a threshold value near the upper (or lower) ends of the range of observed values of the variable." Simon K. Allen et al., *Summary for Policymakers*, *in* IPCC, MANAGING THE RISKS OF EXTREME EVENTS AND DISASTERS TO ADVANCE CLIMATE CHANGE ADAPTATION 1, 5 Box SPM.1 (C.B. Field et al. eds., 2012), *available at* http://ipcc-wg2.gov/SREX/report/.

n41 *See id.* at 9 (noting that, due to uncertainties in tropical cyclone modeling, ascribing any one weather event to climate change or human activity is "challenging").

n42 *See, e.g.*, Barack Obama, President of the United States, Remarks at Hurricane Preparedness Briefing at FEMA Headquarters, Washington, D.C. (May 30, 2014), *available at* http://www.whitehouse.gov/the-press-office/2014/05/30/remarks-president-hurricane-preparednessbriefing (explaining the frequency and severity of storms like Hurricane Sandy that can be expected in the future).

n43 William Sweet et al., *Hurricane Sandy Inundation Probabilities Today and Tomorrow*, 94 BULL. AM. METEOROLOGICAL SOC'Y (Explaining Extreme Events of 2012 From a Climate Persp.) S17, S17-20, *available at* http://www.ametsoc.org/2012extremeeventsclimate.pdf.

n44 *See, e.g.*, HURRICANE SANDY REBUILDING TASK FORCE, HURRICANE SANDY REBUILDING STRATEGY: STRONGER COMMUNITIES, A RESILIENT REGION 3, 33 (2013), *available at* http://portal.hud.gov/hudportal/documents/huddoc?id=hsrebuildingstrategy.pdf.

n45 *Id.* at *passim*.

n46 Field et al., *supra* note 7, at 22-23.

n47 *See, e.g.*, Patrick McGeehan, *Repairs to New York Tunnel Will Limit Rail Service*, N.Y. TIMES (Oct. 2, 2014), http://www.nytimes.com/2014/10/02/nyregion/repairs-to-new-york-tunnels-willlimit-rail-service.html (reporting that Amtrak is sharply curtailing subway services in the tunnels leading in and out of New York City to repair damage from Hurricane Sandy); Liz Robbins, *After the Storm, 20 Months in Limbo*, N.Y. TIMES (June 20, 2014), http://www.nytimes.com/2014/06/22/nyregion/after-thestorm-20-months-in-limbo.html (reporting that many houses in pockets of the city, especially Brooklyn, remain storm-damaged).

n48 See *infra* Part II.C, D.

n49 John Walsh et al., *Our Changing Climate, in* U.S. GLOBAL CHANGE RESEARCH PROGRAM, CLIMATE CHANGE IMPACTS IN THE UNITED STATES: THE THIRD NATIONAL CLIMATE ASSESSMENT 19, 27 (Jerry M. Melillo et al. eds., 2014), *available at* http://downloads.globalchange.gov/usimpacts/pdfs/climate-impacts-report.pdf.

n50 RISKY BUSINESS PROJECT, RISKY BUSINESS: THE ECONOMIC RISKS OF CLIMATE CHANGE IN THE UNITED STATES 3 (2014), *available at* http://riskybusiness.org/uploads/files/RiskyBusiness_PrintedReport_FINAL_WEB_OPTIMIZED.pdf.

n51 NOAA, *supra* note 4, at 1.

n52 *Id.* at iv.

n53 *Id.* at 12.

n54 *Id.*

n55 *Id.* at 1.

n56 *Id.* at 16.

n57 *Id.* at 1.

n58 *Id.* at 13-14.

n59 HURRICANE SANDY REBUILDING TASK FORCE, *supra* note 44, at 19-20. Metropolitan New York includes northern New Jersey. *Id.* at 19.

n60 NOAA, *supra* note 4, at 1.

n61 *Id.* at 13-14.

n62 *Id.* at 1. The deaths occurred in eight states, with the majority in New York (forty-eight) but others ranging from West Virginia to New Hampshire. *Id.*

n63 ERIC S. BLAKE ET AL., NAT'L HURRICANE CTR., TROPICAL CYCLONE REPORT: HURRICANE SANDY 14 (2013), *available at* http://www.nhc.noaa.gov/data/tcr/AL182012_Sandy.pdf.

n64 NOAA, *supra* note 4, at 1.

n65 *Id.* at iv.

n66 *Id.* at 14.

n67 *Id.* at 1.

n68 CITY OF NEW YORK, A STRONGER, MORE RESILIENT NEW YORK 13 (2013) [hereinafter A STRONGER, MORE RESILIENT NEW YORK], *available at* http://www.nyc.gov/html/sirr/html/report/report.shtml.

n69 *Id.* at 87.

n70 *Id.* at 13.

n71 NYCRECOVERY, CITY OF NEW YORK ACTION PLAN INCORPORATING AMENDMENTS 1-7, at 11-12 (2014) [hereinafter NEW YORK ACTION PLAN], *available at* http://www.nyc.gov/html/cdbg/downloads/pdf/CDBG-DR-Action-Plan-incorporating-Amendments-1-7_12-04-14.pdf.

n72 HURRICANE SANDY REBUILDING TASK FORCE, *supra* note 44, at 25.

n73 *Id.* at 26.

n74 *Id.* at 25.

n75 *Id.* at 27. New York City estimated that failures in its wastewater systems resulted in 562 million gallons of sewage overflow. N.Y.C. DEP'T ENVTL. PROT., NYC WASTEWATER RESILIENCY PLAN: CLIMATE RISK ASSESSMENT AND ADAPTATION STUDY 5 (2013), *available at* http://www.nyc.gov/html/dep/html/about_dep/wastewater_resiliency_plan.shtml.

n76 HURRICANE SANDY REBUILDING TASK FORCE, *supra* note 44, at 27-28.

n77 FEMA, HURRICANE SANDY RECOVERY EFFORTS ONE YEAR LATER 1 (2013) [hereinafter HURRICANE SANDY RECOVERY EFFORTS ONE YEAR LATER], *available at* http://www.fema.gov/medialibrary-data/1382967173777-7411aa1b6d729a8a97e84dbba62083d8/FEMA+Sandy+One+Year+Fact+Sheet_508.pdf.

n78 NOAA, *supra* note 4, at 1.

n79 ECON. & STATISTICS ADMIN., U.S. DEP'T OF COMMERCE, ECONOMIC IMPACT OF HURRICANE SANDY: POTENTIAL ECONOMIC ACTIVITY LOST AND GAINED IN NEW JERSEY AND NEW YORK 17 (2013), *available at* http://www.esa.doc.gov/sites/default/files/sandyfinal101713.pdf; *see also* FRAN SUSSMAN ET AL., CLIMATE CHANGE: AN UNFUNDED MANDATE 11 (2013), *available at* http://cdn.americanprogress.org/wp-content/uploads/2013/10/ClimateUnfundedMandate-REPORT.pdf (breaking the New York cost estimate into several components).

n80 ECON. & STATISTICS ADMIN., *supra* note 79, at 17 tbl.4.

n81 SUSSMAN ET AL., *supra* note 79, at 11.

n82 *Id.*

n83 HURRICANE SANDY REBUILDING TASK FORCE, *supra* note 44, at 24.

n84 ECON. & STATISTICS ADMIN., *supra* note 79, at 24.

n85 Jeroen C.J.H. Aerts et al., *Evaluating Flood Resilience Strategies for Coastal Megacities*, SCIENCE, May 2, 2014, at 473, 474, *available at* http://www.scor.com/images/stories/pdf/library/news_media/J2014Science344_EvaluatingFloodResilience.pdf.

n86 U.S. DEP'T OF HOMELAND SECURITY, NATIONAL RESPONSE FRAMEWORK 8-9, 13-16 (2d ed. 2013), *available at* http://www.fema.gov/media-library-data/20130726-1914-25045-1246/final_national_response_framework_20130501.pdf.

n87 FRANCIS X. MCCARTHY & JARED T. BROWN, CONG. RESEARCH SERV., R41981, CONGRESSIONAL PRIMER ON RESPONDING TO MAJOR DISASTERS AND EMERGENCIES 5 (2014), *available at* https://www.fas.org/sgp/crs/homesec/R41981.pdf.

n88 NAT'L RESEARCH COUNCIL, *supra* note 8, at 1, 19.

n89 42 U.S.C. § 5170 (2012).

n90 HURRICANE SANDY REBUILDING TASK FORCE, *supra* note 44, at 19.

n91 FEMA, A GUIDE TO THE DISASTER DECLARATION PROCESS AND FEDERAL DISASTER ASSISTANCE 2 (2014), *available at* http://www.fema.gov/media-library-data/20130726-1536-20490-8240/dec_proc.pdf.

n92 *Id.;* NAT'L RESEARCH COUNCIL, *supra* note 8, at 48.

n93 MCCARTHY & BROWN, *supra* note 87, at 7; *see generally* NAT'L RESEARCH COUNCIL, *supra* note 8, at 45-49 (explaining FEMA's role in disaster relief).

n94 MCCARTHY & BROWN, *supra* note 87, at 7-8.

n95 *Id.* at 3.

n96 HURRICANE SANDY RECOVERY EFFORTS ONE YEAR LATER, *supra* note 77, at 2.

n97 *One Year Later: Examining the Ongoing Recovery from Hurricane Sandy: Hearing Before the Comm. on Homeland Sec. & Governmental Affairs and Subcomm. on Emergency Mgmt., Intergovernmental Relations & the D.C.*, 113th Cong. (Nov. 6, 2013) (written Testimony of Craig Fugate, Administrator, FEMA), *available at* http://www.fema.gov/media-library-data/1387208691195-dda79568fbb827633b3e095d61fa9f7a/11-6-2013_ONE%20YEAR%20LATER_EXAMINING%20THE%20ONGOING%20RECOVERY%20FROM%20HURRICANE%20SANDY.pdf.

n98 *Sandy Recovery Office*, FEMA, http://www.fema.gov/sandy-recovery-office (last visited Apr.11, 2015).

n99 Exec. Order No. 13,632 § 1, 3 C.F.R. 328, 328 (2013).

n100 *Id.* § 2.

n101 *Id.* §§ 3, 5(a)(ii).

n102 *See* HURRICANE SANDY REBUILDING TASK FORCE, *supra* note 44, at 39-159 (offering sixty-nine recommendations on policy priorities for funding and offering strategies to rebuild, as well as methods for prevention and recovery from future flood related disasters).

n103 The plan is embodied in the report, A STRONGER, MORE RESILIENT NEW YORK, *supra* note 68.

n104 NEW YORK STATE SEA LEVEL RISE TASK FORCE, REPORT TO THE LEGISLATURE (2010), *available at* http://www.dec.ny.gov/docs/administration_pdf/slrtffinalrep.pdf.

n105 Handmer et al., *supra* note 8, at 269.

n106 *Swiss Re's Sigma on National Catastrophes and Man-made Disasters in 2012 Reports USD 77 Billion in Insured Losses and Economic Losses of USD 186 Billion*, SWISS RE (March 27, 2013), http://www.swissre.com/media/news_releases/nr_20130327_sigma_natcat_2012.html.

n107 *Id.* According to another report, $ 15.9 billion of these payments centered on New York and New Jersey, and the majority ($ 9 billion) covered commercial property owners. ECON. & STATISTICS ADMIN., *supra* note 79, at 7. Approximately half of the claims paid by private insurance were covered by reinsurance. *Id.*

n108 LLOYD DIXON ET AL., RAND CORP., FLOOD INSURANCE IN NEW YORK CITY FOLLOWING HURRICANE SANDY 17, 87-88 (2013), *available* at http://www.rand.org/content/dam/rand/pubs/research_reports/RR300/RR328/RAND_RR328.pdf (estimating 80% to 90% coverage for New York City both inside and beyond the then-mapped floodplain for large firms that pay more than $ 500,000 in premiums per year).

n109 A STRONGER, MORE RESILIENT NEW YORK, *supra* note 68, at 15; ECON. & STATISTICS ADMIN., *supra* note 79, at 7. Private insurers' commercial and residential policies generally exclude flooding, requiring people to seek a separate policy if they want to insure against risk, and premiums for catastrophic coverage are likely to be high. A STRONGER, MORE RESILIENT NEW YORK, *supra* note 68, at 94-95.

n110 DIXON ET AL., *supra* note 108, at 13, 18.

n111 National Flood Insurance Act, Pub. L. No. 90-448, 82 Stat. 572 (1968) (codified at 42 U.S.C. §§ 4011-33).

n112 42 U.S.C. § 4011 (2012).

n113 *Id.* §§ 4012a, 4106.

n114 U.S. GOV'T ACCOUNTABILITY OFFICE, GAO-09-20, FLOOD INSURANCE: OPTIONS FOR ADDRESSING THE FINANCIAL IMPACT OF SUBSIDIZED PREMIUM RATES ON THE NATIONAL FLOOD INSURANCE PROGRAM 12-13 (2008) [hereinafter U.S. GOV'T ACCOUNTABILITY OFFICE, FLOOD INSURANCE], *available at* http://www.gao.gov/assets/290/283427.pdf.

n115 FEMA, HAZARD MITIGATION ASSISTANCE UNIFIED GUIDANCE 23-24 (2013), *available at* http://www.fema.gov/media-library-data/15463cb34a2267a900bde4774c3f42e4/FINAL_Guidance_ 081213_508.pdf. FEMA will provide up to 100% of the cost of mitigating severe repetitive loss properties and 90% of the cost of repetitive loss properties, provided the state or tribal government has a FEMA-approved mitigation plan that addresses repetitive losses. *Id.* at 89-90

n116 U.S. GOV'T ACCOUNTABILITY OFFICE, GAO-11-297, FEMA: ACTION NEEDED TO IMPROVE ADMINISTRATION OF THE NATIONAL FLOOD INSURANCE PROGRAM 54-55 (2011), *available at* http://www.gao.gov/new.items/d11297.pdf.

n117 A STRONGER, MORE RESILIENT NEW YORK, *supra* note 68, at 97.

n118 The flood insurance rate map for New York City showing high-risk areas in the 100-year floodplain was based on data and modeling that was thirty years old. DIXON ET AL., *supra* note 108, at 7.

n119 A STRONGER, MORE RESILIENT NEW YORK, *supra* note 68, at 13.

n120 *Id.* at 15, 97. For example, in New York City, 55% of the one-to-four family buildings, which comprise 88% of the residential structures in the then-mapped high-risk area, had NFIP coverage. DIXON ET AL., *supra* note 108, at 13-14 & tbl.2.5. Of those with mortgages, only 65% had coverage, and for those without mortgages, only 21% had coverage. *Id.* at 16 tbl.2.6. The average annual premium for these types of structures was about $ 1,800 for properties that predated the FEMA maps and almost $ 1,000 for those built after the initial maps; outside the then-mapped floodplain, the premiums were in the neighborhood of $ 500. *Id.* at 18, 19 tbls.2.7 & 2.8.

n121 A STRONGER, MORE RESILIENT NEW YORK, *supra* note 68, at 97. One study suggests that only 5% to 10% of small businesses in New York City purchased flood insurance, regardless of whether they were inside or outside the floodplain, and when they did, they tended to rely on NFIP policies. DIXON, *supra* note 108, at 17-18.

n122 A STRONGER, MORE RESILIENT NEW YORK, *supra* note 68, at 96-97. NFIP caps the coverage, for example, at $ 250,000 for a single-family residence plus $ 100,000 for contents and at $ 500,000 for a commercial property plus $ 500,000 for contents. *Id.* at 95.

n123 *See generally* RAWLE O. KING, CONG. RESEARCH SERV., R40650, NATIONAL FLOOD INSURANCE PROGRAM: BACKGROUND, CHALLENGES, AND FINANCIAL STATUS (2012), *available at* https://www.fas.org/sgp/crs/misc/R40650.pdf (analyzing the NFIP and its current financial status).

n124 *Id.* at 18; *see also* NAT'L RESEARCH COUNCIL, *supra* note 8, at 49 (accounting for the high percentage (19%) of discounted policies by noting that houses built before flood-risk maps were eligible for subsidy).

n125 U.S. GOV'T ACCOUNTABILITY OFFICE, FLOOD INSURANCE, *supra* note 114, at 11-13.

n126 WILLIAM L. PAINTER & JARED T. BROWN, CONG. RESEARCH SERV., R42869, FY2013 SUPPLEMENTAL FUNDING FOR DISASTER RELIEF 20 (2013), *available at* https://www.fas.org/sgp/crs/misc/R42869.pdf. The storms of 2005 caused the federal government to raise the NFIP's borrowing authority in several steps, from $ 3.5 billion in 2005 to $ 20.725 billion in 2006. *Id.* As of November 2012, NFIP had paid $ 16.3 billion in claims from Hurricane Katrina. RAWLE O. KING, CONG. RESEARCH SERV., R42850, THE NATIONAL FLOOD INSURANCE PROGRAM: STATUS AND REMAINING ISSUES FOR CONGRESS 6 tbl.1 (2013) [hereinafter KING, R42850], *available at* https://www.fas.org/sgp/crs/misc/R42850.pdf.

n127 KING, R42850, *supra* note 126, at 5. As of January 2013, NFIP had processed over 140,000 claims ($ 1.7 billion). *Id.*

n128 Legislation passed in 2012 attempted to address the deficit situation by adjusting rates and mandating the creation of a reserve to avoid borrowing from the Treasury, but the ability to raise rates was partially curtailed by legislation in early 2014 that resulted from concerns about rapidly increasing rates. NAT'L RESEARCH COUNCIL, *supra* note 8, at 49-50.

n129 *See* Pub. L. No. 113-1, 127 Stat. 3 (2013) (codified as amended at 42 U.S.C. § 4016(a)) (increasing NFIP's borrowing authority from $ 20.725 billion to $ 30.425 billion).

n130 *See, e.g.*, Letter from Jeffrey D. Zients, Deputy Dir. for Mgmt., Office of Mgmt. & Budget, Exec. Office of the President, to the Honorable John Boehner, Speaker of the H. Reps. 1 (Dec. 7, 2012), *available at* http://www.whitehouse.gov/sites/default/files/supplemental_december_7_2012_hurricane_sandy_funding_needs.pdf.pdf (requesting funding and explaining that insurance does not cover "a significant amount of damage" from Hurricane Sandy).

n131 *Id.* at 2.

n132 *Id.*

n133 *Id.* at 1.

n134 *Id.* app. at 1

n135 *Id.* app. at 64

n136 Disaster Relief Appropriations Act, 2013, Pub. L. No. 113-2, 127 Stat. 4 (2013).

n137 PAINTER & BROWN, *supra* note 126, at 1-3, 4-8 tbl.1.

n138 The supplemental funding allowed the Army Corps of Engineers to proceed with projects that were previously authorized but unfunded. NAT'L RESEARCH COUNCIL, *supra* note 8, at 62.

n139 *Id.* at 4-8 tbl.1. Congress did not consistently distinguish among immediate response, rebuilding, and resilience. PAINTER & BROWN, *supra* note 126, at 41-42.

n140 BRUCE LINDSAY & JUSTIN MURRAY, CONG. RESEARCH SERV., R40708, DISASTER RELIEF FUNDING AND EMERGENCY SUPPLEMENTAL APPROPRIATIONS 6, 7 tbl.1 (2011), *available at* http://fas.org/sgp/crs/misc/R40708.pdf. Budget requests are based on: unspent, authorized funds; the five-year rolling average for "normal" disasters (with costs less than $ 500 million); and amounts still needed for past catastrophic events. *Id.* at 5. Hence they do not try to anticipate catastrophic events, such as Hurricane Sandy.

n141 For example, in its Action Plan seeking $ 1.8 billion in federal Community Development Block Grant funds, the State of New Jersey identified $ 31.8 billion in needs for housing, business, and infrastructure purposes, of which $ 29.7 billion had not yet been met by other sources. N.J. DEP'T OF CMTY. AFFAIRS, COMMUNITY DEVELOPMENT BLOCK GRANT DISASTER RECOVERY ACTION PLAN 2-2 tbl.2.1 (2013), *available at* http://www.state.nj.us/dca/announcements/pdf/CDBGDisasterRecoveryActionPlan. pdf. New York City identified $ 17.2 billion in unmet needs in the course of seeking $ 3 billion from the Block Grant Program. NEW YORK ACTION PLAN, *supra* note 71, at 34 tbl. The Block Grant program allocated $ 5.4 billion of the newly appropriated $ 16 billion to the first round of funding for the region; additional allocations will be made over time. N.J. DEP'T OF CMTY. AFFAIRS, *supra*, at 1-1.

n142 N.Y. STATE HOMES & CMTY. RENEWAL, OFFICE OF CMTY. RENEWAL, STATE OF NEW YORK ACTION PLAN FOR COMMUNITY DEVELOPMENT BLOCK GRANT PROGRAM DISASTER RECOVERY 59 (2013), *available at* http://www.nyshcr.org/Publications/CDBGActionPlan.pdf.

n143 A STRONGER, MORE RESILIENT NEW YORK, *supra* note 68. For other reports addressing New York City's needs and rebuilding strategies, see CITY OF NEW YORK, PLANYC: PROGRESS REPORT 2014 (2014); NEW YORK ACTION PLAN, *supra* note 71; and N.Y.C. DEP'T ENVTL. PROT., *supra* note 75.

n144 A STRONGER, MORE RESILIENT NEW YORK, *supra* note 68, at 401-02.

n145 *Id.* at 402-04.

n146 *Id.* at 401-06. Note that the city estimates that the housing recovery alone will cost $ 2.5 billion, $ 100 million of which will come from private insurance and philanthropy, *id.* at 401, again indicating how much of the burden falls on the government.

n147 Exec. Order No. 13,653, § 7, 3 C.F.R. 330, 335-36 (2014).

n148 PRESIDENT'S CLIMATE ACTION PLAN, *supra* note 24, at 13.

n149 PRESIDENT'S STATE, LOCAL, & TRIBAL LEADERS TASK FORCE ON CLIMATE PREPAREDNESS & RESILIENCE, RECOMMENDATIONS TO THE PRESIDENT, at i (2014), *available at* http://www.whitehouse.gov/sites/default/files/docs/task_force_report_0.pdf.

n150 *See, e.g., id.* at 6-8 (proposing overarching principles that can be advanced across the federal government that will support communities as they prepare for climate change).

n151 *Id.* at 35; *see also id.* at 40 (recommending that the government work with the private sector to develop "innovative funding platforms"). In July 2014, President Obama announced some federal initiatives that the Task Force inspired, but they appear to draw on existing funding mechanisms. *See* Press Release, Office of the Press Secretary, The White House, Fact Sheet: Taking Action to Support State, Local, and Tribal Leaders as They Prepare Communities for the Impacts of Climate Change (July 16, 2014), *available at* http://www.whitehouse.gov/the-press-office/2014/07/16/fact-sheettaking-action-support-state-local-and-tribal-leaders-they-pre (enumerating various agency funding opportunities, but not pointing to new funding sources for any).

n152 HURRICANE SANDY REBUILDING TASK FORCE, *supra* note 44, at 18, 39.

n153 *Id.* at 65, 95, 140. A New York City plan for resiliency post-Sandy indicates the city's support for $ 1 billion of investments in utilities that could be recovered through utility rates but assumes that any adjustments to rates would be minimal given capital funding already in the rates, modifications of priorities, and savings. A STRONGER, MORE RESILIENT NEW YORK, *supra* note 68, at 404-05.

n154 NEW YORK STATE SEA LEVEL RISE TASK FORCE, *supra* note 104, at 75-76, 79.

n155 NYS 2100 COMM'N, RECOMMENDATIONS TO IMPROVE THE STRENGTH AND RESILIENCE OF THE EMPIRE STATE'S INFRASTRUCTURE 166 (2013), *available at* http://www.governor.ny.gov/sites/governor.ny.gov/files/archive/assets/documents/NYS2100.pdf. The report also recommended the creation of an infrastructure bank that might draw on a wide range of potential sources of revenue, including user fees and revenue from special assessment districts. *Id.* at 163. For a discussion of infrastructure banks, see *infra* Part III.C.1. Two other post-Sandy state commissions also recognized significant needs for improvements in response and preparation for extreme weather events, but their recommendations largely sidestep funding questions. *See generally* NYS READY & NYS RESPOND COMM'NS, SUMMARY OF RECOMMENDATIONS & PROGRESS UPDATE (2013), *available at* http://www.governor.ny.gov/sites/governor.ny.gov/files/archive/assets/documents/NYS-Ready-Respond-Update_10282103.pdf.

n156 A STRONGER, MORE RESILIENT NEW YORK, *supra* note 68, at 406.

n157 *Id.*

n158 *Id.*

n159 WILLIAM GOLDSTEIN, AMY PETERSON & DANIEL A. ZARRILLI, ONE CITY, REBUILDING TOGETHER: A REPORT ON THE CITY OF NEW YORK'S RESPONSE TO HURRICANE SANDY AND THE PATH FORWARD 28-29 (2014), *available at* http://www1.nyc.gov/assets/home/downloads/pdf/reports/2014/sandy_041714.pdf.

n160 Others have called for dedicated revenue streams. *See* Thomas M. Gremillion, *Setting the Foundation: Climate Change Adaptation at the Local Level*, 41 ENVTL. L. 1221, 1250-53 (2011) (calling for a federal adaptation fund); Yee Huang et al., *Climate Change and the Puget Sound: Building the Legal Framework for Adaptation*, 2 CLIMATE L. 299, 310 (2011) (stating that adaptation must be "sufficiently funded with dedicated, guaranteed resources").

n161 For a discussion of Pigouvian taxes, see Janet E. Milne & Mikael Skou Andersen, *Introduction to Environmental Tax Concepts and Research, in* HANDBOOK OF RESEARCH ON ENVIRONMENTAL TAXATION 15, 15-18 (Janet E. Milne & Mikael Skou Andersen eds., 2012).

n162 *See generally* Claudia Dias Soares, *Earmarking Revenues from Environmentally Related Taxes*, *in* HANDBOOK OF RESEARCH ON ENVIRONMENTAL TAXATION 102, 102-21 (Janet E. Milne & Mikael Skou Andersen eds., 2012).

n163 BRUCE R. LINDSAY, CONG. RESEARCH SERV., R43537, FEMA'S DISASTER RELIEF FUND: OVERVIEW AND SELECTED ISSUES 8-9 tbl.2 (2014), *available at* https://www.fas.org/sgp/crs/homesec/R43537.pdf.

n164 The number of natural disasters in the United States costing $ 1 billion from 1996 to 2012 rose to ninety disasters, double the forty-six disasters for the preceding fifteen-year period (1980-1995). Jennifer Daniel, *Rising Tide*, BLOOMBERG BUSINESSWEEK (Nov. 1, 2012), http://www.businessweek.com/articles/2012-11-01/rising-tide.

n165 LINDSAY, *supra* note 163, at 5 tbl.1.

n166 *Id.* at 8-9 tbl.2.

n167 *Id.* at 12.

n168 Raymond Hernandez & Peter Baker, *Obama Asks Congress for $ 60.4 Billion to Help States Recover from Storm*, N.Y. TIMES (Dec. 7, 2012), http://www.nytimes.com/2012/12/08/nyregion/obama-proposes-hurricane-recovery-bill.html; Raymond Hernandez, *Senate Passes $ 60.4 Billion for Storm Aid; Bill's Fate in House Is Unclear*, N.Y. TIMES (Dec. 28, 2012), http://www.nytimes.com/2012/12/29/nyregion/senate-approves-hurricane-aid-bill-fate-in-house-isuncertain.html.

n169 Disaster Relief Appropriations Act, 2013, Pub. L. No. 113-2, 127 Stat. 411 (2013); *see also* Raymond Hernandez, *Congress Approves $ 51 Billion in Aid for Hurricane Victims*, N.Y. TIMES (Jan. 28, 2013), http://www.nytimes.com/2013/01/29/nyregion/congress-gives-final-approval-to-hurricanesandy-aid.html (reporting on the bill's passage).

n170 LINDSAY, *supra* note 163, at 12.

n171 *Id.* at 13 (exploring a rainy-day fund for disaster relief).

n172 HOF ET AL., *supra* note 16, at 14 (citing KELLY DE BRUIN ET AL., OECD, ECONOMIC ASPECTS OF ADAPTATION TO CLIMATE CHANGE: INTEGRATED ASSESSMENT MODELING OF ADAPTATION COSTS AND BENEFITS, OECD ENVIRONMENT WORKING PAPERS NO. 6 (2009); Andries F. Hof et al., *The Effect of Different Mitigation Strategies on International Financing of Adaptation*, 12 ENVTL. SCI. POLICY 832 (2009)).

n173 *See, e.g.*, NAT'L ECON. COUNCIL & PRESIDENT'S COUNCIL OF ECON. ADVISERS, THE WHITE HOUSE, AN ECONOMIC ANALYSIS OF TRANSPORTATION INFRASTRUCTURE INVESTMENT 3 (2014), *available at* http://www.whitehouse.gov/sites/default/files/docs/economic_analysis_of_transportation_investments.pdf (noting that in the United States 65% of the major roads are rated at less than good condition, 25% of the bridges require significant repair or are inadequate for present traffic levels, and 45% of the population lacks access to transit); BEN CHOU ET AL., NATURAL RES. DEF. COUNCIL, ISSUE PAPER 14-06-A, USING STATE REVOLVING FUNDS TO BUILD CLIMATE-RESILIENT COMMUNITIES 5 (2014), *available at* http://www.nrdc.org/globalwarming/files/state-revolving-funds-IP.pdf (exploring the idea of using a revolving fund to pay for infrastructure); Adam Nagourney, *Infrastructure Cracks as Los Angeles Defers Repairs*, N.Y. TIMES (Sept. 1, 2014), http://www.nytimes.com/2014/09/02/us/pipes-roads-and-walks-crack-as-los-angeles-defers-repairs.html (describing the dilapidated state of Los Angeles's infrastructure).

n174 *See* NAT'L RESEARCH COUNCIL, *supra* note 8, at 66-67, 133, 142 (discussing people's tendency to accept the risks of natural disasters and to favor investments with immediate benefit rather than long-term risk-reducing investments).

n175 *See* Daniel A. Farber, *Adapting to Climate Change: Who Should Pay*, 23 J. LAND USE & ENVTL. L. 1, 26-34 (2007) [hereinafter Farber, *Adapting to Climate Change*] (outlining four frameworks for allocating the costs of climate change adaptation); Orr Karassin, *Mapping the Gap: Knowledge and Need in Regulating Adaptation to Climate Change*, 22 GEO. INT'L ENVTL. L. REV. 383, 423-28 (2010) (drawing on Farber's principles).

n176 Farber, *Adapting to Climate Change*, *supra* note 175, at 28.

n177 J.B. Ruhl & James Salzman, *Climate Change Meets the Law of the Horse*, 62 DUKE L.J. 975, 1021-23 (2013).

n178 Legislatures, of course, can dedicate tax revenue to long-term funds through their normal appropriations procedures, as happens with the Disaster Relief Fund. *See, e.g.*, Disaster Relief Appropriations Act, 2013, Pub. L. No. 113-2, 127 Stat. 4 (appropriating funds for Hurricane Sandy relief). Automatically earmarking a percentage or dollar share of a general stream of tax revenue to a fund would represent a very different and unusual situation, quite unlike the earmarking of revenue from a specific tax, such as earmarking the federal gas tax to the Highway Trust Fund. *See* 26 U.S.C. §§ 4081(a)(1)(A), 9503(a), (b)(1)(D) (2012).

n179 This Article cannot fully address the issues of the appropriate allocation of responsibility for adaptation across the various levels of government in the United States. For more comprehensive discussions, see generally Daniel A. Farber, *Climate Adaptation and Federalism: Mapping the Issues*, 1 SAN DIEGO J. CLIMATE & ENERGY L. 259 (2009) [hereinafter Farber, *Climate Adaptation and Federalism*], and Robert L. Glicksman, *Climate Change Adaptation: A Collective Action Perspective on Federalism Considerations*, 40 ENVTL. L. 1159 (2010).

n180 *See* Aerts et al., *supra* note 85, at 474-75 (noting that New York City, New York State, the federal government, and the private sector could share the costs of protecting New York City, since they would all benefit from the investment).

n181 *See* Farber, *Adapting to Climate Change*, *supra* note 175, at 29-35 (discussing benefits of an "Emitter Pays" approach and possible challenges to implementation); Karassin, *supra* note 175, at 424-26 (discussing benefits of and objections to "polluter-pays" model).

n182 The Congressional Budget Office has estimated that a $ 25 per ton tax on most greenhouse gas emissions, with a 2% annual inflation adjustment, would generate $ 1.06 trillion between 2014 and 2023. CONG. BUDGET OFFICE, CONG. OF THE U.S., OPTIONS FOR REDUCING THE DEFICIT: 2014 TO 2023, at 176 (2013), *available at* https://www.cbo.gov/sites/defadef/files/cbofiles/attachments/44471-OptionsForReducingDeficit-3.pdf. The $ 200 billion figure above assumes for sake of simplicity that a $ 5 tax rate would generate one-fifth of the Congressional Budget Office's estimate for a $ 25 tax rate.

n183 For example, in 2014 the EPA proposed regulations reducing greenhouse gas emissions from existing power plants. Carbon Pollution Emissions Guidelines for Existing Stationary Sources: Electric Utility Generating Units, 79 Fed. Reg. 34,830 (proposed June 18, 2014) (to be codified 40 C.F.R. pt. 60). For a general overview of the proposed rule's provisions, see JAMES E. MCCARTHY ET AL., CONG. RESEARCH SERV., R43572, EPA'S PROPOSED GREENHOUSE GAS REGULATIONS FOR EXISTING POWER PLANTS: FREQUENTLY ASKED QUESTIONS (2014), *available at* http://www.fas.org/sgp/crs/misc/R43572.pdf.

n184 Note, however, that emitters in California who must purchase emissions allowances to cover their emissions, *see* CAL. CODE REGS. tit. 17, §§ 95801, 95811, 95856 (2015), can argue that they are already paying for their emissions and should not also owe a tax. In that case, the rationale for the tax would turn on its adaptation function. In California, the proceeds from auctions of allowances are used only for mitigation purposes. John A. Pèrez California Global Warming Solutions Act of 2006: Greenhouse Gas Reduction Fund, Assemb. B. 1532, Reg. Sess., chs. 4.1, 807 (Cal. 2012) (enacted).

n185 *See* Farber, *Climate Adaptation and Federalism*, *supra* note 179, at 273 (noting that spillover effects of pollution are the strongest argument for federal funding of adaptation).

n186 *See, e.g.*, *Obama's Climate Task Force Meets in **Des Moines***, WASH. TIMES (May 13, 2014), http://www.washingtontimes.com/news/2014/may/13/presidents-climate-task-force-in-desmoines/print/ (quoting mayor of **Des Moines,** Iowa, saying "[a] lot of the focus sometimes around country looks at what's happening in coastal regions. I want to tell you it is here").

n187 Directive 2009/29/EC, *supra* note 17, at 63; *see also* Decision No. 377/2013/EU, 2013 O.J. (L. 113) (EU) (recalling that revenue from auctioning aviation allowances should be dedicated to climate change, including adaptation, in EU and third countries, particularly developing countries).

n188 Climate Protection Act of 2013, S. 332, §§ 196(a), 197(a), (b)(2)(A)(i)(I) (as introduced Feb. 14, 2013 by Sen. Bernie Sanders).

n189 CURTIS FISHER & IAN T. SHEARN, EXTREME WEATHER EXTREME COSTS 30-31 (2013).

n190 EUROPEAN INV. BANK, FINANCING **WATER** AND CLIMATE CHANGE ADAPTATION 2 (2011), *available at* http://www.eib.org/infocentre/publications/all/financing_**water**_and_climate_change_adaptation.htm.

n191 EUROPEAN INV. BANK, PROMOTING CLIMATE ACTION 4 (2013), *available at* http://bookshop.europa.eu/pt/promoting-climate-action-pbQH3011054/downloads/QH-30-11-054-ENC/QH3011054ENC_002.pdf;pgid=y8dIS7GUWMdSR0EAlMEUUsWb00003oHTmfqX;sid=zcuSgjnAO-Sj2qKjQMMJVvlgKiM8HSj07k=?FileName=QH3011054ENC_002.pdf&SKU=QH3011054ENC_PDF&CatalogueNumber=QH-30-11-054-EN-C.

n192 *E.g.*, OFFICE OF MGMT. & BUDGET, EXEC. OFFICE OF THE PRESIDENT, BUDGET OF THE UNITED STATES GOVERNMENT, FISCAL YEAR 2015, at 21 (2014). For other discussions of a national infrastructure bank, see DEP'T OF THE TREASURY & COUNCIL OF ECON. ADVISERS, A NEW ECONOMIC ANALYSIS OF INFRASTRUCTURE INVESTMENT 5-6 (2012), *available at* http://www.treasury.gov/resource-center/economic-policy/Documents/20120323InfrastructureReport.pdf, and KEITH MILLER ET AL., CTR. FOR AM. PROGRESS, CREATING A NATIONAL INFRASTRUCTURE BANK AND INFRASTRUCTURE PLANNING COUNCIL (2012), *available at* http://cdn.americanprogress.org/wp-content/uploads/2012/09/InfrastructureBankReport.pdf. Although the White House proposal has not yet been enacted, the Obama administration has launched a $ 10 billion rural infrastructure fund. News Release, USDA, White House Rural Council Announces $ 10 Billion Private Investment Fund to Finance Job-Creating Infrastructure Projects in Rural America (July 24, 2014), *available at* http://www.usda.gov/wps/portal/usda/usdahome?contentid=2014/07/0158.xml.

n193 Press Release, New Jersey Board of Public Utilities, NJ Energy Resilience Bank Now Accepting Applications: Critical Facilities Can Begin Process to Secure Resilience Grant Funds (Oct. 20, 2014), *available at* http://www.state.nj.us/bpu/newsroom/announcements/pdf/20141020_erb_press.pdf.

n194 ANDREW M. CUOMO, MOVING THE *NEW* NEW YORK FORWARD 31-32 (2014), *available at* http://andrewcuomo.com/wp-content/uploads/sites/44/2014/10/Moving-the-New-NY-Forward-by-Andrew-M-Cuomo.pdf; *Governor Cuomo Announces Launch of Build NY Initiative to Redefine State's Approach to Upgrading Vital Infrastructure*, NEW YORK STATE (Oct. 6, 2014), http://www.governor.ny.gov/news/governor-cuomo-announces-launch-build-ny-initiative-redefinestates-approach-upgrading-vital. Although not specifically targeted to post-Sandy adaptation projects, the proposal logically follows from the infrastructure bank recommendation contained within the post-Sandy 2100 Commission's report. NYS 2100 COMM'N, *supra* note 155, at 166. Both the governor's proposal and the 2100 Commission's report look to a broad range of sources of revenue to fund the infrastructure bank, *see id*.; CUOMO, *supra*, but the Governor's proposal includes one-time sources, such as settlements with banks. CUOMO, *supra*. The Cuomo Administration is pursuing the bank-settlement tact. Greg Farrell et al., *New York Officials Jockey as Bank Settlements Create Windfall*, BLOOMBERGBUSINESS (Dec. 4, 2014, 5:00 AM), http://www.bloomberg.com/news/articles/2014-12-04/new-york-officials-jockey-as-bank-settlements-create-windfall.

n195 Shira Ovide & Clint Boulton, *Flood of Rivals Could Burst Amazon's Cloud*, WALL ST. J. (July 25, 2014), http://www.wsj.com/articles/storm-clouds-over-amazon-business-1406328539.

n196 GREENHOUSE GAS PROTOCOL, GHG PROTOCOL PRODUCT LIFE CYCLE ACCOUNTING AND REPORTING STANDARD: ICT SECTOR GUIDANCE 7 (2013) (draft), *available at* http://www.ghgprotocol.org/files/ghgp/GHGP-ICT-Cloud-v2-6-26JAN2013.pdf. Clouds' physical locations have been dubbed "server farms," which are massive data centers. *Down on the Server Farm*, ECONOMIST (May 22, 2008), http://www.economist.com/node/11413148. Shifting away from Silicon Valley, these server farms are often located in rural parts of the country, where security is fairly easy to maintain, natural disasters are rare, energy is cheap, and generous state tax incentives are in place. *See* David Lumb, *How Microsoft's "Project Mountain" Stacks Up Against Data Centers from Google, Apple, and Facebook*, FAST CO. LABS (June 26, 2013, 4:45 PM), http://www.fastcolabs.com/3013493/how-microsofts-project-mountain-stacks-up-against-data-centers-from-google-apple-and-facebook; Shira Ovide & Mark Peters, *Why Data Centers Collect Big Tax Breaks*, WALL ST. J. (Nov. 14, 2014), http://www.wsj.com/articles/why-data-centers-collect-big-tax-breaks-1416000057.

n197 GREENHOUSE GAS PROTOCOL, *supra* note 196, at 6.

n198 *See generally* Jack Newton, *Is Cloud Computing Green Computing?*, GPSOLO, Dec. 2010, at 28, 29-30.

n199 James Glanz, *Power, Pollution and the Internet*, N.Y. TIMES (Sept. 22, 2012), http://www.nytimes.com/2012/09/23/technology/data-centers-waste-vast-amounts-of-energy-belyingindustry-image.html.

n200 Reuven Cohen, *The Cloud Hits the Mainstream: More than Half of U.S. Businesses Now Use Cloud Computing*, FORBES (Apr. 16, 2013, 9:23 AM), http://www.forbes.com/sites/reuvencohen/2013/04/16/the-cloud-hits-the-mainstream-more-than-half-of-u-s-businesses-now-use-cloud-computing.

n201 Nick Wingfield, *In E-Sports, Virtual Gamers Draw Real Crowds and Big Money*, N.Y. TIMES (Aug. 30, 2014), http://www.nytimes.com/2014/08/31/technology/esports-explosion-bringsopportunity-riches-for-video-gamers.html.

n202 *Id.*

n203 David Carr, *Amazon's Bet on Content in Deal for Twitch*, N.Y. TIMES (Aug. 31, 2014), http://www.nytimes.com/2014/09/01/business/media/amazons-bet-on-content-in-a-hub-for-gamers.html. The 55 million users reportedly watched 155 billion minutes of gaming. *Id.*

n204 JOSH WHITNEY, ANTHESIS, & PIERRE DELFORGE, NATURAL RES. DEF. COUNCIL, ISSUE PAPER 14-08-A, DATA CENTER EFFICIENCY ASSESSMENT 9 (2014), *available at* http://www.nrdc.org/energy/files/data-center-efficiency-assessment-IP.pdf.

n205 *Id.*

n206 Tony Danova, *Most People Are Still Confused About Cloud Storage, and No One Service Is Winning the Race to Educate and Acquire Users*, BUSINESS INSIDER (Aug. 22, 2014), http://www.businessinsider.com/people-use-the-cloud-and-dont-even-realize-it-2014-7.

n207 MARK P. MILLS, THE CLOUD BEGINS WITH COAL: BIG DATA, BIG NETWORKS, BIG INFRASTRUCTURE, AND BIG POWER: AN OVERVIEW OF THE ELECTRICITY USED BY THE GLOBAL DIGITAL ECOSYSTEM 38 (2013), *available at* http://www.tech-pundit.com/wp-content/uploads/2013/07/Cloud_Begins_With_Coal.pdf.

n208 Anna Bernasek, *Two Countries, Two Vastly Different Phone Bills*, N.Y. TIMES (Aug. 24, 2014), http://www.nytimes.com/2014/08/24/business/two-countries-two-vastly-different-phonebills.html.

n209 GARY COOK, GREENPEACE INT'L, HOW CLEAN IS YOUR CLOUD? 10 (2012), *available at* http://www.greenpeace.org/international/Global/international/publications/climate/2012/iCoal/HowCleanisYourCloud.pdf.

n210 WHITNEY & DELFORGE, *supra* note 204, at 5.

n211 Ehren Goossens, *Amazon Joins Apple Using Clean Energy at Cloud Data Centers*, BLOOMBERGBUSINESS (Jan. 20, 2015, 11:55 AM), http://www.bloomberg.com/news/articles/2015-01-20/amazon-joins-apple-using-clean-energy-at-cloud-computing-centers; *see also* COOK, *supra* note 209, at 6, 7 tbl., 26 (ranking Google and Yahoo highest in prioritizing reliance on renewable energy and noting Facebook's commitment to renewable energy).

n212 WHITNEY & DELFORGE, *supra* note 204, at 5. Data centers at the largest "consumer-facing" companies constitute only an "estimated 5 to 7 percent of the total installed base of servers globally." *Id.*

n213 *But see* COOK, *supra* note 209, app. at 1 (providing a statistical analysis of the extent of reliance on renewable electricity by data centers operated by major cloud-computing facilities, such as Amazon, Apple, Facebook, and Google).

n214 *See* Alexandra L. Pichette, *Becoming Positive About Being Carbon Neutral: Requiring Public Accountability for Internet Companies*, 14 VAND. J. ENT. & TECH. L. 425, 435-37 (2012).

n215 GREENHOUSE GAS PROTOCOL, *supra* note 196, at 5.

n216 MILLS, *supra* note 207, at 39.

n217 Glanz, *supra* note 199 (quoting David Cappuccio at Gartner, a technology research firm).

n218 MILLS, *supra* note 207, app. B.

n219 For a discussion of the challenges facing state-level taxes on cloud services, see generally Walter Hellerstein & John Sedon, *State Taxation of Cloud Computing: A Framework for Analysis*, 117 J. TAXATION 11, 11 (2012).

n220 A recent report underscores the need to reduce the carbon footprint of data centers and to improve their energy efficiency. *See generally* WHITNEY & DELFORGE, *supra* note 204. When data centers operate on a multi-tenant basis, the efficiency incentive would be more effective when the tenant, who is the user of the energy, is directly responsible for the tax based on the tenant's energy usage. *Id.* at 20. In many multi-tenant situations, however, the data center owner pays the utility directly based on space and power block, and the lease arrangements do not call for a per-kilowatt-hour pricing. *Id.* As a result, the arrangements do not create an incentive to reduce energy usage along to the tenant. *Id.* at 6, 20. The report recommends moving toward actual usage terms, *id.* at 25, a recommendation that would increase the behavioral impact of a dark cloud tax.

n221 A proposed Internet tax in Hungary sparked protests. Rick Lyman, *Hungary Drops Internet Tax Plan After Public Outcry*, N.Y. TIMES (Oct. 31, 2014), http://www.nytimes.com/2014/11/01/world/europe/hungary-drops-internet-tax-plan-after-surge-of-protests.html.

n222 *See generally* Vlad Frants, *The Evolution of Cloud Computing Taxation: Characterizing and Sourcing Cloud Computing Payments in an Uncertain World*, AM. BAR ASS'N, http://www.americanbar.org/groups/young_lawyers/publications/the_101_201_practice_series/the_evolution_of_cloud_computing_taxation.html (last visited Apr. 11, 2015); Hellerstein & Sedon, *supra* note 219; Stephan J. Lusch, *State Taxation of Cloud Computing*, 29 SANTA CLARA COMPUTER & HIGH TECH. L.J. 369 (2012); Orly Mazur, *Taxing the Cloud*, 103 CAL. L. REV. 1 (2015); David J. Shakow, *The Taxation of Cloud Computing and Digital Content*, 140 TAX NOTES 333, 350-52 (2013).

n223 Under equal protection principles, one would want to ensure that there is a rational basis for imposing a tax on some activities but not others. *See, e.g.*, Regan v. Taxation With Representation of Wash., 461 U.S. 540, 547 (1983) (noting that most equal protection challenges to taxation provisions only require extremely deferential rational basis review). Taxing some cloud services but not all digital services that use energy, or taxing cloud services but not all economy-wide demands on electricity, might be justified as a rational first step. *See* Williamson v. Lee Optical of Okla., 348 U.S. 483, 489 (1955) ("[T]he reform may take one step at a time, addressing itself to the phase of the problem which seems most acute to the legislative mind. . . . The prohibition of the Equal Protection Clause goes no further than the invidious discrimination.").

n224 For example, development in data center infrastructure management systems and software can provide information about energy usage. WHITNEY & DELFORGE, *supra* note 204, at 13, 20. One could explore whether that type of data could be used in the implementation of a dark cloud tax.

n225 Data centers are energy-intensive and therefore sensitive to the price of energy. MILLS, *supra* note 207, at 36.

n226 PETER FLINKER, THE NEED TO REDUCE IMPERVIOUS SURFACE COVER TO PREVENT FLOODING AND PROTECT **WATER** QUALITY 3 (2010), *available at* http://www.dem.ri.gov/programs/bpoladm/suswshed/pdfs/imperv.pdf.

n227 *Id.* at 5; *see also* Lance Frazer, *Paving Paradise: The Peril of Impervious Surfaces*, 113 ENVTL. HEALTH PERSPS. A457, A458 (2005) (reporting that an acre of pavement generates runoff ten to twenty times the amount from an acre of grass).

n228 COMM. ON REDUCING STORMWATER DISCHARGE CONTRIBUTIONS TO **WATER** POLLUTION, NAT'L RESEARCH COUNCIL OF THE NAT'L ACADS., URBAN STORMWATER MANAGEMENT IN THE UNITED STATES 47 (2009) [hereinafter URBAN STORMWATER MANAGEMENT IN THE UNITED STATES], *available at* http://www.nap.edu/catalog/12465/urban-stormwater-management-in-the-united-states. For a history of federal flood control policy, see Debbie M. Chizewer & A. Dan Tarlock, *New Challenges for Urban Areas Facing Flood Risks*, 40 FORDHAM URB. L.J. 1739, 1746-54 (2013).

n229 URBAN STORMWATER MANAGEMENT IN THE UNITED STATES, *supra* note 228, at 47. *See generally* CTR. FOR WATERSHED PROTECTION, THE VALUE OF STORMWATER FEES IN MARYLAND 1-2 (2014), *available at* www.cwp.org/images/stories/PDFs/SW%20Utility%20Fact%20Sheet2.pdf (describing the history of stormwater fees that focus on flood control and **water** quality requirements from the 1970s to the 1990s).

n230 *See, e.g.*, A STRONGER, MORE RESILIENT NEW YORK, *supra* note 68, at 212 (summarizing the risks of increased precipitation from climate change to New York's wastewater systems and categorizing increased precipitation and heavy downpours as causing "moderate" risk by 2050); N.Y.C. DEP'T ENVTL. PROT., *supra* note 75, at 5 (reporting that 562 million gallons of wastewater overflowed treatment facilities during Hurricane Sandy and entered local waterways).

n231 *See* Robin Kundis Craig, *Climate Change Comes to the Clean **Water** Act: Now What?*, 1 WASH. & LEE J. ENERGY, CLIMATE & ENV'T 9, 30 (2010) (explaining that state implementation plans under the Clean **Water** Act could help manage increased stormwater); BEN CHOU ET AL., *supra* note 173, at 5 (indicating that Clean **Water** State Revolving Funds provide grants to repair and strengthen wastewater infrastructure, including grants to New York and New Jersey after Sandy).

n232 One study found that the United States will need to invest between $ 123 and $ 252 billion in wastewater systems by 2050 just to address climate change adaptation, not taking into account upgrades and replacements of existing systems. ASS'N OF CLEAN **WATER** AGENCIES & ASS'N OF METRO. **WATER** AGENCIES, CONFRONTING CLIMATE CHANGE: AN EARLY ANALYSIS OF **WATER** AND WASTEWATER ADAPTATION COSTS 3-10 (2009), *available at* http://www.amwa.net/galleries/climatechange/ConfrontingClimateChangeOct09.pdf.

n233 *Stormwater Homepage*, EPA, http://**water.**epa.gov/polwaste/npdes/stormwater/index.cfm (last updated Jan. 21, 2015).

n234 C. WARREN CAMPBELL, WESTERN KENTUCKY UNIVERSITY STORMWATER UTILITY SURVEY 2013, at 1 (2014), *available at* http://www.wku.edu/engineering/civil/fpm/swusurvey/western_kentucky_university_swu_survey_2013.pdf.

n235 EPA, FUNDING STORMWATER PROGRAMS 3 (2009), *available at* http://**water.**epa.gov/infrastructure/greeninfrastructure/upload/FundingStormwater.pdf (using the terms "stormwater fees" and "stormwater utilities" interchangeably, and classifying both as funding mechanisms).

n236 *See generally* DEP'T OF LEGIS. SERVS., STORMWATER REMEDIATION FEES IN MARYLAND: LOCAL IMPLEMENTATION OF HOUSE BILL 987 OF 2012 (2013) (explaining Maryland's stormwater utility fee plan).

n237 MD. CODE ANN., ENVIRONMENT § 4-202.1(e), (f) (LexisNexis 2014).

n238 EPA, *supra* note 235, at 3.

n239 *Id.* at 3-4.

n240 The lack of stormwater utilities does not mean that state and local governments are not subject to federal regulations concerning stormwater; it only means that they are financing regulatory investments in other ways, such as through general tax revenues or bonds. Note that bills authorizing the use of stormwater fees in New Jersey have failed in recent years. MICKENZIE ROBERTS-LAHTI, NEW JERSEY FUTURE, STORMWATER UTILITIES: A FUNDING SOLUTION FOR NEW JERSEY'S STORMWATER PROBLEMS 8-9 (2014), http://www.njfuture.org/wp-content/uploads/2014/09/New-Jersey-Future-Stormwater-Utilities-Report.pdf.

n241 NYC BUILDINGS, NYC GREEN ROOF PROPERTY TAX ABATEMENT PROGRAM 1 (2010), *available at* http://www.nyc.gov/html/dob/downloads/pdf/green_roof_tax_abatement_info.pdf.

n242 *See, e.g.*, City of Lewiston v. Gladu, 2012 ME 42, PP 24-26, 40 A.3d 964 (holding that an impervious-surface-based stormwater fee was a fair approximation of cost and benefit and that the charge was a fee and not a tax).

n243 DEP'T OF LEGIS. SERVS., *supra* note 236, at 3-4.

n244 *See, e.g.*, Travis H. Brown, *When it Rains, it Pours Tax Dollars in Maryland*, FORBES (Jan. 3, 2014, 8:00 AM), http://www.forbes.com/sites/travisbrown/2014/01/03/when-it-rains-it-pours-taxdollars-in-maryland (referring to the Maryland Stormwater Management-Watershed and Restoration Program as a "rain tax").

n245 Note, however, that the 1% "mansion tax" in New Jersey and New York State, which applies to sales of residences for over $ 1 million, pushed prices below the $ 1 million threshold and depressed sales. Janet Novack, *Mansion Tax Kills Some Million Dollar Home Sales, Study Concludes*, FORBES (May 7, 2014, 11:54 AM), http://www.forbes.com/sites/janetnovack/2014/05/07/mansion-taxkills-some-million-dollar-home-sales-study-concludes.

n246 N.Y. TAX LAW § 1402(a) (Consol. 2014).

n247 *Id.* § 1421; N.Y. STATE FINANCE LAW § 92-s (Consol. 2014).

n248 STATE FIN. § 92-s(1), (6).

n249 Sarah Crean, *Environmentalists See Mixed Bag in Cuomo Budget*, GOTHAM GAZETTE (Feb. 18, 2014), http://www.gothamgazette.com/index.php/environment/4866-environmentalists-see-mixedbag-in-cuomo-budget.

n250 N.Y. TAX. LAW § 1449-bb (Consol. 2014) (authorizing Peconic Bay towns to use transfer taxes); N.Y. TOWN LAW § 64-e(2) (requiring deposit of transfer taxes into Peconic Bay region community protection funds).

n251 *See* S. Assemb. A5939A-2013, Reg. Sess. 2013-2014 (N.Y. 2013) (codified as amended at N.Y. TOWN LAW § 64-e) (proposing an amendment to the enabling legislation to allow the Peconic Bay Community Preservation Fund to be used to preserve shorelines "at significant risk of coastal flooding due to projected sea level rise and future storms").

n252 Farber, *Adapting to Climate Change*, *supra* note 175, at 27.

+++

Margot J. Pollans, 2015, The Safe Drinking Water / Food Law Nexus. 32 Pace Environmental Law Review 501.

TEXT:
[*501]

At 2 AM on August 2, 2014, the Ohio Environmental Protection Agency issued the following warning to the citizens of Toledo: "Do Not Drink." [n1] The Ohio City's tap **water** was contaminated with microcystin, a toxin that can cause diarrhea, vomiting, and abnormal liver function. [n2] The source was an algal bloom in Lake Erie resulting from high levels of agricultural fertilizers and animal waste. [n3] For three days, Toledo residents drank only bottled **water.**

This is just one of many similar examples of agricultural contamination of urban drinking **water** supplies. Creating a physical connection between urban and rural communities, this pollution highlights the need for an environmentally-minded and systems-based food and agriculture law.

Despite over forty years of extensive federal regulation of **water** pollution, agricultural waste, most of which enters drinking **water** as "nonpoint source pollution," remains a significant threat to safe drinking **water** as well as aquatic ecosystems. Climate **[*502]** change threatens to exacerbate this threat. [n4] Furthermore, the Clean **Water** Act's failure to address these harms is well documented. [n5] The Act provides no federally enforceable mechanism for mitigating nonpoint source pollution. Many have proposed solutions including radical amendments of the statute itself, aggressive state action to fill the gap, and expansion of the United States Department of Agriculture's conservation programs which pay farmers to change their practices to reduce **water** contamination. [n6]

As a component of food law, the Clean **Water** Act's failure to address agricultural **water** pollution must be understood as a back drop to a companion federal statute: the Safe Drinking **Water** Act (SDWA). [n7] The SDWA requires the Environmental Protection Agency (EPA) to set drinking **water** standards for harmful contaminants, and it requires that public **water** utilities meet those standards either through **water** filtration and treatment, or through source **water** protection. [n8]

The SDWA is widely attacked, particularly by local government officials, as an unfunded mandate imposing **[*503]** excessive, and often unjustified, costs on local governments. [n9] Critics argue that its uniform and risk-averse requirements reflect the need to devolve authority to states to engage in more location-specific standard setting. Proponents argue that the cost and complexity of risk assessment combined with the need to provide uniformly clean **water** to all, justify federal intervention. [n10]

This debate, which focuses on the SDWA in isolation from the Clean **Water** Act, misses a central flaw in the structure of the SDWA. As implemented by the EPA and the states, the SDWA assigns primary responsibility for provision of clean **water** to municipal and regional **water** utilities that often have little or no control over drinking **water** sources.

Where point source pollution is the primary threat to safe **water,** this allocation is reasonable. **Water** utilities are simply providing a backstop to ensure that **water,** whose content is often already heavily policed under the Clean **Water** Act, is safe to drink.

By contrast, where the primary threat to safe drinking **water** is nonpoint source pollution, **water** utilities provide what is often the first line of defense. Of the nearly ninety pollutants for which the EPA sets SDWA standards, at least twenty-four enter **[*504]** waterways through agricultural nonpoint source pollution. [n11]

The list includes pesticides, herbicides, nitrates, and microbial contaminants from animal waste. [n12] Without independent source controls, **water** utilities must engage in burdensome cleanup in order to meet SDWA standards. [n13]

Taken together, the Clean **Water** Act and the SDWA thus assign primary responsibility for nonpoint source pollution cleanup to **water** utilities. Although both statutes envision a role for states in establishing source control programs, neither statute mandates such controls, and many states have declined to develop robust programs. [n14] In the remainder of this essay, I will draw three conclusions about this dynamic.

First, in the long run, particularly if predictions are correct that climate change will exacerbate the risk of drinking **water** contamination from agricultural pollutants, the dynamic described in the preceding paragraphs could serve as an **[*505]** important catalyst for change. [n15] As filtration and treatment costs rise, **water** utilities and the state agencies overseeing them will continue to seek alternative approaches, including using litigation to reallocate mitigation costs from municipal ratepayers to farmers. [n16] They may also put pressure on state governments to develop more comprehensive nonpoint source pollution regulatory programs. Public support for such efforts may also increase in response to high salience contamination events, such as the Toledo incident described above. In other words, this type of extremely costly and public pollution in urban areas creates a constituency for environmental protection that may not have existed before.

Second, the failure to regulate nonpoint source pollution creates an arbitrary assignment of pollution abatement costs. The extent to which a **water** utility provides the first line of defense or merely end-of-line finishing cleanup depends on the nature of the pollution source. [n17] Those within the direct ambit of agricultural **[*506]** **water** pollution must take on this extra cost; utilities outside that ambit need not. This concern is a more specific variation of the general concern that the statute imposes uniform standards on utilities facing highly variable compliance costs. [n18] Indeed, this is a standard critique of many types of uniform federal regulations. [n19]

What is different and particularly troublesome here is that the variation stems from underlying disparate application of the "polluter pays" principle. Because a large category of polluters are not responsible for the costs of the **water** pollution they cause, a subset of **water** utilities are saddled with extra costs. Ratepayers ultimately bear the burden of this arbitrary allocation of costs. Although there is some federal and state financial assistance, a substantial portion of increased compliance costs falls to **water** users. [n20]

This allocation of responsibility is often inefficient. In some cases, it is less costly to control the source than it is to filter or treat at the tap, particularly where increased contamination **[*507]** necessitates building entirely new treatment facilities. [n21] In theory, if a **water** utility determines that source protection is cheaper than building or renovating a treatment or filtration facility, it should engage in Coasian bargaining and pay for protection rather than build or renovate the treatment or filtration facility. [n22] Some **water** utilities are able to take control of their source **water** via land purchase or through green payments to land owners to reduce their pollution. [n23] New York City is one of the best examples of a large urban **water** system that has successfully protected its source **waters** and does not filter its **water.** [n24] But for many municipalities and **water** utilities the transaction costs to take control of source **water** are simply too high. These transaction costs may include, among others, difficulty identifying sources, lack of political will at the state level to develop nonpoint source pollution controls, lack of will **[*508]** among polluters to engage in negotiation, or lack of expertise at the public **water** utility about source control options. [n25]

The ancillary benefits of prevention at the source - beyond safer drinking **water** - also sway this cost benefit analysis. Prevention at the source protects aquatic ecosystems, creating benefits for biodiversity, the recreation industry, the fishing industry, and for agriculture itself where pollution affects sources of irrigation **water.** [n26] Agricultural nonpoint source pollution generates numerous environmental and human health costs. The SDWA mitigates only one of those costs.

Finally, as the title of this essay suggests, the interaction between the two statutes must be understood in the broader context of the food system. **Water** is food too. I mean this in the literal sense: the Food Drug and

Cosmetic Act defines food as "articles used for food or drink for man or other animals." [n27] But, **water** is often excluded from discussions about the importance of protecting our food system. The agriculture industry has been very successful at curbing federal environmental regulation. [n28] Among the industry's wide-ranging rhetoric is the argument that meager regulation generates the benefit of cheap food, which we all enjoy. But letting farmers off the hook in the name of cheap **[*509]** food is less justifiable, if it was ever justifiable, if the spillover cost is expensive **water.** [n29]

Even worse, the interplay between the Clean **Water** Act and the SDWA pits cities against agricultural areas, and residential communities against farmers. Although some urban **water** utilities and environmental protection agencies have or could enter into cooperative relationships with their rural hinterlands, others will take a more antagonistic path. [n30] This antagonism perpetuates the perception of an urban/rural dichotomy and obscures the mutually dependent relationship between the two that is the basis of a healthy food system. [n31]

To return to the theme of this symposium, reconceptualizing the future of environmental law, the dynamic between the SDWA and the Clean **Water** Act highlights the need for a systems approach to thinking about environmental regulation of the food system. [n32] **Water** is an environmental system in physical space. It feeds farms (as irrigation **water)**, it collects their pollution (from irrigation and stormwater runoff), and it feeds municipalities (as drinking **water**). This system crosses political jurisdictions. A regulatory system that creates antagonism across jurisdictions makes this physical system more difficult to manage. [n33]

[*510] Access to safe drinking **water** is nearly ubiquitous in this country. Efficient (as in cost minimizing) preservation of this resource requires reconciliation of the various statutory schemes that govern the resource and the various political jurisdictions that manage it. Food Law, as an outgrowth of environmental law, among other things, provides a useful lens through which to approach this reconciliation. As an emerging discipline, Food Law invites a fresh examination of **water** as a complex element of the food system, drawing together what otherwise might be disparate environmental law questions related to equitable access to safe drinking **water**, preservation of aquatic ecosystems, and transitions to sustainable agriculture.

Legal Topics:

For related research and practice materials, see the following legal topics:
Environmental LawWater QualityClean Water ActNonpoint Source PollutionEnvironmental LawWater QualitySafe Drinking Water ActGeneral OverviewTortsStrict LiabilityHarm Caused by AnimalsGeneral Overview

FOOTNOTES:

n1. Codi Kozacek, Seven Ohio Drinking **Water** Sources Don't Meet State **Water** Quality Standards for Toxic Algae, Circle of Blue (Aug. 25, 2014, 4:58 PM), http://www.circleofblue.org/waternews/2014/world/seven-ohio-drinking-**water**-sources-dont-meet-state-**water**-quality-standards- toxic-algae/, archived at http://perma.cc/8DBW-T6DR.

n2. Id.

n3. Id.

n4. Robert W. Adler, Agriculture and **Water** Quality: A Climate-Integrated Perspective, 37 Vt. L. Rev. 847, 875 (2013) (describing how climate change might affect existing **water** quality problems).

n5. See, e.g., J.B. Ruhl, Farms, Their Environmental Harms, and Environmental Law, 27 Ecology L.Q. 263, 298-304 (2000).

n6. See id.; Robert W. Adler, Addressing Barriers to Watershed Protection, 25 Envtl. L. 973 (1995); Terence J. Centner, Nutrient Pollution from Land Applications of Manure: Discerning a Remedy for Pollution, 21 Stan. L. & Pol'y Rev. 213 (2010); John R. Nolon, In Praise of Parochialism: The Advent of Local Environmental Law, 26 Harv. Envtl. L. Rev. 365, 413-16 (2002); J.B. Ruhl & James Salzman, Climate Change, Dead Zones, and Massive Problems in the Administrative State: A Guide for Whittling Away, 98 Calif. L. Rev. 59 (2010); David Zaring, Note, Agriculture, Nonpoint Source Pollution, and Regulatory Control: The Clean **Water** Act's Bleak Present and Future, 20 Harv. Envtl. L. Rev. 515, 524-25 (1996).

n7. Safe Drinking **Water** Act, 42 U.S.C.§§300f to 300j-26 (2012).

n8. Id. § 300g-1 (mandating that the EPA set national drinking **water** standards); id. § 300g-2 (delegating primary enforcement authority to the states). Public **water** utilities are utilities that provide **water** to at least twenty-five people or have at least fifteen service connections. Id. § 300f(4). The statutory requirements thus do not apply to wells or to very small drinking **water** systems.

n9. Scott D. Laufenberg, The Struggle of Cities to Implement the Safe Drinking **Water** Act in the Context of Intergovernmental Relations, 3 Drake J. Agric. L. 495, 499 (1998) (observing that the SDWA can be extremely burdensome for municipalities adjacent to agricultural communities); David L. Markell, The Role of Local Governments in Environmental Regulation: Shoring Up Our Federal System, 44 Syracuse L. Rev. 895, 898-90 (1993) (describing concern that the SDWA fails to prioritize among various risks); Jeffrey Marks, The Role of Federal Environmental Mandates in Intergovernmental Relations, 20 Environs Envtl. L. & Pol'y J. 17, 23 (1996) (observing that many local officials have called for increased local flexibility in standard setting and explaining that tension arises when federal financial support does not keep up with rising compliance costs); Rena I. Steinzor, Unfunded Environmental Mandates and the "New (New) Federalism": Devolution, Revolution, or Reform?, 81 Minn. L. Rev. 97, 202 (1996) (arguing that the SDWA regulations do not allow adequate tailoring to local conditions or adequate assessment of compliance feasibility).

n10. See, e.g., Steinzor, supra note 9, at 140, 171-73 (noting that cities and counties identify the SDWA as one of the most expensive federal mandates but expressing concern that "unrestricted devolution of fundamental regulatory decisions to the local level" could result in massive inequality in availability of safe drinking **water**).

n11. EPA, 816-F-09-004, Nat'l Primary Drinking **Water** Regulations (2009), available at http://**water.**epa.gov/drink/contaminants/upload/mcl.pdf, archived at http://perma.cc/4MQQ-Q7V5. The Twenty-four pollutants are those identified by the EPA as entering drinking **water** from agricultural-related runoff. Envtl. Working Grp., Drinking **Water** Pollution Has Many Sources (2009), available at http://www.ewg.org/tap-**water/**sourcesofwaterpollution.php, archived at http://perma.cc/KC8W-BWEJ. The Environmental Working Group (EWG) identifies a total of ninety-seven agricultural-related contaminants in drinking **water**. Of these, thirty-five are regulated. For those thirty-five, EWG found that 127 million people had been exposed to levels exceeding EPA guidelines. Id. See also Ronald Munger et al., Intrauterine Growth Retardation in Iowa Communities with Herbicide-Contaminated Drinking **Water** Supplies, 105 Envtl. Health Persp. 308 (1997), available at http://www.ncbi.nlm. nih.gov/pmc/articles/PMC1470002/pdf/envhper00316-0054.pdf, archived at http://perma.cc/6PAR-6ETM (discussing pesticide contamination in humans).

n12. See EPA, supra note 11.

n13. For instance, following a cryptosporidium outbreak in 1993, the Milwaukee **Water** Works invested eighty-nine million dollars for capital improvements to its **water** filtration systems. Don Behm, Milwaukee Marks 20 Years Since Cryptosporidium Outbreak, Milwaukee J. Sentinel, Apr. 6, 2013, http://www.jsonline.com/news/milwaukee/milwaukee-marks-20-years-since-cryptosporidium-outbreak-099dio5-201783191.html, archived at http://perma.cc /HWH3-GUAM. See infra notes 16, 21-25, and accompanying text (discussing the potential for **water** utilities to engage in source control).

n14. See, e.g., Adler, supra note 4, at 855-56 (noting that while there are some watershed specific success stories the overall picture is bleak). See also Clean **Water** Act, 33 U.S.C. § 1342(b) (2012); 42 U.S.C. § 300g-2.

n15. See Adler, supra note 4, at 875 (describing the potential effects of climate change on drinking **water**).

n16. The Clean **Water** Act preempts interstate nuisance suits under federal common law. Milwaukee v. Illinois, 451 U.S. 304 (1981) (holding that the Clean **Water** Act preempted interstate nuisance claims under federal common law). But, **water** utilities can still bring suit under state common law. Int'l Paper Co. v. Ouellete, 479 U.S. 481 (1987). Interstate suits, by state or private parties, can also be brought under state law provided that they are brought under the law of the source state. Id. (holding that the Clean **Water** Act preempted the common law of an affected state where that state, or a citizen of that state, attempts to impose liability on a point source in another state). In City of Tulsa v. Tyson Foods, Inc., Tulsa sued various poultry processors claiming that poultry waste from factory farms was contaminating the drinking **water** supply. City of Tulsa v. Tyson Foods, Inc., 258 F. Supp. 2d 1263 (N.D. Okla. 2003), vacated, No. 01-CV-0900EA(C), 2003 U.S. Dist. LEXIS 23416 (N.D. Okla. July 16, 2003). The City of **Des Moines** also made a recent creative attempt to sue its neighboring agricultural communities under the Clean **Water** Act, attempting to characterize some agricultural pollution as a point source. Notice of Intent to Sue from William Stowe, Bd. of **Water** Works Trs. of the City of **Des Moines,** Iowa, to Rick Hecht, Chairperson of the Sac Cnty. Bd. of Supervisors, Gary Nicholson, Chairperson of the Calhoun Cnty. Bd. of Supervisors, Dale Arends, Chairperson of the Buena Vista Cnty. Bd. of Supervisors (Jan. 9, 2014) at 7, available at http://www.circleofblue.org/waternews/wp-content/uploads/2015/01/DMWW notice-of-intent-to-sue-2.pdf, archived at http://perma.cc/D4EC-AUSK (attempting to characterize tile drainage as a point source). The Iowa notice of intent to sue also alleged Iowa common law nuisance and trespass claims. Id.

n17. Of course, other factors affect the scope of cleanup necessary to meet SDWA standards. A utility whose source **water** has many point sources may face a larger burden than one with fewer, even if all those sources are complying with their Clean **Water** Act obligations. Likewise, a utility that relies heavily on groundwater, which is generally not directly policed under the Clean **Water** Act, may face similar problems. See James Salzman, Drinking **Water**: A History 127-31 (2013) (describing the threat of fracking).

n18. In the context of the SDWA, proponents of less uniform regulations believe that the statute imposes costly obligations whether or not they are relevant to different regions. Some also believe that localities should have the leeway to opt for lower safety standards if that is their preference.

n19. See Nicole V. Crain & W. Mark Crain, The impact of Regulatory Costs on Small Firms 7 (2010); Ashlea Ebeling, The Other Federal Budget, Forbes (Oct. 1, 2003, 11:20 AM), http://www.forbes.com/2003/10/01/cz_ae_ 1001beltway.html, archived at http://perma.cc/ZZ8D-YV7V; Jim Tankersley, Report: New Regulations Cost $ 216B and 87 Million Hours of Paperwork. What do they reap?, Wash. Post (Jan. 14, 2013), http://www.washingtonpost.com/ blogs/wonkblog/wp/2013/01/14/report-new-regulations-cost-216-billion-and-87-million-hours-of-paperwork/, archived at http://perma.cc/D59T-S8AX.

n20. See, e.g., Funding Sources, EPA, http://**water.**epa.gov/lawsregs/rulesregs/ sdwa/arsenic/funding.cfm (last updated Mar. 6, 2012), archived at http://perma.cc/B7NS-XFBX. Rate increases also depend on the size of a **water** district. A 1990s EPA study on **water** utility financial capacity revealed that for large systems, compliance required increasing average annual rates by about three dollars per household; for smaller systems, the average increase was $ 145. Steinzor, supra note 9, at 208-09.

n21. See, e.g., Mark D. Hoffer, The New York City Watershed Memorandum of Agreement: Forging a Partnership to Protect **Water** Quality, 18 U. Baltimore J. Envtl. L. 17 (2010); Stephanie Perez, Note and Comment, New York City's Drinking **Water** - Champagne or Beer?, 12 Pace Envtl. L. Rev. 859 (1995).

n22. See generally James M. Buchanan, The Coase Theorem and the Theory of the State, 13 Nat. Resources J. 579 (1973).

n23. The 1996 Amendments to the SDWA acknowledged the importance of source **water** protection and created a mechanism for **water** utilities to engage in source control as an alternative to filtration and treatment. Safe Drinking **Water** Act Amendments of 1996, Pub. L. No. 104-182 (1996) (codified as amended in throughout title 42 of the U.S. Code). Filtration avoidance is available where the utility demonstrates adequate ownership or control over the source watershed: "the public **water** system must demonstrate through ownership and/or written agreements with landowners within the watershed that it can control all human activities which may have an adverse impact on the microbiological quality of the source **water.**" 40 C.F.R. § 141.71(b)(iv)(2)(iii) (2015). Filtration avoidance is also a possibility where a utility relies on **water** from "uninhabited, undeveloped watersheds in consolidated ownership, and having control over access to, and activities in, those watersheds." 42 U.S.C. § 300g-1(b)(7)(C)(v) (2012).

n24. See, e.g., About Watershed Protection, NYC Envtl. Prot., http://www.nyc.gov/html/dep/html/watershed_protection/ab out.shtml (last visited Feb, 27, 2015), archived at http://perma.cc/ZQ5X-BMTR; New York City **Water** Supply, N.Y. State Dep't of Envtl. Conservation, http://www.dec.ny.gov /lands/25599.html (last visited Feb. 27, 2015), archived at http://perma.cc/ZM3P-M7M6.

n25. Even New York City would likely not be able to achieve the level of source control it now enjoys had it not taken significant steps to obtain that control over a century ago. In the late nineteenth century, the City annexed lands and protected large swaths of land for watershed protection at a time when there was widespread support for this kind of aggressive step to protect the City's economic competitiveness and with little resistance from the surrounding territories. See generally Matthew Gandy, Concrete and Clay: Reworking Nature in New York City 18-23 (2003) (retelling the history of New York City's **water** infrastructure and the political context's that made its development possible). Given changed political circumstances this model would be difficult, if not impossible, to replicate today.

n26. See Marc O. Ribaudo et al., Economics of **Water** Quality Protection from Nonpoint Sources: Theory and Practice 23-25 (1999), available at http://www.ers.usda.gov/media/1385896/aer782.pdf, archived at http://perma.cc/ 79YA-87W7.

n27. 21 U.S.C. § 321(f)(1). While the EPA regulates tap **water** through the SDWA, the Food and Drug Administration regulates bottle **water** as a food pursuant to the Food Drug and Cosmetic Act (FDCA).

n28. See Megan Stubbs, Cong. Research Serv., R41622, Environmental Regulation and Agriculture 15 (2014), available at http://fas.org/sgp/crs/misc /R41622.pdf, archived at http://perma.cc/L539-5Q6X.

n29. Another way to think about this is that **water** contamination is itself a food safety issue. **Water** safety law thus suffers from a similar critical flaw with the recent food safety modernization. Neither statute adequately addresses sources of cross contamination. Just as the SDWA provides no mechanism to address nonpoint source pollution, the Food Safety Modernization Act provides inadequate mechanisms to protect leafy greens and other fresh produce from contaminated runoff from concentrated animal feeding operations. 42 U.S.C. § 300f-g; FDA Food Safety Modernization Act, Pub. L. No. 111-353, 124 Stat. 3885 (codified as amended throughout title 21 of the U.S. Code).

n30. See supra text accompanying note 16.

n31. William Cronon, Nature's Metropolis: Chicago and the Great West, at xiv-xv (1992).

n32. See, e.g., Jody Freeman & Daniel A. Farber, Modular Environmental Regulation, 54 Duke L.J. 795 (2005) (calling for "a high degree of flexible coordination across government agencies as well as between public agencies and private actors" to allow for creative and bigger picture problem solving).

n33. Many scholars have recognized the mismatch between environmental systems and political systems and have considered how political systems should approach environmental regulation in light of both this fact and the fact that environmental systems themselves are

extraordinarily complex. See, e.g., J.B. Ruhl, Thinking of Environmental Law as a Complex Adaptive System: How to Clean up the Environment by Making a Mess of Environmental Law, 34 Hous. L. Rev. 933, 981 (1997).

+++ -- End