ENVIRONMENTAL ENFORCEMENT IN DIRE STRAITS – THERE IS NO PROTECTION FOR NOTHING AND NO DATA FOR FREE

Victor B. Flatt[*] and Paul M. Collins, Jr.[α]

Abstract: Those charged with drafting and enforcing our environmental laws have had to work with little or no information about whether or not the programs are actually working properly. There are a host of reasons for this, many of them having to do with availability of data that can be examined empirically. Using newly available data on state actions in environmental enforcement, and a new dataset of state environmental expenditures which they created, the authors of this article are able to examine for the first time the relationship between state environmental expenditures and effectiveness of state environmental enforcement for all permitted sources. They conclude that state expenditures on environmental programs are strongly associated with effective environmental compliance, which has important implications for environmental law and policy. The authors also examine the debate over the effectiveness of cooperative vs. deterrence based enforcement, relate that to findings on state expenditures, and make suggestions for improving the availability of data and environmental enforcement generally.

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INTRODUCTION

While much of the world debates what our environmental laws should be[1], the less esoteric question of whether the environmental laws we do have are being properly enforced continues to be insufficiently examined. Yet this question is absolutely critical to any discussion of environmental protection or policy. Whether one agrees with the goals in our current environmental statutes or not, determining whether and how environmental laws are enforced is critical to the successful operation of any environmental law, present or future.

The question of how well environmental enforcement works is really the question of whether our environmental laws get the jobs of cleaning the environment and protecting public health done. In a world of limited financial resources, the answer to this question must include whether the job is done in the most effective and efficient way

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[1] *See, e.g.*, Marcilynn A. Burke, *Green Peace? Protecting Our National Treasures While Providing for Our National Security*, 32 Wm. & Mary Envtl. L. & Pol'y Rev. 803 (2008) (discussing requested changes to a host of federal environmental laws to accommodate national security); Charles de Saillan, *The Use of Imminent Hazard Provisions of Environmental Laws to Compel Clean-up at Federal Facilities*, 27 Stan. Envtl. L. J. 43, 206 (2008); Robert Percival, *Environmental Law in the Twenty-First Century*, 25 Va. Envtl. L. J. 1, 2 (2007).

possible. As we approach the 40th anniversary of modern environmental laws, the answer to this "$64 billion question" still isn't clear.

We are told that the environmental laws provide extraordinarily high benefits *if enforced properly*. In its Draft Report to Congress on the Costs and Benefits of Federal Regulation, the Office of Management and Budget noted that the EPA estimated the total benefits of ten years of CAA enforcement would be $1.4 *trillion*, and the benefits for enforcement of the more stringent regulation of criteria pollutants since 1990 would exceed costs of $55 billion.[2] Various assumptions exist however, relating to these estimates.[3] More importantly though, we don't know if these laws *are* being properly enforced. Even though we can identify the many areas where pollution has been reduced and environmental improvements have occurred, we are unable to clearly determine whether we are valuing and protecting the environment in the most cost-effective and efficient way possible.

Numerous commentators have noted that the difference of any environmental law in actually protecting the environment is highly dependent on whether, and in what way, that law is enforced.[4] Testing whether we are correctly and/or adequately enforcing our environmental laws, however, has proven remarkably difficult as measures of

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[2] 65 Fed. Reg. 7197-7267 (2000), *available at* http://www.epa.gov/EPA-GENERAL/2000/February/Day-11/g3175.htm.

[3] Professor Hsu presents a very good description of how environmental harms and benefits, as well as the societal costs of regulation, may be routinely under- (or sometimes over-) valued. *See*, She-Ling Hsu, The Identifiability Bias in Environmental Law, 35 Fla. State Univ. L. Rev. 433 (2008).

[4] Victor B. Flatt, *Spare the Rod and Spoil the Law: Why the Clean Water Act has Never Grown Up*, 55 Ala. L. Rev. 595, 596 (2004); William Andreen, *Beyond Words of Exhortation: The Congressional Prescription for Vigorous Enforcement of the Clean Water Act*, 55 Geo. Wash. L. Rev. 202, 211 (1987); Robert L. Glicksman and Dietrich H. Earnhart, *The Comparative Effectiveness of Government Interventions on Environmental Performance in the Chemical Industry*, 26 Stan. Envtl. L. J. 317, 319 (2007) (hereinafter "*Chemical Industry*"); see also Mintz, Rechtschaffen, and Kuehn, Environmental Enforcement: Cases and Materials (Carolina Academic Press, 2007).

environmental quality have changed over time and differ between locations.[5] This makes the actual connection between enforcement action and environmental improvements very difficult to ascertain. The possibility of having any more than broad based measures of actual environmental quality improvements or changes seems so difficult, especially when related to enforcement mechanisms, that their pursuit may be impossible.

Throughout much of the history of environmental law, the assumption has been that vigorous enforcement deters non-compliance with laws, and thus brings about the desired outcomes.[6] This is reflected in the very structure of the federal state cooperative federalism in administering environmental laws ("if the state is enforcing, it is doing a good job")[7], to the theories underlying citizen's suit provisions which are only necessary when the state or federal government is not fulfilling its enforcement role.[8] However, merely examining the number of such actions taken against non-complying parties may not tell us much about the overall effectiveness of an environmental program.[9] Because pollution sources may be different and states may utilize different strategies, standards, and penalties for enforcement, it is not obviously apparent that the number of actions

[5] Robert Adler, *The Two Lost Books in the Water Quality Trilogy: The Elusive Objectives of Physical and Biological Integrity*, 33 Envtl. L. 29, 49 (2003) (Citations omitted); Clifford Rechtschaffen and David Markell, *Improving State Environmental Enforcement Performance Through Enhanced Government Accountability and Other Strategies*, 33 ELR 10559, 10565 (2003)(Hereinafter "Improving").
[6] Glicksman and Earnhart, *Chemical Industry, supra*, n. 4, at 321.
[7] Richard J. Pierce, Jr., *Issues Raised by Friends of the Earth v. Laidlaw Environmental Services: Access to the Courts for Environmental Plaintiffs*, 11 Duke Envtl. L. & Pol'y F.207, 234 (2001) (arguing that the environmental federalism standard allows no or very little second guessing of state enforcement decisions).
[8] Peter Appel, *The Diligent Prosecution Bar & Citizens Suits: The Search for Adequate Representation*, 10 Widener L. Rev. 91, 91 (2003).
[9] Michael P. Vandenburgh, *Beyond Elegance: A Testable Typology of Social Norms in Corporate Culture*, 22 Stan. Envtl. L. J. 55, 66 (2003)(citing Cliff Rechtschaffen, *Deterrence v. Cooperation and the Evolving Theory of Environmental Enforcement*, 71 S .Cal. L. Rev. 1181, 1219 (1998))

taken to bring sources into compliance is a good measure of how effective different enforcement mechanisms may be in reaching statutory goals.[10]

Additionally, recent "second generation" regulatory proponents have suggested that direct enforcement may not achieve effective compliance (and thus environmental improvements), and that so-called cooperative mechanisms may work better.[11] As defined by Professors Cliff Rechtschaffen and David Markell, authors of a 1990s book about environmental enforcement, cooperative based enforcement "eschews penalties in favor of persuasion."[12] Cooperative based enforcement suggests that carrots work better than sticks. Many states have actively championed this strategy, pushing towards market mechanisms for pollution control, and proposing to change environmental enforcement from primarily deterrence based enforcement to a cooperative regime.[13] Some of the cooperative enforcement literature propounds the theory that in addition to better results, "cooperative enforcement" may cost less, and thus be a more cost efficient form of effective environmental enforcement.[14]

Theories regarding different environmental policies and enforcement strategies are important to making environmental protection efficient and responsive to societal needs. So where is the answer to the question of whether we are enforcing our environmental laws in the most effective and efficient ways possible? What is really needed is an empirical examination of what kinds of environmental enforcement strategies work successfully. Good attempts have been made in the past and recently, and

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[10] Victor B. Flatt, *A Dirty River Runs Through It (The Failure of Enforcement in the Clean Water Act*), 25 B.C. Envtl. Aff. L. Rev. 1, 17 (1998) (hereinafter "*Dirty River*").
[11] Rena Steinzor, *Myths of the Reinvented State*, 29 Cap. U. L. Rev. 223, 231-32 (2001).
[12] Rechtschaffen and Markell, Reinventing *Environmental Enforcement & the State/ Federal Relationship* 2. (Environmental Law Institute 2003) (hereinafter "Reinventing").
[13] *Id*.
[14] Steinzor, *supra* n. 11, at 233.

upon those attempts, we set out in this article to gather data and conduct statistical analyses that can take the discussion even further. By using data painstakingly culled from the states and combining it with newly available EPA enforcement data, we put forward some important new conclusions regarding the resource allocation necessary for effective environmental enforcement strategies.[15] Just as importantly, we use the knowledge gained from the process and results of data collection to propose ways that data can be improved to make future analysis of environmental enforcement and progress both easier and more useful. This will not be an easy task, especially given the difficulty in data retrieval and usage which suggests there are forces that may be at work to prevent the clarity of data needed to fully explore environmental law effectiveness.

Certain theories on enforcement have political constituencies that may be more concerned with political gain, or on spending money on other priorities, than with cost efficient and effective environmental regulation. Particularly now, in a time of falling state revenues, many states may not wish to learn that specific resource levels are necessary for effective environmental enforcement. If the different strategies based on such theories are not held up for empirical testing, however, then legislators, administrators, businesses and environmentalists will keep asserting their differing views about what works in enforcement and what doesn't. The citizens and the environment will thus be the ones to suffer. Environmental enforcement strategies incur costs – to the government, regulated industries, and society when enforcement strategies fail[16]. We have a duty to acquire the best data available to assist in making policy decisions for the benefit of the whole, rather than for a select few.

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[15] *See* discussion *infra* pp. 37-39.
[16] Carol Rose, *Rethinking Environmental Controls: Management Strategies for Common Resources*, 1991 Duke L.J. 1, 12 (1991).

In this article, we attempt to answer the important questions about approaches to general enforcement across all industry groups, at least partially, and to make recommendations based on these answers. Additionally, we highlight the difficulty in acquiring the data necessary to make these comparisons effectively, and propose a systematic approach for collecting this data that makes enforcement effectiveness and thus environmental protection more transparent. In Part I, we will discuss the different enforcement ideas and strategies and what we would like to learn about them. In Part II, we will set out the research background, ultimate methodology, and data acquisition chosen to answer these questions. Part III contains our analysis of the results of the statistical analyses, Part IV contains our summary of the core empirical findings and their implications, and in Part V we will set out the policy prescriptions that can be drawn from this study.

I. ENFORCEMENT STRATEGIES

A. Theories of Environmental Enforcement

The issue of the effectiveness of environmental enforcement is an old one that begat the modern environmental laws. Though federalization of environmental laws is supported by the economic theory of controlling all factors in a commons pollution problem[17], as well as providing a floor of environmental health for all American citizens[18], much of our modern environmental laws can be traced directly to the historic

[17] Craig Johnston, William Funk, and Victor B. Flatt, Legal Protection of the Environment 24 (Thomson West, 2nd Ed. 2007).
[18] William Buzbee, *Asymmetrical Regulation: Risk, Pre-emption, and the Floor/Ceiling Distinction*, 82 N.Y.U. L. Rev. 1547, 1551 (2007).

failures of the states as governments to address these harms themselves.[19] Environmental law was traditionally local in origin.[20] Through the concept of public nuisance and later that of zoning, the most obvious environmental harms of the past, from raw sewage to choking smoke, were dealt with by local government.[21]

As environmental harms increased, the ability of states or localities to control those harms did not seem to keep up with them. Even when the federal government stepped in, both the Clean Air Act and the Clean Water Act (before their modern incarnations) relied primarily upon the states to do the regulation necessary to control environmental harms.[22] The states proved spectacularly unsuccessful, however, giving impetus to federal government to take the lead in environmental law.[23] A new kind of cooperative federalism was created which moved beyond the traditional reliance on states to deal with such issues, in favor of a state/federal mix of controls.[24] Though the states were still to play a role, theoretically, it was the federal government that would ensure a fail-safe system in case of state failure.[25] The fail-safe system would occur primarily through federal oversight and federal ability to take over failing state programs.[26] Though federal oversight showed some strength at first, with the federal government taking over state programs and ordering particular kinds of compliance[27], this changed quickly. For

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[19] Flatt, *Dirty River, supra* n. 10, at 7, 14 (e.g. the failure of states in administering the Clean Water Program).
[20] Glicksman, Markell, Mandelker, Tarlock, and Anderson, Environmental Protection Law and Policy 24, 505 (4th Ed. 2003); Johnston, et al., *supra*, n. 17, at 3.
[21] Glicksman et al., s*upra,*. n. 20, at 505-06.
[22] Johnston et al., *supra*, n. 17, at 6-8.
[23] Jerome Organ, *Limitations on State Agency Authority to Adopt Environmental Standards More Stringent than Federal Standards: Policy Considerations and Interpretive Problems*, 54 Md. L. Rev. 1373 (1995).
[24] Johnston, et al, *supra* n. 17 at 9-10.
[25] Flatt, *Dirty River, supra* n. 10, at 15.
[26] Buzbee, *supra* n. 18, at 1565.
[27] Flatt, *Dirty River, supra* n. 10, at 16; *see also Union Electric Co. v. EPA*, 427 U.S. 246, 252-53, 96 S.Ct. 2518, 2523 (1976).

political reasons, some of the federal power was reduced.[28] Moreover, the appetite for such involvement with local issues as well as the resources for such takeovers quickly became a thing of the past.[29]

At this point the states themselves began to assert their own visions for environmental enforcement and, in the face of economic downturns, many of these states perceived less aggressive environmental enforcement as maximizing scarce state resources.[30] Many states thus prohibited themselves or localities from adopting any regulations more stringent than the federal government, in effect, making an environmental floor a ceiling.[31] Many states also began actively pursuing a new "cooperative" based enforcement strategy, typified by the passage of audit shield laws, which protected polluters from environmental prosecutions if they corrected environmental problems and also allowed them to avoid reporting of environmental violations.[32] These two examples were but part of a larger pattern. Whether because of state independence, flexibility, friendliness to business, or friendliness to state coffers, the late 1980s and 1990s saw a new wave of enforcement, wherein states were to "reinvent" environmental enforcement to be more cooperative.[33] Many environmental scholars were suspicious of such an agenda, and noted that assertions of state primacy and "better" environmental

[28] *See e.g.* 42 U.S.C. Sec. 7410(a)(5)(A)(i), added in 1977, which prohibits the federal administrator from requiring states to control indirect sources of air pollution, i.e. control of land use, for SIP program approval.
[29] Flatt, *Dirty River, supra*, n. 10, at 16.
[30] Kirstin Engel, *State Environmental Standard Setting: Is there a Race, and Is it to the Bottom?,* 48 Hastings L. J. 271, 340-41 (1997).
[31] Organ, *supra* n. 23, at 1376-77.
[32] Rechtschaffen and Markell, Reinventing, *supra, n.* 12, at 2 (noting that almost one half of the states passed audit privilege shield laws despite EPA objection.).
[33] *Id.*, at 1.

enforcement may be a screen for special interests which only undermine environmental protection.[34] Rechtschaffen and Markell summarize this movement as follows:

> "Two major tenets, among others, lie at the heart of the movement to reinvent environmental regulation. The first is that environmental enforcement should be shifted from a deterrence-based approach to one based on cooperation or compliance. The second is that the federal government should devolve more environmental responsibility to the states. These two distinct, yet related areas have generated enormous interest and debate. From 1997 to 2000 alone, for example, the U.S. Congress held over a dozen hearings on one of these two topics."[35]

B. Prior Empirical Analyses of Environmental Enforcement

Despite the major shift in theories regarding enforcement in the last two decades, empirical analysis and testing of these strategies have been limited. Most of the data examining the effectiveness of either deterrence or compliance based enforcement is industry specific. In one case, Rechtschaffen and Markell note the importance of the Harrison study from the 1990s which compared pulp and paper mill pollution sources in Canada and the United States.[36] The Canadian sources, which were in the more cooperative enforcement jurisdiction, showed less compliance.[37] Conversely, there have also been evaluations of smaller programs that have shown positive results from using cooperative based enforcement methods.[38] However, none of these studies control for

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[34] *See e.g*. Daniel Esty, *Next Generation Environmental Law: A Response to Richard Stewart*, 29 Cap. U. L. Rev. 183, 189 (2001).
[35] Rechtschaffen and Markell, *supra*, n. 12, at 1-2.
[36] *Id* at 242.
[37] *Id.*
[38] *Id*. at 238-240.

other factors that could influence the outcome, and many of the successful programs were resource intensive, which doesn't support the theory of cooperative based enforcement saving money.[39]

From 2005 through 2008, a research group at the University of Kansas surveyed opinions of major NPDES sources as to which types of enforcement are believed to be most effective, and also sought to see what happened to source compliance following various enforcement actions to these large sources.[40] Their findings have been an important source of new information, particularly about the effectiveness of state enforcement versus federal enforcement. Through a complex analysis, the group was able to compare how state administrative actions compared to federal administrative actions in affecting the amount that major chemical dischargers were over the NPDES permitted limits.[41] The results tended to show that federal administrative actions were more effective than state ones, thus complementing the earlier research on state comparisons.[42]

In a follow-up article, Professors Glicksman and Earnhart were able to classify regulated sources into two categories depending on whether permit terms had been modified or not modified, using that differentiation as a marker for cooperative versus deterrence based enforcement.[43] (They supposed that sources with allowed permit modifications were beneficiaries of cooperative based enforcement.)[44] Though this

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[39] *Id.* at 240.
[40] Glicksman and Earnhart, *Chemical Industry*, *supra, n.*4, at 322.
[41] *Id.* at 347-352.
[42] *Id*. at 349.
[43] Robert L. Glicksman & Dietrich H. Earnhart, *Effectiveness of Government Interventions at Inducing Better Environmental Performance: Does Effectiveness Depend on Facility or Firm Features?,* 35 B.C. Envtl. Aff. L. Rev. 479 (2008) (hereinafter "*Effectiveness*").
[44] *Id*. at 487.

could provide a method for categorizing type of enforcement in some circumstances, for reasons noted *infra*, such a comparison may be unavailable for large, general data sets.

A 1996 through 1998 statistical analysis by one of the authors of this article looked at state enforcement of the Clean Water Act in two states and examined enforcement across all industrial groups for that program. The study found that although enforcement actions may be occurring at the same rate, the individual nature of each state's enforcement actions that actual compliance achievement was not uniform even for similarly situated sources.[45] This finding challenged the assumption that "enforcement" automatically leads to compliance and focuses us more on the type or kind of enforcement which is occurring.

C. What Else Can We Learn About Enforcement?

Despite the prior empirical analyses, we still have no real idea to what extent resource allocation is necessary for effective enforcement, or whether cooperative or deterrence based enforcement is more effective. How do we determine these answers? We know the states are required to meet the same federal standards and implement the same federal statutes. The states are also increasingly responsible for primary enforcement of the environmental laws, which means that their ability to effectively enforce the standards and the laws determines if our environment is protected.[46] As a result, examining the effectiveness of various state programs might be a good way to determine optimal enforcement strategy.

[45] Flatt, *supra* n. 10, 27-28.
[46] *Id.*, at 20.

Particularly, it would be illuminating to analyze: 1) the effects of budgeting in state environmental agencies on enforcement effectiveness, 2) the effectiveness of cooperative vs. deterrence based enforcement, 3) the effects of budget redeployment in state environmental agencies, and 4) the effects of state enacted environmental policies, such as lenient audit procedures.[47] These input variances could be compared between numerous states, or within a single state where policies change temporally. Other theoretically relevant variables could be accounted for through the inclusion of statistical control variables. This would produce both general data for use by a state or anyone else (e.g. this data might show that the state of Texas has a higher percentage of out of compliant sources now than it did in 1990 for type, size, and source violations), or for use statistically to praise or indict strategies (e.g. a statistical analysis of state enforcement agencies around the country could show that audit privilege laws are associated with less compliance of permitted sources). We would not have to measure every state, only a statistically valid sampling thereof.

The main impediment to such analysis is acquiring the data. In addition to the acquisition of output variable (i.e., dependent variable) data on environmental source compliance noted in the Introduction, *supra*, many of the input variables (i.e., independent variables), such as state funding directed to particular programs or state policies on enforcement, require extensive digging even if they can be found and are available at all. Our goal was to acquire the data necessary to answer our questions empirically, or if unable to secure the data, to make suggestions on how policies should be changed to make the needed data available. Following are the inter-related stories of

[47] For reasons explained in the text, *infra*, the data is not sufficient to test all of these questions.

the construction of possible statistical methods for testing our findings and the attempt to gather data to provide the raw inputs for such analyses.

II. RESEARCH BACKGROUND, METHODOLOGY, AND DATA COLLECTION

A. Outcome measurement issues

The underlying issue in trying to conduct the statistical analysis of the effectiveness of any variable, such as different environmental enforcement strategies, is an outcome measurement. In the environmental arena this is particularly problematic, because in general, as noted above, there is no direct measurement of environmental quality. Even in the cases where such measurements are being developed, identical methods do not exist temporally or locationally, i.e. today's analysis of water quality may be conducted differently from that of ten years ago, or measurement methodologies in California may not be identical to those in North Carolina.[48] Therefore in the environmental arena there must be some effective substitute for environmental markers which replicate or come close to replicating the actual state of the environment. Over time, the number of enforcement actions and penalty amounts have been used as outcome variables for federal environmental laws.[49] However, each of these suffers from the problem that they are themselves varying enforcement strategies and thus varying input variables. In other words, how does one measure the effectiveness of stepped up enforcement on environmental health if stepped up enforcement is the outcome variable?

[48] Adler, *supra*, n. 4, at 49.
[49] Rechtschaffen and Markell, *supra*, n. 12, at 247.

As a second best option, one can try to test whether enforcement actually alters the way that pollution sources comply with the law.[50] The average length of time violators are out of compliance may be related to the actual harm that the environment is undergoing.[51] Courts have affirmed the assumption that violating congressionally mandated standards can reasonably assumed to be harmful to the environment.[52]

In an article from 1998 entitled "A Dirty River runs through it . . .," one of the authors of this article proposed using the average time a regulated source is non-compliant as an outcome variable for environmental quality.[53] This measure assumes that the basic laws and standards, if enforced, are markers for environmental health.[54] Even absent this assumption, it will always at least be a marker of how long permitted sources are in technical violation of laws and standards, and thus it will at least always be an outcome variable for legal compliance with environmental standards. This variable can thus be used to test whether various administrative strategies, such as budget devoted to environmental protection, or cooperative versus deterrence based enforcement, are more likely to lead to less violation of standards. This is an appropriate measure because, even when the enforcement strategy changes, the sources themselves must still self report technical compliance with the standards on a monthly basis. Its use is limited though, as it fails to capture those sources that are outside the regulatory net altogether and so

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[50] Flatt, *supra,* n. 10, at 24.
[51] *Id.*
[52] *Friends of the Earth, Inc. v. Laidlaw Environmental Services (TOC), Inc.*, 528 U.S. 167, 183, 120 S.Ct. 693, 706, 145 L.Ed. 2d. 610 (2000) (Here, in contrast, it is undisputed that Laidlaw's unlawful conduct-discharging pollutants in excess of permit limits-was occurring at the time the complaint was filed. Under *Lyons,* then, the only "subjective" issue here is "[t]he reasonableness of [the] fear" that led the affiants to respond to that concededly ongoing conduct by refraining from use of the North Tyger River and surrounding areas. Unlike the dissent, *post,* at 714, we see nothing "improbable" about the proposition that a company's continuous and pervasive illegal discharges of pollutants into a river would cause nearby residents to curtail their recreational use of that waterway and would subject them to other economic and aesthetic harms. The proposition is entirely reasonable).
[53] Flatt, *supra* n. 10, at 24.
[54] *Id.*

cannot test whether we are regulating the correct things or not.[55] Nor does it determine whether the permit terms themselves are consistent with the legal requirements of the Acts (another concern with administrative discretion).[56] It does simply tell us the effects of various regulatory strategies on the legal compliance issues.

Therefore, we propose the use of non-compliance with permits history, which are self reported, as the output variable to test the effects of various enforcement strategies. In addition, we also examine the amount of fines levied against facilities for environmental violations as a second means to gauge compliance. While this second measure is somewhat crude, it is nonetheless useful because monetary fines can potentially act as a deterrent to polluting activities and thus encourage facilities' compliance with environmental laws.[57] This proxy for enforcement thus assumes that facilities fined for environmental violations are more likely to come into compliance with environmental regulations as a result of this enforcement strategy.

Of course, we recognize that, while the size of fines appears to be relevant to whether cooperative or deterrence based enforcement is a primary strategy of a jurisdiction (i.e. one might assume that lower fines are associated with cooperative based enforcement), it is difficult to disentangle this output variable from others. For instance, fines might rise the longer a source is non-compliant (meaning higher fines would be associated with longer non-compliant times), or conversely, higher initial fines may be an incentive for a source to become compliant more quickly (meaning higher fines would be

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[55] *Id.* at 22.
[56] Glicksman and Earnhart attempt to measure this in *Effectiveness, supra* n. 43.
[57] *See e.g.* Mark A. Cohen, *Empirical Research on the Deterrent Effect of Environmental Monitoring and Enforcement*, 30 ELR 10245 (2000); Surabhi Kadambe & Kathleen Segerson, *On the Role of Fines as an Environmental Enforcement Tool*, 41 J. of Envtl. Planning and Management 217 (1998); Dorothy Thornton, Neil Gunningham, & Robert A. Kagan, *General Deterrence and Corporate Environmental Behavior*, 27 L. & Policy 262 (2005); Montserrat Viladrich-Grau & Theodore Groves, *The Oil Spill Process: The Effect of Coast Guard Monitoring on Oil Spills*, 10 Envtl. & Resource Economics 315 (1997).

associated with shorter non-compliant time). Despite these concerns, we can draw some conclusions about the relationship between fines levied and money spent on enforcement, possibly shedding light on whether states with larger per capita environmental program expenditures are more likely to impose higher punishments through higher fines. However, without information on non-compliance times, which we do not have for the Clean Water Act data, it may be difficult to disentangle the relationship between fines and non-compliance times.

B. Data

In order to conduct empirical research on environmental enforcement, one must overcome data problems on the sources and pollutants as well as what individual state factors might influence environmental compliance. Below, we discuss these issues in regards to federal data from the EPA concerning pollution sources and individual state data concerning environmental funding and enforcement policies for comparison purposes.

1. *Federal Data from the Environmental Protection Agency concerning pollution sources*

Historically, it has not been easy to gather information about compliance of particular sources with various environmental laws, let alone find ways of comparing them.[58] The EPA would, in theory, monitor state actions regarding permitted sources, but it had no way to directly compare the intensity of the resolutions.[59] In response to continuing difficulties in tracking enforcement, the EPA introduced its Integrated Data for

[58] Flatt, *supra*, n. 10, at 18.
[59] *Id.*

Enforcement Analysis (or "IDEA") in the early 1990s.[60] IDEA, in theory, meant that all sources permitted under any statute could be examined and compared with each other and across media.[61] Nevertheless, the introduction of IDEA has still not generally enabled outside examinations of enforcement effectiveness, for several reasons.

First, IDEA is generally complex, and difficult to access, even to those dedicated to getting the data.[62] Second, the entire database is not available to the public. Compliance data is presented to the public through the system known as "Enforcement and Compliance System Online"("ECHO").[63] ECHO purports to allow a user to acquire data on compliance history, violations and enforcement actions.[64] The current online version also allows one to search for permitted sources on several factors such as location, compliance, history, etc.;[65] however, this is not in a format that would allow downloading data to conduct comparisons across state variables.[66] Third, at the time we proposed this study, the public ECHO search would only allow the return of 1,000 data hits.[67]

Further compounding those limitations, data available on ECHO does not contain a description of the permitted source that would allow a researcher to control for source differences in making comparisons of compliance of sources between states.[68] For example, although a single numeric indicator, such as quarters of non-compliance (SNC),

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[60] Peter J. Fontaine, *EPA's Multimedia Enforcement Strategy: The Struggle to Close the Environmental Compliance Circle,* 18 Colum. J. Envtl. L. 31, 57-58 (1993).
[61] *Id.*
[62] Vandenburgh, *supra*, n. 9, at 87.
[63] http://www.epa-echo.gov/echo/ (last accessed on August 1, 2008).
[64] *Id*.
[65] http://www.epa-echo.gov/echo/compliance_report_air.html (last accessed on August 1, 2008).
[66] *Id.*
[67] *Id*.
[68] Victor Flatt, memo to Center for Progressive Reform Member Scholars on follow-up data available for proposed empirical research, May 1, 2005 (on file with the author) ("Memo 3").

could be compared across states, such a comparison would be a sloppy use of data and a meaningless comparison without accounting for source differences.[69] Additionally, through a blocking program, the EPA prevents data from being downloaded from the ECHO site by a computer system, thus requiring manual entry of data.[70]

A second, more complete Online Targeting Information System ("OTIS") allows some online queries of the full IDEA database, but OTIS is only available to the EPA, the federal government, and state governments.[71] By only allowing the data to be accessed through queries, data from OTIS cannot be directly downloaded into a program file. Therefore, one cannot introduce different variables, such as state enforcement spending, to do statistical comparisons between state enforcement actions. To conduct a statistical comparison using IDEA data with other data, the IDEA data would have to be re-entered into a spreadsheet to allow a computer program to conduct the many mathematical calculations necessary to do a statistical comparison.[72]

Faced with this data problem, in April 2005, we contacted EPA personnel who worked in the Office of Compliance Assistance.[73] A representative of this office confirmed that the IDEA database contained all of the compliance data (including the data which would allow a control of extraneous factors in a state comparison) for three

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[69] *Id*.
[70] *Id*. (This is ostensibly because of the large computer time costs the EPA would incur through such a download.) Since our study has hundreds of thousands of pieces of data, this would make analysis virtually impossible.
[71] http://www.epa.gov/Compliance/data/systems/multimedia/idea/
[72] Because of this difficulty, in 1998, one of the authors only conducted a comparison of two states for one environmental program, the CWA. The summarized data was received from the states themselves, and even only two years worth of data required the manual entry of over 10,000 data points. Flatt, supra, n. 10, at 35 (Appendix A).
[73] Flatt, Memo 3, *supra* n. 68.

major federal environmental laws: The Clean Air Act, the Clean Water Act, and the Resource Conservation and Recovery Act.[74]

We also learned there was possible public access directly to the IDEA data. One would simply need to obtain an EPA mainframe user ID and account (to compensate for the costs of the searching) and obtain remote access via a web browser.[75] The EPA contact informed us that the amount of data that we would be using and manipulating might not be downloadable over the internet, and might require working at one of the main frame computers either at the EPA's headquarters in Washington, D.C., or at their research contractor's facility in Cambridge, MA.[76]

Another EPA employee in the same office, who wished to remain anonymous, sent the authors the description for all variables in the IDEA database, specifically, what fields can be searched or downloaded.[77] We were informed that downloads could be transferred into EXCEL and thus into common statistical analysis programs, such as R, SAS, SPSS, and Stata. The full description of this data and fields is designated Appendix A, which due to its size, is not attached but is accessible at a permanent online location, at http://www.law.uh.edu/faculty/vflatt/cleanwater.pdf and http://www.law.uh.edu/faculty/vflatt/cleanair.pdf

The description of the data fields in IDEA seemed to indicate that if we could obtain this data, we could meet our research needs. With respect to the air data, the amount of

[74] *Id.*
[75] http://www.epa.gov/compliance/data/systems/multimedia/idea/pubusers.html (last accessed on March 17, 2005).
[76] Flatt, *supra*, n. 74.
[77] *Id.*

quarters that a source is non-compliant (one of our proposed dependent variables) is listed as a number for the two years preceding the date of a facility's inspection.[78]

There were also data fields that would help us to control for differences between sources, including: a) which air programs are permitted (i.e., NSR, PSD, etc.), b) what kind of a source is under consideration based on Standard Industrial Classification Code (allowing us to categorize like sources with like sources), c) size of source pollution (i.e. greater than 100 tons per year of major pollutant, etc.), d) pollutant subject to most serious compliance violation, and e) the source's federal regulation status.[79] With respect to the use of number of quarters in non-compliant status, there are variables that describe the kind of non-compliance more specifically (i.e. is it a procedural or a permitting violation?). This indicated that we could separate out reporting violations from permit violations. There are also fields that assist in testing the dependent variables that we have at issue. There are fields that show amount of penalty, action taken (closed, fined, etc.), and the date of a completed compliance action.[80]

By examining the field description, we were able to determine at least one possible way that we could conduct the research on comparison of enforcement, assuming we could get the data. It seemed that the relationship between compliance amount and compliance date data and the number of quarters in violation in the two years preceding a facility's inspection date (VIOLQTR – for air data) could be compared with state enforcement policies (funding, etc . . .) while controlling for differences in the sources. Though the time divisions were gross (number of quarters in violation for the two years preceding the inspection date), they provided some discrimination on non-compliance

[78] *Id.*
[79] *Id.*
[80] *Id.*

information regarding a state's dominant enforcement attitude. It also seemed that the water and RCRA data has similar markers to allow similar analysis. Both the water and RCRA data also allowed for distinction between types of permitted facilities and, had fields that corresponded to violation determination, history, and status.[81]

Despite all of the restrictions on the data usage online, an EPA employee was willing to transfer the raw data for all three programs to us for these research purposes free of charge, allowing us to directly load it into a spreadsheet in which we could then input information corresponding to measures of state-level environmental spending and the political orientation of a state's political elite. As the amount of data was so large, it had to be transferred into an FTP account at the University of Houston.[82] From there it was downloaded entirely into a computer for later work.[83] Although we obtained data covering compliance with the AIRS Facility Subsystem (involving compliance with the Clean Air Act), the National Pollutant Discharge Elimination System (involving compliance with the Clean Water Act), and the Resource Conservation and Recovery Act (involving compliance with hazardous waste management provisions of RCRA), we were unable to extract information regarding the penalties assessed against a facility for violations of RCRA or the number of quarters a facility is in violation of RCRA requirements. Further, we were unable to extract information related to the number of quarters a facility is in violation of the Clean Water Act.[84] As a result, our empirical

[81] *Id. (*The unit of analysis in these databases is the facility-inspection type-inspection date. This means that each facility appears in the data on the basis of the date of the compliance inspection and the type of compliance inspection.)

[82] E-mail from Rob Brothers, Director of Information Technology, University of Houston Law Center, institution, to Victor Flatt, A.L.O'Quinn Chair in Environmental Law, University of Houston, April 13, 2005, time stamp (copy on file with the author).

[83] *Id*.

[84] Rather bewilderingly, the National Pollutant Discharge Elimination System (NPDES) data codebook indicates that it contains a variable composed of the number of quarters a facility is in violation of Clean

analyses focus only on the following dependent variables: 1) the penalties assessed against facilities for violations of Clean Water Act regulatory requirements; 2) the penalties assessed against facilities for violations of Clean Air Act regulatory requirements; and 3) the number of quarters (in the two years preceding the inspection date) facilities are in violation of compliance with Clean Air Act regulatory requirements. In other words, due to a lack of data availability, we exclude compliance with RCRA requirements from our empirical analyses.

2. *Data From States for Comparison Purposes*

Since we wished to examine the relationship between state funding, attitudes about cooperative vs. deterrence based enforcement, and a source's non-compliance status, we would need a way to operationalize these concepts. With respect to state "attitudes," we originally hoped to be able to examine specific legislative, regulatory, or executive branch requirements that might direct a state environmental agency to choose one of these methods. Since there were no uniform words in either legislation or regulation to indicate such a direction, we believed that the most direct way to get this information was from the enforcement staffs of the state environmental agencies themselves. Similarly, since states had different methods of organizing their state environmental organizations, we would probably have to depend on the state agencies to tell us how much of each state's budget had gone to enforcement programs.

Water Act requirements over the two years preceding a facility's inspection date (labeled Historic Noncompliance Quarter). According to the NPDES codebook, this variable takes on values ranging from 1 to 8. However, in the actual data, this variable does not take on these values, but rather contains year-quarter entries (e.g., 20011, 20012, 20013, 20014) that do not correspond to the number of quarters a facility is in violation of Clean Water Act requirements in the manner described in the codebook and do not range from 1 to 8 (even after removing the year from the variable entries).

Because we realized that obtaining this much information on an individual basis might be difficult and time consuming, we decided to use a selection of states in this comparison rather than examine the data from all states. The most populous states generally have the most sources, so the inclusion of these states allows us to both examine the environment in which more people live, as well as increase the number of data points without additional work or complexity. Thus, our sample contains most of the largest states in the country. Since we are examining attitudes about environmental enforcement and since these attitudes have at least loosely been correlated with political orientation and possibly with regional differences[85], we felt that the sample needed to include states from different regions that were governed by different political elites with varying ideologies. In particular, in selecting the large states, it was important to select states with different political orientations. Finally, some states have relatively unique and important environmental values, and this was also used in making the selection.

The states selected were Alaska, Arizona, California, Colorado, Connecticut, Florida, Georgia, Indiana, Kansas, Maryland, New Jersey, New Mexico, New York, North Carolina, Ohio, Oregon, Tennessee, and Texas. Though we originally hoped to obtain data for ten years, since we only had four years of source data from the EPA (2000-2003), we focused on the overlapping time in the states searched. Research assistants working on the project performed an extensive search of online databases to

[85] *See e.g.* Riley E. Dunlap, Chenyang Xiao, & Aaron M. McCright, *Politics and Environment in America: Partisan and Ideological Cleavages in Public Support for Environmentalism*, 10 Envtl. Politics 23 (2001); David M. Konisky, *Regulator Attitudes and the Environmental Race to the Bottom Argument*, 18 J. of Public Administration Research & Theory 321 (2008); Eugene S. Uyeki & Lani J. Holland, *Diffusion of Pro-Environment Attitudes?*, 43 Am. Behavioral Scientist 646 (2000).

determine if any of this information had been compiled in one place.[86] Without success, our attention turned to individual state sources.[87] The research assistants then obtained contact information by e-mail and telephone for each state's environmental agency.[88] With this information, and an initial round of contacts, they were able to obtain budget information on environmental spending practices for 8 of the 18 states.[89]

The state budget numbers did not exactly match up with one another, i.e. states might report budgets based on authorizations or expenditures, and the budgets might be subdivided by medium (air, water), or by expense category (personnel, fines, etc . .).[90] It seemed that the best option we had for comparing budget numbers was to start with the largest common categories that were informative. We decided that this would be total environmental expenditures, assuming that most states categorized "environmental" similarly.

The location of this information varied from state to state. Our research assistants began using the "yellow book of state government" to locate contact persons in specific agencies for information.[91] We received at least skeletal budget information from most of the states quickly. This was obtained either directly from the state agency or through

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[86] E-mail from Phillip Schotts, Research Assistant, University of Houston Law Center, to Victor Flatt, A.L. O'Quinn Chair in Environmental Law, University of Houston Law Center, Feb. 17, 2006, time stamp. (on file with the author).

[87] *Id.*

[88] See XL spreadsheet, "enviro budget contacts.xls" prepared by Jere Overdyke and Emily Buckles, from May 17, 2006 (on file with the author).

[89] See XL spreadsheet, "Flatt Research JCO additions.xls" prepared by Jere Overdyke, May 17, 2006 (on file with the author).

[90] See Compendium of state budget figures, Appendix B, PDF available at http://www.law.uh.edu/faculty/vflatt/state-budget-data/

[91] E-mail from Ben Rhem, University of Houston Law Center, to Victor Flatt, A.L. O'Quinn Chair in Environmental Law, University of Houston Law Center, August 28, 2007, time stamp. (on file with the author).

sources to which research assistants were directed by the state agency.[92] Some information was found through online research.[93]

a. State Per Capita Environmental Spending

A cursory examination of the state budget data seemed to indicate wide swings in per capita environmental spending, so the authors revisited each state's budget data to see how the budget was broken down. In several cases, we discovered that the budget numbers were not comparable after all. The most common differences occurred in whether broad health, agriculture, or recreation programs (such as hunting or fishing) were included in the state's "environmental" or "natural resource" category. We made adjustments to the figures of some of the states as appropriate. Full breakdown of all state budgets from each year are available in the compendium, Appendix B, accessed at http://www.law.uh.edu/faculty/vflatt/state-budget-data/
Data corrections by state are set out in Appendix C.

Ultimately, though we contacted sources in Georgia multiple times, we received no return calls or information; therefore, Georgia was dropped from the consideration.

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[92] Sources for budget information included:
California – California State Library, California EPA
Oregon – Dept. of Environmental Quality
North Carolina – Dept. of Natural Resources and Environment – Budget and Planning
Arizona – Dept. of Environmental Quality Library
Texas – Texas Commission on Environmental Quality
Kansas – Dept. of Health and Environment
Ohio – EPA – Office of Fiscal Administration
Connecticut - Office of Policy & Management - Budget & Financial Mgmt Division
Georgia – Dept. of Natural Resources
Indiana - Indiana Department of Environmental Management Office of External Affairs
Florida – Dept. of Environmental Quality
Maryland – Dept. of Environment – Maryland Manual Online
See compendium of state research, supra, n. 92, at
http://www.law.uh.edu/faculty/vflatt/state-budget-data/

[93] Rhem memo, *supra* n. 93.

With this data in hand, our measure of *State per Capita Environmental Spending* represents each of the seventeen state's per capita environmental spending, calculated by year. This variable allows us to examine the relationship between state environmental spending and compliance with Clean Air Act and Clean Water Act regulatory requirements.

b. State Ideology

As noted above, we were also interested in whether cooperative versus deterrence enforcement strategies has a significant effect on source compliance. After conducting research on such state policies, we could find no uniform legislative or regulatory marker indicating whether a state had one of these enforcement "attitudes" as dominant. As an alternative, we followed Glicksman and Earnhart, who proposed using permit modification as a marker for cooperative versus deterrence based enforcement on the logical assumption that a permit modification demonstrated a cooperative action.[94] However, we realized that, because Glicksman and Earnhart examined only a subset of Clean Water Act data, corresponding to the chemical industry, their permit modified variable exhibited much more variability than a congruent measure in our data since our dataset is more expansive. More specifically, in our Clean Water Act data, only 700 observations indicate that a permit was modified, out of 101,498 total observations (less than 0.70%). Accordingly, due to the limited variability in the permits modified for facilities in our data, we are unable to rigorously control for cooperative enforcement

[94] Glicksman and Earnhart, Effectiveness, *supra*, n. 43, at 508.

using a permit modified variable.[95] Further, we were unable to locate a similar permit modified variable in our Clean Air Act data.

Since cooperative based enforcement has been associated with a conservative political point of view[96], we examined whether the political orientations of state political actors influence compliance with environmental regulations. This provided us with the opportunity to determine whether facilities located in states governed by conservative political actors are more or less likely to comply with environmental regulations as compared to facilities operating in states governed by liberal political actors. Because our data contain a sample of states that vary widely in terms of both their geography and political orientation, we were cognizant of the fact that a Republican in New Jersey is not the same as a Republican in Texas. Accordingly, relying solely on the political party affiliations of the state political elite (i.e., governor and legislature) is undesirable since such a modeling strategy would make the assumption that all Democrats and all Republicans are created equal, regardless of the geographical location and political history of the state.

Thus, we needed a proxy for state elite ideology that was capable of capturing the nuances between the political ideologies of the American states. Fortunately, Berry et al. provide such a measure.[97] This measure, calculated yearly for each state, is based on three points of information: interest group ratings of a state's members of Congress, the power division among Republicans and Democrats in a state's legislative chambers, and

[95] When we include such a variable in our Clean Water Act models, the permit modification variable fails to attain statistical significance anywhere near conventional levels.

[96] *See e.g.* John T. Scholz, *Cooperative Regulatory Enforcement and the Politics of Administrative Effectiveness*, 85 Am. Political Science Rev. 115 (1991).

[97] William D. Berry, Evan J. Ringquist, Richard C. Fording, and Russell L. Hanson, *Measuring Citizen and Government Ideology in the American States, 1960-1993*, 42 Am. J. of Political Science. 327 (1998). (These ideologies scores have subsequently been updated through 2006 and are available here: http://www.uky.edu/~rford/Home_files/page0005.htm.)

the ideology of a state's governor. These scores have been shown to have substantial face validity and are able to capture the differences between the underlying ideologies of the major political parties that vary between states.[98] For example, in 2003, Republicans controlled the legislative and executive branches in Texas (i.e., there was unified Republican government), as they did in New Jersey in 2001. Reflecting the fundamental differences between the Republican parties in Texas and New Jersey, Berry et al. score Texas in 2003 very conservative (8.93), while New Jersey is much more moderate (50.23), relatively speaking, even though both states were controlled by the Republican Party. Given the power offered by the Berry et al. scores, we utilized them to operationalize our measure of *State Elite Ideology.* This variable ranges from 0 to 97.5, with higher scores reflecting more liberal state elite ideologies.[99]

In addition to our key independent variables (*State per Capita Environmental Spending* and *State Elite Ideology*), we also control for attributes of the facilities through the inclusion of dummy variables. In the models capturing a facility's compliance with Clean Air Act regulatory requirements, we include 12 dummy variables controlling for the Air Program Code of the facility, 15 dummy variables accounting for the National Action Type Code of the facility, and 113 dummy variables controlling for the Standard Industrial Code clusters of the facility. In the model capturing a facility's compliance

[98] *Id.* at 341-343.

[99] As an alternative to the Berry et al. scores, we operationalized a measure of elite ideology based on the political party affiliation of a state's legislative and executive branches scored such that: 6 = unified Democrat (governor and legislature), 5 = Democratic governor, divided legislature, 4 = Democratic governor, Republican legislature, 3 = Republican governor, Democratic legislature, 2 = Republican governor, divided legislature, 1 = unified Republican (governor and legislature). This information was collected from each state's legislative website, the website of the National Governor's Association, and individual contacts with the following agencies: Colorado Legislative Council Staff, Connecticut State Library, Kansas State Library, New Jersey State Library, Maryland Department of Legislative Services, State Library of Ohio, and the New Mexico State Library. This alternative measure is correlated with the variable employed here at the 0.8 level. Substituting it for the measure utilized in this article does not alter the substance of the results.

with Clean Water Act regulatory requirements, we include 94 dummy variables controlling for the Enforcement Action Code of the facility, 31 dummy variables accounting for the Inspection Type Code of the facility, and 97 dummy variables controlling for the Standard Industrial Code clusters of the facility.[100] The purpose of including these controls is to allow us to "hold all else constant" in interpreting the influence of our central explanatory variables of interest. Accordingly, although we include these dummy variables in the statistical models, we do not report the coefficients associated with these variables.

III. Empirical Results

Table 1 reports the results of the model that captures the penalty assessed against a facility in violation of compliance with Clean Water Act regulatory requirements.

[100] The number of dummy variables accounting for the Standard Industrial Code clusters of facilities differs in the Clean Air Act and Clean Water Act models due to the fact that a smaller number of Standard Industrial Code clusters are applicable to facilities appearing in the Clean Water Act data.

Table 1. Ordinary Least Squares Regression Estimates of the Penalty Assessed Against a Facility in Violation of Compliance with Clean Water Act Regulatory Requirements, 2000-2003

Variable	Coefficient
State per Capita Environmental Spending	17.94***
	(8.43)
State Elite Ideology	−14.32***
	(3.74)
Constant	−443.06
	(649.1)
R^2	0.075
N	101,498

Entries are ordinary least squares regression coefficients. Numbers in parentheses indicate robust standard errors, clustered on facility. *** p < .05 (two-tailed tests).

Model includes 94 dummy variables controlling for the Enforcement Action Code of the facility, 31 dummy variables controlling for the Inspection Type Code of the facility, and 97 dummy variables controlling for the Standard Industrial Code clusters of the facility (results not shown).

Sample includes the following states: Alaska, Arizona, California, Colorado, Connecticut, Florida, Indiana, Kansas, Maryland, North Carolina, New Jersey, New Mexico, New York, Ohio, Oregon, Tennessee, and Texas.

As our dependent variable[101], the monetary penalty levied against a facility, is a continuous variable, we utilize ordinary least squares regression to model the influence of state per capita environmental spending and state elite ideology on the penalty assessed against a facility.[102] This table reveals that the more a state spends per capita on its environmental budget, the higher the fines levied against polluters for violations associated with the Clean Water Act. In substantive terms, for each $1 per capita increase

[101] The mean of the dependent variable in Table 1 is 903.8 (standard deviation = 15,159.87; range = 0 to 792,000). The data used in Table 1 include facilities that were assessed monetary penalties for violations of Clean Water Act regulatory requirements, as well as those facilities that were not assessed monetary penalties. The data contain 25,282 unique observations of facilities, meaning that, on average, facilities appear in the data 3.93 times. To account for this non-independence of observations, we estimate the regression model employing robust standard errors, clustered on facility. See, e.g., M. Arellano, *Computing Robust Standard Errors for Within-groups Estimators*, 49 OXFORD BULLETIN OF ECONOMICS AND STATISTICS 431 (1987).

[102] For an overview of OLS regression, see generally Christopher H. Achen, INTERPRETING AND USING REGRESSION (1982) and Damodar N. Gujarati, BASIC ECONOMETRICS (2002).

in state environmental spending, the fine levied against a facility increases by about $18, holding all else constant. A one standard deviation increase from the mean of state environmental spending (raising per capita spending from $27.60 to $39.00) increases the penalty levied against a polluter by $204.50, *ceteris paribus*. The results of our proxy for state elite ideology indicates that, as a state's political elite become more liberal, the fines levied against polluters for violations of Clean Water Act regulatory requirements decrease. All else equal, a one unit increase in the liberalism of the state's political elite corresponds to a $14 decrease in the monetary penalty levied against a polluter. A one standard deviation increase from the mean of elite ideology (increasing state elite ideology from 43.9 to 70.4) decreases the penalty assessed against a facility by $379.48, *ceteris paribus*.

Table 2 presents the results of the model that captures influences on the penalty assessed against a facility for violations of compliance with Clean Air Act regulatory requirements. As with Table 1, since our dependent variable[103] is continuous, we utilize ordinary least squares regression. The results of the Clean Air Act model indicate, unlike the results of the CWA model, that neither state per capita environmental spending nor state elite ideology influence the monetary penalty assessed against a facility. This is evidenced by the fact that the coefficients associated with these variables fail to obtain statistical significance at conventional levels.

[103] The mean of the dependent variable in Table 2 is 2,250.3 (standard deviation = 60,139.4; range = 0 to 8,000,000). The data used in Table 2 include facilities that were assessed monetary penalties for violations of Clean Air Act regulatory requirements, as well as those facilities that were not assessed monetary penalties. The data contain 15,407 unique facility-observations, meaning that, on average, facilities appear in the data 6.59 times. To control for the non-independence of observations, we estimate the regression model utilizing robust standard errors, clustered on facility.

Table 2. Ordinary Least Squares Regression Estimates of the Penalty Assessed Against a Facility in Violation of Compliance with Clean Air Act Regulatory Requirements, 2000-2003

Variable	Coefficient
State per Capita Environmental Spending	−2.59 (31.9)
State Elite Ideology	−2.83 (6.86)
Constant	8,855.3 (10,435.9)
R^2	0.007
N	99,428

Entries are ordinary least squares regression coefficients. Numbers in parentheses indicate robust standard errors, clustered on facility. *** p < .05 (two-tailed tests).

Model includes 12 dummy variables controlling for the Air Program Code of the facility, 15 dummy variables controlling for the National Action Type Code of the facility, and 113 dummy variables controlling for the Standard Industrial Code clusters of the facility (results not shown).

Sample includes the following states: Alaska, Arizona, California, Colorado, Connecticut, Florida, Indiana, Kansas, Maryland, North Carolina, New Jersey, New Mexico, New York, Ohio, Oregon, Tennessee, and Texas.

Table 3 reports the results of the model that captures the number of quarters (in the two years preceding the inspection date) a facility is in violation of compliance with Clean Air Act regulatory requirements. As this dependent variable[104] is a non-negative count, we utilized a negative binomial regression model.[105] Since the parameter

[104] The mean of the dependent variable in Table 3 is 1.55 (standard deviation = 2.01; range = 0 to 8). The data used in Table 3 include facilities that were in violation of Clean Air Act regulatory requirements, as well as those facilities that were not in violation of Clean Air Act regulatory requirements. The data contain 25,282 unique observations of facilities, meaning that, on average, facilities appear in the data 3.93 times. To account for this non-independence of observations, we estimate the negative binomial regression model employing robust standard errors, clustered on facility.

[105] The negative binomial regression model (NBRM) model is preferable to the ordinary least squares regression model given the makeup of our dependent variable. The NBRM is distinct from the most obvious alternative, the Poisson model, in that the NBRM does not make the assumption that the variance is equal to the conditional mean of the dependent variable. Rather, the NBRM estimates a parameter, α, that accounts for the unobserved heterogeneity among observations in the data. In order to test for the appropriateness of the NBRM as compared to the Poisson model, we estimated a log-likelihood test for over dispersion in the data, which indicates that the NBRM is the more appropriate modeling strategy. For

Table 3. Negative Binomial Regression Estimates of the Number of Quarters a Facility is in Violation of Compliance with Clean Air Act Regulatory Requirements, 2000-2003

Variable	Coefficient	Δ (%)[a]
State per Capita Environmental Spending	−.006*** (.003)	−0.6***
State Elite Ideology	.002*** (.001)	+0.2***
Constant	.513*** (.225)	
α	3.98 (.290)***	
Wald χ^2	34,651.06***	
N	99,428	

Entries are negative binomial regression coefficients. Numbers in parentheses indicate robust standard errors, clustered on facility. *** p < .05 (two-tailed tests).

[a] Indicates percentage change in the number of quarters a facility is in violation of compliance with Clean Air Act Regulatory Requirements corresponding to a one-unit change in the independent variable.

Model includes 12 dummy variables controlling for the Air Program Code of the facility, 15 dummy variables controlling for the National Action Type Code of the facility, and 113 dummy variables controlling for the Standard Industrial Code clusters of the facility (results not shown).

Sample includes the following states: Alaska, Arizona, California, Colorado, Connecticut, Florida, Indiana, Kansas, Maryland, North Carolina, New Jersey, New Mexico, New York, Ohio, Oregon, Tennessee, and Texas.

estimates of the independent variables in the negative binomial regression model cannot be interpreted directly (as in an ordinary least squares regression model), Table 3 also reports the percentage change in the number of quarters a facility is in violation of Clean Air Act regulatory requirements corresponding to a one unit change in each independent variable. This table reveals that as state environmental spending increases, the number of quarters a facility is in violation of Clean Air Act regulatory requirements decreases. In substantive terms, for each $1 per capita increase in state environmental spending, the

a general discussion of the NBRM, see, e.g., A. Colin Cameron and Pravin K. Trivedi, REGRESSION ANALYSIS OF COUNT DATA (1998) and J. Scott Long, REGRESSION MODELS FOR CATEGORICAL AND LIMITED DEPENDENT VARIABLES (1997).

number of quarters a facility is in violation of the Clean Air Act decreases by 0.6 percent, *ceteris paribus*. For example, compared to a state that spends $28 per capita on the environment, for a state that spends $68 per capita, the number of quarters a facility is in violation of the Clean Air Act decreases by 0.2 quarters. Table 3 also indicates that, as a state's political elite ideology becomes more liberal, the number of quarters a facility is in violation of Clean Air Act regulatory requirements increases. More substantively, for each one unit increase in state elite liberalism, the number of quarters a facility is in violation of the Clean Air Act increases by 0.2 percent, all things being equal. A one standard deviation increase from the mean of elite ideology (increasing state elite ideology from 48.1 to 80.2) increases the number of quarters a facility is in violation of the Clean Air Act by 6 percent, *ceteris paribus*.

IV. Summary of Empirical Results

Taken as a whole, the results from our analyses are both expected and surprising. The most important finding is that, with regard to the Clean Air Act, the more a state spends per capita on its environmental budget, the shorter time a permitted source is in violation of the Act. Assuming that we have adequately controlled for differences in fines based on the type of facility and type of violation (as we attempted to do), this supports the conclusion that funding of environmental programs plays a very important role in how successful an agency is in avoiding, catching, and/or ending, violations. Both the substantive and statistical effects of this relationship are strong. To the extent that support for cooperative based enforcement has been premised on accomplishing compliance at a cost savings, we show that, at least at this time, "cost savings" in

environmental programs are very strongly associated with less compliance, and thus should be removed as a supporting reason for using more cooperative types of enforcement. While this does not reject the idea that cooperative enforcement may assist compliance in some circumstances, or that it can be productively paired with deterrent based enforcement in certain circumstances (as detailed by Rechstaffen and Markell),[106] it does indicate that at this time at least, whatever effective cooperative enforcement has been used would not have resulted in significant cost savings.

To the extent that the standards set forth in our environmental laws result in environmental protection, we have also shown that increased state environmental spending translates into better compliance, thus potentially improving the quality of the environment. Unfortunately, with regard to the Clean Water Act data, we were not able to show the same correlation since the data was incorrectly entered by the EPA for the important variable that measures how many quarters a source is compliant. We also do not know how the spending of environmental budgets into different categories in each state might help in a more efficient enforcement. Nevertheless, this result is important.

We also found that for administration of the Clean Water Act, the more a state spends per capita on its environmental budget, the higher fines levied against the polluters. Though we cannot make any definitive conclusion about how this relates to non-compliance times, if the CAA results were replicated in the CWA context, it might indicate that higher fines (associated with deterrence based enforcement) spur compliance or that higher per capita spending states support higher fines.

Our results also indicate that facilities are assessed larger fines for violations of the Clean Water Act and remain out of compliance with the Clean Air Act for shorter

[106] Rechstaffen and Markell, *supra*, n.12, at 251-52.

periods of time in states governed by conservative political elites. To the extent our other results suggest that cooperative based enforcement, at least cooperative based enforcement premised on cost savings, is not particularly effective, this result might seem surprising, particularly if we believe that conservative political ideologies are more likely to be associated with cooperative based enforcement.

Since we do not know how ideology actually relates to cooperative vs. deterrence based enforcement, we can draw no real conclusions. However, these findings do give rise to interesting speculation. The CWA finding could suggest that conservative ideologies allow polluters to reach worse violations, which in turn support higher fines. Conversely, the CAA finding may suggest that conservative state ideologies foster better compliance, perhaps through the use of more cooperative methods. It is possible that *adding* the carrot of cooperative schemes for enforcement in certain circumstances to the stick of deterrence based enforcement, may improve results overall. This is suggested by Rechstaffen and Markell, wherein they note that "a system that is purely or primarily deterrence-based can be improved by integrating features of the cooperative model, such as emphasis on agency advice and consultation, and incentives for voluntary self-policing."[107]

V. Implications for Enforcement Policy

A. Resource Allocation

R*esources do matter*. For purposes of enforcement policy, this is the most important finding our research. The strong relationship between per capita spending on state environmental programs and shorter non-compliance times in the Clean Air Act

[107] Rechstaffen and Markell, *supra*, n.12, at 251.

across many states of different sizes, environmental challenges, and political governance, demonstrates this. That "*resources do matter"* means that states cannot adequately do their jobs in enforcing environmental laws without necessary resources. While our study does not show any "optimal" level of resource expenditure on environmental programs, it does show that lack of spending creates non-compliance rates outside of what the American public would assume or expect for enforcement of environmental programs. Presumably, this implication is generalizable to federal environmental enforcement as well. Coupled with the results demonstrating that more resources lead to higher fines, the study also suggests that deterrence based enforcement is important in actually creating effective compliance.

The efficacy of cooperative based enforcement, either alone or in combination with deterrence based enforcement, is harder to evaluate. We can see that at least during the time of our study, no cooperative based enforcement was able to successfully produce effective environmental compliance at a significantly lower cost. We do note that a more conservative political ideology does have a relationship with better compliance, and that conservative political ideologies have been more generally supportive of cooperative based enforcement. The substantive effect of elite ideology is not as strong as the effect of per capita state spending on the environment, but it is provocative. As noted above, it might suggest that some combination of cooperative and deterrent based enforcement is the optimal formula. We do know that it does not suggest that "leaner" government, at least in terms of environmental expenditures will lead to better compliance. You can't get compliance on the cheap. Whether one uses cooperative or deterrent based enforcement, one still must spend money to protect the environment.

B. Importance of Data to Understanding the Effectiveness of Environmental Policies

The other important implication from our four year study is related to the acquisition and reporting of the data. Though we believe that this study goes further than some previous studies and provides strong evidence as to the importance of sufficient funds to promote environmental compliance, it does not answer more subtle questions directly. These questions can only be answered by an improvement in the availability of relevant data. For instance, to more thoroughly test the efficacy of cooperative based enforcement, we would need to procure data from each state about which money in environmental enforcement is spent in each arena. The gross per capita numbers that we were able to retrieve from the states do not give the more tailored information on exactly how much a state spends on which program and in what way.

Of course it is likely that data problems are themselves related to money spent on environmental programs. According to research done on EPA enforcement by Professor Joel Mintz, budget shortfalls are directly linked to poor data keeping and record collection.[108] According to Professor Mintz, "when faced with tight budgets, enforcement managers tend to cut record keeping first rather than contract the size and principal responsibilities of their staffs of inspectors, engineers, attorneys, etc . . ."[109]

Whatever the reason, given that data issues have bedeviled research on environmental enforcement and effectiveness from the beginning, it seems that the time has come for the EPA to tackle this head on.

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[108] E-mail from Joel Mintz to Victor B. Flatt, December 26, 2008, on file with the author.
[109] *Id*.

To really understand whether state programs are effective and which programs promote better compliance, the EPA needs to receive enforcement data and information about resources in a uniform manner. This could be accomplished without impinging on federalism. States can create and operate their budgets in any manner they see fit, but they (and EPA regions) should be required to report data on delegated programs in a uniform manner, much as the SEC requires regulated companies to report data. One option could be to require states to organize their data to show how much money was spent on environmental programs, how much went for enforcement, and how much went for different kinds of enforcement (as specified by the EPA), further breaking this all down among delegated programs. The states already have this information, and changing to uniform reporting should not be too difficult.

Recently, the federal government began to require that all states use the federal definition of graduation and drop rates to avoid the "tangle of inaccurate state data."[110] Still, the EPA's own data system also needs improvement. Though the EPA has moved in the direction of providing more data to the public, the current publicly available database is difficult to use. Moreover, longstanding flaws in the data suggest that there is no effective mechanism to ensure correct reporting and entry of data.[111] Funding directed to this alone would be important. It will continue to be difficult to understand enforcement without these corrections.

[110] Sam Dillon, U.S. to Require States to Use a Single School Dropout Formula, The New York Times, April 1, 2008.
[111] For instance, the incorrect CWA quarters in non-compliance data, *supra*.

CONCLUSION

Although our modern environmental programs have been in existence for decades, we have not learned all we need to know about which ways of enforcing these programs work and which do not. Over time, diverse scholars have gathered critical data points and contributed to the debate about which types of environmental enforcement programs are most effective at the lowest cost.

In the study we conducted, we are not able to put to rest the question of which is "better" – cooperative or deterrent based enforcement. In fact, sweeping generalizations may never be possible since most every state conducts its programs in a unique way. However, we were able to empirically demonstrate that higher per capita spending by states on environmental enforcement programs (at least with respect to the Clean Air Act) is strongly associated with better program compliance, and thus, presumably better environmental results. This is an important finding and should spur re-examination of theories about how cheaper enforcement (usually supposed to be cooperative-based) can still provide adequate environmental protection. The study also creates interesting questions regarding state ideology and program effectiveness that will have to wait for more comprehensive data in order to more fully untangle these relationships.

Just as importantly, our study again demonstrates the incredible difficulty in answering such questions, primarily because of the lack of data in usable form, or failure to effectively monitor and give attention to the data support systems. Given these ongoing problems in understanding how well environmental programs work, it is difficult to avoid reaching the conclusion that the lack of adequate and uniform data is a partial function of the contentious nature of American politics in which public officials, corporations, and

interest groups may profit from this state of affairs. This article should be a call to action on finally making the agency compel uniform data reporting or explain why it should not.

Appendix A – Description of Data Elements included in IDEA Download, PDF from the EPA accessed at http://www.law.uh.edu/faculty/vflatt/cleanwater.pdf and http://www.law.uh.edu/faculty/vflatt/cleanair.pdf

Appendix B – Raw data on sample state spending, ideology, population, and budget breakdown from 2000-2003, accessed at http://www.law.uh.edu/faculty/vflatt/state-budget-data/

Appendix C – State Per Capita Environmental Spending Data Corrections

California: California lists its expenditures in separate locations depending on the source of the money. The California numbers were determined by adding all categories of environmental expenditures across general fund appropriation, federal funding, and other. This does not include the category of bond funding.

Ohio: Though listed as appropriation, expenditures match this number closely. Appropriations include all money received from permitting programs, such as fees for CAA permitting. Though a separate budget item in Ohio, this number is in other states expenditures and was thus added back into the Ohio figures.

Tennessee: The total includes all conservation and fish, wildlife, and state park services. The expenditure total given backs out the following categories: Tennessee Elk River Resource Management, Conservation Administration, Historical Commission, Land and Water Conservation Fund, Archaeology, Geology, Maintenance of Historical Sites, Local Parks Acquisition Fund, State Lands Acquisition Fund, West Tennessee River Basin Authority, West Tennessee River Basin Authority Maintenance, Tennessee State Parks, and Tennessee State Parks Maintenance. *The Tennessee figure does include all money allocated to administration, even though it can go to any of these departments. This amount could be reduced by the overall percentage, but it is unclear how much administration may go more towards environmental programs or not.*

Colorado: The initial figures came from yearly appropriation bills for the Department of Health and the Environment. This included amounts of money spent for public health. This amount of money was backed out of the total figure by category. The categories eliminated include Consumer Protection, Special Purpose Disease Control Technology, Family and Community Health Services Division, Health Facilities Division, and Emergency Medical Services and Prevention Division.

Indiana: Only some of the expenditures in the two categories environmental management and conservation and environment are comparable to other states programs. Programs in Conservation and Environment that were subtracted include legislator's trees, entomology division, Entomology and Plant Pathology Fund, the engineering division, the state museum, the historical preservation Division, Historic Preservation and Archeology Division, Outdoor Recreation

Division, Deer Research and Management Division, Conservation Officers Fund, Oil and Gas Division, State Parks Division, Snowmobile Licensing, Law Enforcement Division, Reservoir Management Division, Soil Conservation, Boating Safety Trust, Reservoir Crop Lease Funds, Nongame Fund, Fall of the Ohio Interpretive, Outdoor Recreation, and Natural Heritage Fund.

Kansas: Funds associated with the Division of Health, including Administration, Health, and CHES (Community Health Services) were backed out.

New York: Funds spent on Forest and Land Resources, Agriculture, Capital Projects and Sale of Timber were backed out of the initial report.

North Carolina: Figures did not include amounts that were spent that came from proceeds from permitting programs; these were put back in.

Oregon: Figures do not include large amount for fish and wildlife since most of this goes to commercial salmon run protection as opposed to traditional environmental expenditures.