ASSESSING WETLAND ASSESSMENT: UNDERSTANDING STATE BUREAUCRATIC USE AND ADOPTION OF RAPID WETLAND ASSESSMENT TOOLS

Gwen Arnold

Submitted to the faculty of the University Graduate School
in partial fulfillment of the requirements
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July 19, 2012

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For Lin

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Gwen Arnold

ASSESSING WETLAND ASSESSMENT: UNDERSTANDING STATE BUREAUCRATIC USE AND ADOPTION OF RAPID WETLAND ASSESSMENT TOOLS

Rapid wetland assessment tools, technically complex science policy innovations that are deployed within the regulatory sphere and have relatively low public salience, can highlight and help interpret the data a bureaucrat should use when making wetland regulatory choices. These tools can help bureaucrats overcome the longstanding challenge of quantifying wetland benefits when making such choices. However, state wetland bureaucrats use these tools infrequently in regulation, and states find adopting tools into regulatory policy difficult. This research explores why.

These problems are analyzed by focusing on six Mid-Atlantic states and using an original survey of state wetland bureaucrats (n=149), interviews with policy actors (n=98, 58 hours), ethnographic data collection (18 months spent working with federal wetland bureaucrats who work regularly with state counterparts), and secondary source analyses. Research reveals that street-level wetland bureaucrats are more likely to deploy tools in regulation when they have more opportunities to learn about tools via on-the-job experience, lateral communication about tools with policy network members, and vertical communication of tool-supportive cues from their administrative hierarchies.

The institutions of cooperative environmental federalism and the Clean Water Act generate power inequities, path dependencies, and perverse incentives which discourage states from adopting tools into regulatory policy. This phenomenon is illuminated via

synergistic institutional analysis, an approach the dissertation proposes for using the complementarities among rational choice, sociological, and historical institutionalism to explain policy outcomes. Contrary to a core expectation of cooperative environmental federalism, ostensibly pro-environment pressures the federal government imposes on states can prevent states from pursuing environmentally beneficial policies.

Finally, the dissertation develops the concept of the street-level policy entrepreneur, an implementing bureaucrat who crafts or secures a policy innovation intended to improve implementation processes, then seeks to entrench the innovation in the practices of bureaucratic peers. Neither the conventional political science literature on policy entrepreneurship nor the street-level bureaucracy literature gives sufficient attention to the entrepreneurial capacity of these actors. Yet case studies of tool adoption efforts pursued by states show that implementing bureaucrats can pioneer, rather than merely receive and execute, policy innovations.

Burnell Fischer, Ph. D., Chair

Marjorie Hershey, Ph. D.

Michael McGinnis, Ph. D.

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Chapter 1: Introduction

1.0 Background, justification, and research focus

In 2007, the U.S. Environmental Protection Agency began the National Wetland Condition Assessment (NWCA), a program that seeks to estimate a condition baseline for most of the nation's wetland types by 2013. This effort is important. Wetlands are one of the United States' most imperiled natural resources (Mitsch and Gosselink 2007), yet scientists and policymakers know startlingly little about their status nationwide. In 2004, only 10 states reported to Congress on the extent of their wetland pollution, and the data covered only approximately 1.6% of the nation's wetland acreage (EPA 2009a).[1] The information policymakers do possess indicates that much more must be done to protect wetlands: Of the tiny fraction of U.S. wetlands assessed for the 2004 report, 30% of the acreage was significantly polluted (ibid.).

Having wetland data for more than one time point is necessary to assess and improve the effectiveness of current wetland protection efforts. However, NWCA is a one-shot initiative (C104: Oct. 30, 2010).[2] Thus, one of NWCA's goals is to help states develop capacity to pursue wetland monitoring and assessment independently in the future, using

[1] Water quality reports to Congress for years subsequent to 2004 (e.g., 2006, 2008) are still under review.

[2] An EPA official interviewed for this project provided this information. EPA (2008) notes that the NWCA effort may be iterated in the future to track trends in particular wetland classes or regions; the expert interviewee, however, did not indicate that another comparably wide-scale project is planned. Interview data are cited with a random number and a letter indicating the anonymous interviewee's sector: A = state bureaucracy, B = U.S. Army Corps of Engineers bureaucracy, C = U.S. Environmental Protection Agency bureaucracy, D = regulated entity, E = academia, and F = other/mixed (nonprofit sector, other policy expert, or mixed experience among multiple sectors). The date indicates when the interview occurred.

assessment tools based on protocols NWCA develops (ibid.; EPA 2008). Ideally, state wetland programs would incorporate tools for monitoring and assessment not only into data-gathering, land-use planning, and restoration initiatives, but also into regulatory programs which require individuals whose proposed projects could damage wetlands to apply for permits so that the permit-granting agency can ensure minimum practicable wetland harm and can require permit recipients to compensate for wetland damage (A041, A343: Nov. 18, 2010; A119: Nov. 19, 2010; A280: Feb. 16, 2011; A285: Nov. 3, 2010; A369: Dec. 13, 2010; A476: Nov. 19, 2010; A778: Dec. 14, 2010; B191: Feb. 17, 2011; C114: March 23, 2011; D725: Feb. 7, 2011; F303: Nov. 18, 2010; F804: Oct. 13, 2010).

Integrating wetland assessment tools into regulatory practice has been a goal and a persistent stumbling block for wetland managers for the last two to three decades (Kusler 2004, 2006; C104: Oct. 30, 2010; C114, C796: March 23, 2011; F840: Oct. 13, 2010). And despite NWCA's aim to help states adopt these tools, the initiative is not optimally structured to advance that goal. Rather, NWCA is heavily focused on developing model assessment protocols and ensuring that their indicators are scientifically rigorous and relevant nationwide (Olsen and Scozzafava 2008). While this focus is desirable in terms of advancing the state of science, it is problematic in that NWCA is not systematically analyzing the factors that make state wetland bureaucrats and their agencies likely to use and adopt assessment tools, respectively, and what has caused them to struggle in these areas in the past. Rather, the initiative appears to be following a model that policy utilization scholarship has largely identified as ineffective: developing policy-relevant research products and then hoping that policy implementers will use them (e.g., Amara, Ouimet, and Landry 2004; Beyer

and Harrison 1982; Knott and Wildavsky 1980; Landry, Lamari, and Amara 2003; Lester and Wilds 1990; Ritter 2008; Sabatier 1978).

The strategy of develop-then-hope is particularly likely to be ineffective given the barriers to tool use and adoption already identified, most by notably Kusler (2004, 2006). Kusler's research and this dissertation focus on rapid (non-tidal) wetland assessment tools. The application of these tools is intended to take no more than one day and sometimes far less time. Rapid wetland assessment tools combine elements of a questionnaire and an instruction sheet. They highlight the data a bureaucrat should collect to evaluate the important attributes of a wetland and the potential impacts of activities proposed for it, and help him interpret those data so they can inform his management decision concerning the wetland.

Over a ten-year period, Kusler (2006) discussed these tools with state wetland bureaucrats nationwide. Those bureaucrats reported only limited usage, even though Kusler identified more than 100 wetland assessment tools in the scientific and gray literatures (ibid.). This dissertation examines, with greater methodological rigor, a stronger theoretical orientation, and a different perspective than previous research, why state environmental bureaucrats do or do not use tools and their administrative agencies do or do not adopt tools that many experts (e.g., Ainslie 1994; EPA 2006; Fennessy, Jacobs, and Kentula 2007; Ruhl and Salzman 2007; Sutula et al. 2006) say can be valuable components of a wetland management program. This research yields insights NWCA leaders can use to encourage states to adopt rapid wetland assessment tools. The research also addresses a broader problem in U.S. environmental policy wherein best available science sometimes is not integrated into the day-to-day implementation decisions made by government bureaucrats

(e.g., Dilling and Lemos 2011; Husbands Fealing et al. 2011; Jasanoff 1990, Latin 1988). To accomplish these tasks, this investigation focuses on regulatory implementation (use) and agency-level adoption of rapid wetland assessment tools by state bureaucrats over the period 1995–2011 in Delaware, Maryland, Ohio, Pennsylvania, Virginia, and West Virginia. The investigation relies for data on a survey of state bureaucrats (n=149), interviews with wetland policy actors in the Mid-Atlantic region (n=98), ethnographic data collection, and secondary source research.

The rest of this introduction provides more detail about rapid wetland assessment tools, defining them, describing their importance, and highlighting existing research about tools and the contribution of this dissertation to that body of work. The introduction then provides an overview of the regulatory context in which these tools might be deployed. It finishes with a brief outline of the dissertation. The sections in the introduction do not correspond to dissertation chapters, but rather are intended to contextualize the substance of the dissertation.

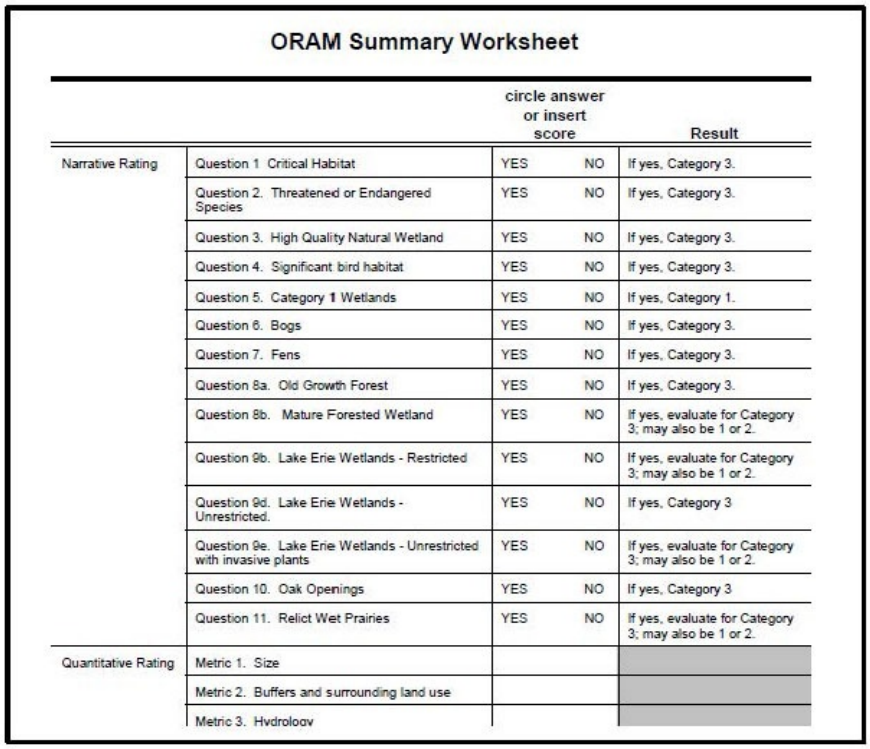
2.0 Rapid wetland assessment tool definition

Rapid wetland assessment tools have been developed by state and federal government agencies, scientists and academic research centers, non-profits, and private-sector environmental consulting groups (Kusler 2006). A rapid wetland assessment tool "(1) measures wetland condition, *functions, or value*, (2) includes a site visit, and (3) takes two people no more than a half day in the field and another half day in the office to complete" (Fennessy, Jacobs, and Kentula 2004, 543; own modifications in italics). Rapid wetland assessment tools prompt users to collect data about a wetland which will allow them to

characterize the wetland directly or make inferences about wetland characteristics. Rapid wetland assessment tools often rely on indicators of wetland condition and particularly of function rather than directly measure these attributes, since direct measurement can be a long, difficult, and resource-intensive process (Cole 2006; Hruby 1999; Stein et al. 2009; C193: Oct. 30, 2010; D324: March 24, 2010; E670: Oct. 17, 2010; F078: March 14, 2011; F111: March 15, 2011). These tools are a science policy innovation because they ground the evaluation a regulator might otherwise make about a wetland based only on his own professional judgment in a foundation of empirical data and analysis. These data and analyses may be peer reviewed via traditional academic processes and/or produced and quality-checked using protocols based in scientific best practices (Bartoldus 1999; Stein et al. 2009; Sutula et al. 2006).[3] Rapid wetland assessment tools are mechanisms developed by experts, codified in print or electronic form, and recognized, at the state, regional, or national levels, as more or less legitimate techniques for wetland evaluation. Figure 1-1 shows the page from the Ohio Rapid Assessment Method:

[3] This is the ideal for rapid wetland assessment tool construction. For critiques of some tools' failure to reach this ideal, see Cole (2006) and Hruby (1999), among others.

Figure 1-1. Snapshot of an ORAM form[4]



ORAM Summary Worksheet

		circle answer or insert score		Result
Narrative Rating	Question 1 Critical Habitat	YES	NO	If yes, Category 3.
	Question 2. Threatened or Endangered Species	YES	NO	If yes, Category 3.
	Question 3. High Quality Natural Wetland	YES	NO	If yes, Category 3.
	Question 4. Significant bird habitat	YES	NO	If yes, Category 3.
	Question 5. Category 1 Wetlands	YES	NO	If yes, Category 1.
	Question 6. Bogs	YES	NO	If yes, Category 3.
	Question 7. Fens	YES	NO	If yes, Category 3.
	Question 8a. Old Growth Forest	YES	NO	If yes, Category 3.
	Question 8b. Mature Forested Wetland	YES	NO	If yes, evaluate for Category 3; may also be 1 or 2.
	Question 9b. Lake Erie Wetlands - Restricted	YES	NO	If yes, evaluate for Category 3; may also be 1 or 2.
	Question 9d. Lake Erie Wetlands - Unrestricted.	YES	NO	If yes, Category 3
	Question 9e. Lake Erie Wetlands - Unrestricted with invasive plants	YES	NO	If yes, evaluate for Category 3; may also be 1 or 2.
	Question 10. Oak Openings	YES	NO	If yes, Category 3
	Question 11. Relict Wet Prairies	YES	NO	If yes, evaluate for Category 3; may also be 1 or 2.
Quantitative Rating	Metric 1. Size			
	Metric 2. Buffers and surrounding land use			
	Metric 3. Hydrology			

3.0 Importance of rapid wetland assessment

Wetlands provide myriad services that support healthy human communities and ecosystems (Mitsch and Gosselink 2007). These complex ecosystems resupply groundwater aquifers; receive, process, and retain upstream sediments and pollutants; purify water; regulate and reduce flood flows; buffer shorelines from erosive forces; provide habitat for migratory birds and many other species; offer opportunities for human recreation; and, as major carbon sinks, can even help mitigate global warming (ibid., Ramsar 2000).

However, wetlands in the United States are in trouble. More than half of the roughly 220 million wetland acres that covered the country in the 1600s has been destroyed by

[4] Ohio Environmental Protection Agency Wetlands Ecology Section, http://www.epa.ohio.gov/portals/35/401/ORAMv5_score_forms_10_page.pdf.

human development, pollution, or draining for agriculture (EPA 2012f). Many remaining wetlands are functionally impaired because of anthropogenic influences (ibid.). The United States had a positive rate of wetland loss until the late 1990s (Dahl 2006). Over 1998–2004, the federal government reported that wetland losses had been more than offset by gains from compensatory wetland creation and restoration (ibid.), processes wherein an entity granted a permit to damage or destroy a wetland commits to restoring a different impaired wetland or creating a new wetland. However, analysis by the National Resource Council (Schoch 2001) and my own research (Nevel et al. 2004) casts doubts on whether compensatory wetlands function like those they replace, or whether some promised compensatory wetlands are even created at all.

Beyond these rough measures of wetland condition, scientists and policymakers know remarkably little about the status of wetlands nationwide. Section 305(b) of the Clean Water Act requires states (via the U.S. Environmental Protection Agency) to report to Congress on the quality of their waters, yet 80% of states can provide no information about the extent of their wetland pollution (EPA 2009a). Fennessy and co-authors (2007) report that only approximately 4% of wetlands nationwide have been assessed. "This leaves insufficient data to evaluate the health of wetlands or to quantify the extent to which they are degraded" (ibid., 543). This lacunae also hamstrings wetland regulatory programs, since wetland bureaucrats must make choices about which impacts to allow, which to allow conditionally upon the applicant taking steps to protect the resource, and which to deny in a relative information vacuum. For example, instead of requiring that replacement wetlands be designed so that they replicate the functions and services lost wetlands had provided, regulators generally require applicants replacing wetlands to adhere to a standard set of

acreage ratios intended to approximate generally the value of certain wetland types and account for the uncertainties and frequent failures associated with the replacement process.[5] Relying on acreage ratios is a flawed approach for a variety of reasons, not least because this practice does not pay attention to the nature of the functions and services lost versus replaced and whom these different sets of environmental amenities benefit (BenDor, Brozovic, and Pallathucheril 2008; Dale and Gerlak 2007), and because replacement wetlands may meet acreage criteria while not replicating the type or condition of the damaged or destroyed wetland (e.g., Kettlewell et al. 2008). However, this simplified approach is used because regulators often lack quantifiable information about wetland conditions, functions, services, and values—information which could be provided by assessment tools.

States need to adopt and then implement effective wetland assessment approaches so that they know the extent of pollution in their wetlands and can quantify the value of those wetlands. No rapid wetland assessment tool is a "silver bullet" (Novitzki, Smith, and Fretwell 1997) in that no tool's metrics can fully capture a wetland's myriad complex benefits (Smith et al. 1995; Stein and Ambrose 1998; Stetson 2008; Kusler 2006; Kusler and Riexinger 1986). However, these tools arguably are an improvement over the rough, estimate-reliant, potentially idiosyncratic evaluative practices currently used by many wetland bureaucrats (Ainslie 1994; Sutula et al. 2006; A041, A343: Nov. 18, 2010; A119: Nov. 19, 2010; B191: Feb. 17, 2011; C114: March 23, 2011; F078: March 14, 2011). Assessment tools

[5] Although the ratios can vary by U.S. Army Corps of Engineers district or state, and sometimes may be tailored to specific cases, they often are similar to the ratios typically used in Virginia: 1:1 replacement for an emergent wetland, 1.5:1 for a scrub-shrub wetland, and 2:1 for a forested wetland (VDEQ 2011a).

can allow states to use the regulatory process to combat wetland pollution more effectively and better protect the amenities wetlands offer. State governments often lack the resources to complete detailed scientific studies of all the wetlands in their jurisdictions, but rapid wetland assessment tools can help state bureaucrats evaluate wetlands slated for impacts in a quicker and less resource-intensive manner. Consequently, research investigating the factors that make state bureaucrats more or less likely to use these tools, and state bureaucracies more or less likely to adopt them, is critical.

4.0 Prior research on rapid wetland assessment tools and the contribution of this research

Much of the existing research on rapid wetland assessment tools falls into two categories, although the line between the two is sometimes blurry. The first category contains articles and monographs on the science of rapid wetland assessment. Scholarship in this arena debates and explores the kinds of metrics that tools ought to contain, the best ways of measuring important characteristics of wetlands, and the assumptions undergirding assessment approaches (e.g., Cole 2006; Hruby 1999; Hruby, Cesanek, and Miller 1995; Kolka, Nelson, and Trettin 2000; Lopez and Fennessy 2002; Rheinhardt, Brinson, and Farley 1997; Van Dam, Camilleri, and Finlayson 1998; Whitford et al. 1998). The second category of research is more apt to consider assessment tool users and the range of issues that arise when moving assessment from the realm of basic science research to applied policy application. Scholarly and gray literature in this arena discusses the practical advantages and disadvantages of particular tools, the needs of potential tool users and the extent to which available tools meet those needs, and characteristics that make tools more or less tractable for implementation (e.g., Bartoldus 1999; Chaun 1993; Kusler 2004, 2006; Kusler and

Riexinger 1986; Stein and Ambrose 1998; Stetson 2008; Stevenson and Hauer 2002; Sutula et al. 2006; Thiesing 2001). This dissertation aligns more closely with the second category, but it aims to fill two gaps in that literature. First, it uses more rigorous research methods and a broader comparative scope than much of the existing scholarship. Second and arguably more importantly, it addresses factors that affect tool use beyond the tool level.

Articles written about the utility or lack thereof of assessment tools for users tend to justify their claims in two ways. First, the articles rest their arguments on the expert opinions and knowledge of their authors, often resource agency officials or practitioners with field experience and scientific training. Examples in this vein are Thiesing (2001), offering insight on the strengths and weaknesses of rapid assessment from her perspective as a regional EPA wetland scientist; Ainslie (1994), another EPA scientist, arguing the advantages of rapid wetland assessment that focuses on hydrogeomorphic conditions; and Cole (2006), a Pennsylvania State University expert with field experience critiquing the value that hydrogeomorphic assessment brings to regulatory processes. Second, articles root their claims in evidence gained in place- and context-specific practice. For example, Sutula and co-authors (2006) provide advice about developing rapid wetland assessment tools based on their experience creating the California Rapid Assessment Method. Hruby, Cesanek, and Miller (1995) discuss the usefulness of their Indicator Value Assessment for regional planning based on its application in one location in New Jersey and two in Washington State. Wardrop and co-authors (2007) show how their Floristic Quality Assessment Index can help identify factors impacting wetland condition in the Upper Juniata watershed in central Pennsylvania. Fennessy, Jacobs, and Kentula (2004, 2007) span and somewhat move beyond this dichotomy by using their substantial respective wetland expertise (as academics,

state practitioners, and national policy experts) to evaluate 40 rapid wetland assessment methods used nationwide. However, their analysis still largely rests on expert opinion and the literature. Overall, this scholarship is lacks research where the main focus is actually asking wetland managers, in a rigorous and systematic way, about their tool use and perceptions of tool utility.

Kusler (2004, 2006) is the only author whose primary focus is practitioner perspectives on assessment tools. Working with the Association of State Wetland Managers, Kusler spent roughly a decade talking to would-be regulatory tool users about rapid wetland assessment. This project involved workshops, a national symposium, and "many hundreds of interviews with regulators and scientists working with wetland assessment methods" (Kusler 2006, ii). Unfortunately, this statement is essentially the extent of Kusler's specificity regarding research methods. He concludes that potential users often find assessment tools "unrealistic, unusable, and impractical" (ibid., 5), and offers a number of recommendations for more effectively using existing assessment approaches and building better tools, but does not systematically link these recommendations to well-documented empirical evidence. Kusler does not make clear which regulators and scientists informed the research, which geographic regions they represented, to which professional affiliations they adhered (e.g., state, local, or federal regulators), and other ways in which the backgrounds of interviewees could have affected the research findings. One of the contributions of this dissertation is that it pursues research similar to Kusler's, but does so with greater methodological rigor and transparency.

This research also extends Kusler's work. Kusler's interviews suggested that tool use is not frequent among state bureaucrats engaged in wetland regulation, but his research

design prevented him from further quantifying this finding. This dissertation empirically investigates this claim by surveying wetland bureaucrats in six states about their tool usage and other characteristics, using the latter to tease out in statistical analysis some factors which appear to make usage more or less likely. In so doing, this research also distinguishes itself from the place- and context-specific investigations common in the literature, producing findings that are generalizable at least to the Mid-Atlantic region and potentially beyond it.

Like many assessment tool scholars, Kusler focuses heavily on attributes of assessment tools and their alignment with the needs of potential users. He found, for example, that regulatory users want tools that can yield data amenable to inclusion in environmental impact assessments; that the applicability and context specificity of assessment tools should be better documented so that potential users can more easily determine which tools to use; and that potential users need more and better training about how to select and use various tools (Kusler 2006). The interview and survey data collected for this dissertation largely confirm these findings and suggest others along similar lines. This dissertation could have focused, as did Kusler, on these very practical, micro-level dimensions of assessment tool application. However, during the data collection process—particularly the ethnographic element—it became clear that this dissertation could offer a different and important contribution to assessment scholarship by focusing on tools as a class of innovations and investigating the larger forces that affect tool use and adoption.

Much of the existing literature that falls into the second category described above (research focusing on tool application) devotes substantial attention to the pluses and minuses of various tools. However, assessment tools can be understood as a class of policy instruments. They may require different amounts of time in the field, be more or less

complex, focus more on wetland functions or wetland conditions, and have other differences, but fundamentally, they all seek to give users a quick run-down of the important attributes of a wetland. As one veteran EPA regulator noted regarding tool choice:

> It's like, why do I buy a Ford or a Chevy? They are competing, and yet there is not a big conflict between Fords or Chevys. . . . They [tool users] go, "Well, we got to do something on this EIS [environmental impact statement] and say something about these [wetland] values and so we are going to just pick, I don't know, this method, and we will say stuff." (C796: March 23, 2011)

Similarly, a national assessment expert said, "It's been encouraging that rapid wetland assessment has really caught on" (A009: Oct. 21, 2010), implying that the assessment enterprise can be discussed generally. A state bureaucrat affirmed that "You can view any assessment tool as a paradigm . . . meaning that you have a lot of support for any methodology" (A343: Nov. 18, 2010). Said another, "There are only so many ways to do functional assessments" (A827: Dec. 13, 2010).

Moreover, there is a tradition in political science scholarship on adoption and diffusion of policy innovations of studying innovations as a class rather than focusing on the ways in which innovations are tweaked to accommodate their new contexts.[6] Mintrom and Vergari (1998, 132), for example, study the diffusion and adoption of school choice reforms by noting that the first school choice law was adopted in Minnesota in 1987 and in the next five years, "37 more state legislatures considered variations on the school choice idea, 14 of which adopted some form of it." The authors' statistical analysis does not differentiate among these forms. True and Mintrom (2001) study the transnational diffusion and adoption

[6] There are some exceptions. Glick and Hays (1991), for example, examine how laws and policies are reinvented as they diffuse among states and the implications of changes in the substance of the innovations for the nature of their diffusion.

of gender mainstreaming bureaucracies. While the authors note that "Gender equality bureaucracies take several institutional forms and are variously located within the state apparatus" (ibid., 31), in their statistical analysis the authors only differentiate between stand-alone government ministries and divisions created within existing bureaucracies. "Event history analysis," the authors point out, "does not allow us to distinguish our cases based on the *type* of mainstreaming institution that is adopted" (ibid., italicized in text, 37). Other authors (e.g., Balla 2001; Boehmke and Witmer 2004; Berry 1994; Berry and Berry 1990; Gray 1973) take a similar tack.

This tradition, comments made by interviewees which suggest that tools can be understood as a class, and ethnographic experience highlighted the value of attending to determinants of tool use and adoption beyond those at the tool level. Yes, tools may be flawed in various ways, but they are nonetheless considered a wetland management best practice (EPA 2006). Moreover, their technical problems arguably can be fixed with technical solutions given application of enough expertise and resources. Acknowledging this, what makes a state wetland bureaucrat more or less likely to use any type of rapid wetland assessment tool? And what makes a state environmental agency more or less likely to adopt any such tool? These are questions on which the literature to date has not squarely focused, and they are the questions that this dissertation seeks to answer.

This perspective is not an argument that the attributes of tools do not matter. The statistical analysis in Chapter 3 explains roughly 33% of the variation in bureaucrat-level tool adoption choices. It is certainly possible that a chunk of the unexplained variation is due to the quality and tractability of the tools available to bureaucrats, with a key component of tractability being implementation costs; these possibilities merit future research. The

institutional analysis in Chapter 4 argues that macro-level forces substantially affect the ability of states to adopt tools, but it is certainly also possible that states considering better-quality or more tractable tools (as evaluated per any number of criteria offered by authors cited above) might have a smoother path toward adoption because they only have to contend with adverse structural forces, and do not have to deal with those forces while also trying to improve a tool or find a better one. It is certainly possible that the street-level policy entrepreneurs described in Chapter 5 are more likely to be successful when they are pushing for the adoption of a tractable, quality tool (though part of that chapter's definition of entrepreneurial skill involves creating, adapting, or securing a tool tailored to user needs). The point is that this dissertation complements existing research by showing that use and adoption of this type of policy innovation is affected not only by frequently discussed micro-level factors such as tool characteristics, but also is influenced by higher-level factors such as policy networks, organizational cues conveyed to bureaucrats, incentives and disincentives built into the structure of cooperative environmental federalism, and the skill of policy entrepreneurs.

5.0 Overall regulatory context

Analyzing use and adoption of rapid wetland assessment tools in state environmental management requires a comprehension of the complex governance arrangements affecting wetlands in the United States. Federal regulation variously replaces, complements, and conditions state wetland regulation. When and where each dynamic occurs, and which regulatory agencies are involved, can depend on the state, the location and type of wetland, the proposed impact to the wetland, and other factors. This section gives a basic overview of

the regulatory context in which rapid wetland assessment tools might be deployed by state bureaucrats. Understanding the opportunities for state action requires first understanding the role of federal agencies in wetland regulation.

The two major federal players in wetland regulation are the U.S. Army Corps of Engineers and the U.S. Environmental Protection Agency. The Corps' involvement began with the Rivers and Harbors Act of 1899, while Section 404 of the Clean Water Act of 1972 authorized the EPA's involvement. Section 404 gave the Corps and the EPA joint responsibility for implementing a permit program intended to manage damage done to federally jurisdictional wetlands by the insertion of dredge or fill material (Copeland 2010). The Corps runs day-to-day permitting operations, while the EPA provides environmental review and oversight and can veto Corps permits if the EPA judges that they will adversely impact wetlands, though the EPA has used this power rarely. Other federal agencies, such as the U.S. Fish and Wildlife Service, may comment on permits or play other, less central roles in the regulatory process under certain conditions (ibid.).

The Corps can issue individual or general permits under Section 404. General permits encompass two sub-types, regional and nationwide permits. Both are issued by rule: the proposed activities and related impacts are assumed to have negligible environmental impact and individuals who prosecute those impacts may not have to notify or gain approval from the Corps in advance. Roughly 91% of the roughly 85,000 permits the Corps handles annually are general permits (Copeland 2010). The other 9% are individual permits associated with impacts sufficiently large or consequential that they require closer scrutiny (ibid.). The EPA (and, at times, other relevant federal agencies) can review and comment on individual permit applications, but these actors generally do not have an opportunity to

scrutinize specific impacts allowed under general permits. The rules governing general permits are periodically revised, and the EPA, other agencies, and the public can have input into that process.

The federal agencies do not run the Section 404 permitting program in a vacuum of state influence. Section 401 of the Clean Water Act gives states authority to approve, qualify, or deny federal permits that could cause discharges of pollutants to state waters. States decide whether to certify under Section 401 activities for which applicants have applied to the Corps for a Section 404 permit. The state's certification choice in theory hinges on whether the discharges associated with the proposed activities comply with state water quality standards for which minimum requirements are set by federal law (EPA 2009c). States can make Section 401 certification rigorous; as discussed in later chapters, Ohio has an fairly involved Section 401 process. However, Section 401 certification is more frequently treated by states as a rubber stamp (Johnson 1999).

States also can participate in the Section 404 program. They can enter into state programmatic general permitting arrangements with the Corps, which authorize a state to administer certain nationwide and regional permits in situations where the wetland impacts would meet permit qualifications, the state's wetland permitting requirements are roughly equivalent to those the Corps would impose, and having a single permitting process would reduce regulatory burden (ASWM 2011; USACE 2011). Depending on the terms of its agreement with the Corps, a state may process some of these permits entirely independently, or may submit permits to the Corps for review subsequent to state review (USACE 2011).

In addition, states can enter into joint permitting arrangements with the Corps. If an applicant's proposed impacts do not meet nationwide or regional general permit conditions,

the applicant generally must submit to the Corps an individual permit application pursuant to Section 404 (PADEP 2006). However, the proposed impacts also may trigger state permitting requirements. In a joint permitting system, the applicant completes just one permit application, and the relevant state and federal agencies review it to determine which state and federal strictures apply (VDEQ 2011b).

The above discussion indicates that states sometimes have their own wetland regulatory regimes that operate alongside and sometimes in cooperation with the federal system. State programs may regulate resources not considered federally jurisdictional or impose additional requirements on certain types of impacts that might be allowed under a federal permit. State programs vary substantially in their breadth; some regulate all state waters, usually above some minimum acreage threshold, while others regulate only wetlands not considered federally jurisdictional (Kusler and Christie 2006). Twenty-four states have freshwater (non-tidal) wetland regulatory programs (ibid.), including four of the six states examined in this dissertation.

The take-away from this section is that the U.S. wetland regulatory structure generally affords state bureaucrats multiple opportunities to use rapid wetland assessment tools in wetland regulation. They can use them when deciding whether to grant Section 401 certification. They can employ them when evaluating impacts proposed for a state programmatic general permit. They can use these tools when evaluating, as part of a joint permit application or independent of federal action, whether a proposed activity meets the requirements of the state's wetland program. State environmental agencies can adopt assessment tools for official use in all of these situations. Subsequent sections discuss more

specifically the ways in which state wetland bureaucrats and their environmental agencies can use assessment tools.

6.0 Regulatory activities in which rapid wetland assessment tools can be used

Conventional wetland bureaucrats—those employed by the primary environmental regulatory agency in a state and tasked with wetland regulation—may grant or deny Section 401 certifications. If state statute allows, these officials issue or deny permits for proposed activities that stand to destroy or damage wetlands. They may place conditions on permits requiring applicants to avoid, minimize, or mitigate for wetland harm.

Conventional wetland bureaucrats also enforce wetland laws, seeking to identify law violations, determine their extent, and penalize violators. Penalties can be monetary and/or involve wetland restoration and mitigation. Wetland bureaucrats also frequently are responsible for following up to ensure that mitigation, whether required as part of a penalty or permit package, is achieved.

Rapid wetland assessment tools could play a role in these regulatory arenas. A bureaucrat could use a tool to evaluate a site and determine whether a permit or Section 401 certification is warranted. He could use a tool to inform his choice of permit conditions and mitigation requirements. Rapid wetland assessment tools could be useful in the enforcement process, not necessarily in identifying violations but in helping an official evaluate the environmental amenities the damaged wetland might have provided and thus the appropriate level of penalty.

The substantive arena in which a tool is deployed depends on the user. Some tool users are not conventional wetland bureaucrats. Permit managers in a state's department of

transportation might use a rapid wetland assessment tool to evaluate impacts of a proposed highway. Environmental managers charged with overseeing dam creation and maintenance or mining might similarly use tools. Rapid wetland assessment tools might be used by staff in a state's department of natural resources (typically the non-regulatory complement to a state's environmental regulatory agency) who are partnering with regulatory staff to evaluate specific aspects of habitat at the site of a proposed impact. One reason it has been difficult for researchers to gauge specifically how and the extent to which state officials use rapid wetland assessment tools is because they could be used by a diversity of actors in a diversity of environmental management scenarios. In this investigation, the term "wetland bureaucrat" refers both to those individuals who are primarily tasked with wetland regulation in a state's main environmental regulatory agency and to other state employees who may use rapid wetland assessment tools in tasks connected to wetland regulation.

7.0 How wetland bureaucrats use rapid wetland assessment tools

Sometimes, wetland bureaucrats take a rapid wetland assessment tool to a site of a proposed impact and work through it. However, they do not have time or resources to go onsite for all proposed impacts (D019: Feb. 3, 2011; D222: Feb. 16, 2011; D557, D687: Dec: 29, 2010; F590: Nov. 8, 2010). Thus, conventional wetland bureaucrats may rely on the information applicants provide them about proposed impacts to decide whether a site visit is necessary (B088: March 17, 2011). Other (non-conventional) wetland bureaucrats may use site data gathered by project partners or a consulting agency (A868: Nov. 15, 2010).

If these officials opt against a site visit, they use the data provided by others to make permitting or other regulatory choices. In this research and in the wetland policy community,

a bureaucrat who requests that another entity use a rapid tool to obtain data the bureaucrat then evaluates is generally understood as having used a tool. The official handles tool data forms submitted to him by the other entity, and his management choices are informed by their analysis; he simply did not apply the tool himself. That bureaucrat also likely used a rapid tool in training exercises that prepared him to review the tool-associated data submitted by others.

This understanding of tool use as both direct (a bureaucrat applying the tool himself) and indirect (a bureaucrat working through submitted tool data) is supported by ethnographic experience and comments of interviewees, such as the Ohio Section 401 coordinator who, referring to the Corps districts with wetland regulatory jurisdiction in the state, said "They understand our use of it [Ohio's assessment tool] . . . if we come out and say something is a Category 3 wetland through our assessment tool, they're okay with that" (A041: Nov. 18, 2010). The 401 coordinator understood Ohio's wetland bureaucrats as using Ohio's tool, though in reality, applicants often complete tool forms and state officials review them. He continued, "We have to verify it [the tool data] . . . and so we have that ultimate authority. We'll verify those scores. We'll look at it [a site] using photos [or] whatever tool we need . . . whether we go to Google Maps, or whatever it will be . . . I've had situations . . . where the applicant performed a [tool assessment] and came up with a Category 2 wetland, and we had some assessment folks go out there [onsite] . . . and come up with a much lower rating" (ibid.). State bureaucrats and applicants (typically represented by consultants) both use the assessment tool, and that mutual use is understood by bureaucrats as constituting their own use. A Virginia official, discussing the intended future application of that state's draft tool, said "Our staff will use it . . . [right now the problem is] when we are not getting

something back [from applicants] that we can check and review, then we have no idea if the consultant may check the right box or not . . . [with the tool we will have] the capability of looking at the data after it's entered" (A528: Nov. 29, 2010). A Pennsylvania official, referring to the assessment tools the state currently recommends applicants use (as discussed in Section 8.0) but hopes to replace with the draft tool the state is developing, said "Those are mostly still on our books . . . until we revise our [permit] application and officially adopt something else, or utilize something else, and recommend it" (A369: Dec. 13, 2010). From this perspective, bureaucratic utilization of tools and recommendation of tools to consultants amounts to the same thing.

The same understanding emerges from the regulated side of the equation. A consultant said that her company would use an assessment tool if "the bottom line was . . . the agency specifically asked for it" (D229: Feb. 3, 2011). A consultant with extensive experience in Pennsylvania said "We've used PAMHEP, HEP, WET. We actually had a project where they [bureaucrats] asked for the New England Rapid Method" (D687: Dec. 29, 2010).[7] Another consultant said "We're not going to use it [a tool] unless they [bureaucrats] make us use it . . . if they say we have to know [the results of a tool-based analysis], then you know we'll do it" (D334: Dec. 29, 2010). A bureaucrat requests that applicants (or their consultants) apply a tool, they submit the data to the bureaucrat, and the bureaucrat uses the tool by using its data to make a regulatory choice.

[7] The acronyms in this interviewee's statement all stand for particular assessment tools, some of which will be discussed in later chapters.

8.0 Opportunities for rapid wetland assessment tool use in the six states

Investigating the factors that influence bureaucratic use of rapid wetland assessment tools might seem nonsensical if one assumes that bureaucrats perform precisely the tasks they are given by their political and administrative superiors in precisely the ways they are directed. Under such an assumption, bureaucrats would only use tools if the tools were officially adopted by their administrative agency. However, the literature on street-level bureaucracy tells us that the actions of individuals on the front lines of policy implementation are rarely so constrained (Lipsky 1980).

Administrative and political principals cannot foresee and plan for the diversity of complex implementation situations street-level bureaucrats may encounter; in fact, they may not want to do so (Arnold 1990; Kerwin 1994). Consequently, street-level bureaucrats often are left with substantial discretion to shape their implementation choices according to their professional norms and personal values (ibid., Evans and Harris 2004; Hupe and Hill 2007; Maynard-Moody and Musheno 2003). Such discretion is particularly common when regulatory issues are highly complex and of fairly low public salience, as in the wetland arena (Gormley 1986). Expansive discretion also may be more likely when—as in the wetland context—there are many rules and regulations coming from different levels of governance. Collectively, such rules can be contradictory and conflicting, forcing bureaucrats to develop informal work-arounds (Evans and Harris 2004). The substantial discretion of wetland bureaucrats is evident in an assay of the language and processes that authorize regulatory action in each of the states examined in this dissertation. In each instance, there are opportunities for bureaucrats to use a rapid wetland assessment tool.

In Delaware, bureaucrats regulate wetlands via their interpretation of the state's surface water quality standards and designated uses. While these mandates sometimes have numeric specifications, most are narrative. For example:

> The Department may consider synergistic, antagonistic, and additive impacts of combinations of toxicants to fish, aquatic life, and wildlife, and human health in assessing aggregate environmental impacts and mandating point and nonpoint source controls. (DNREC 2004, 22)

Delaware bureaucrats could use rapid wetland assessment tools or principles derived from them to evaluate such impacts and other fairly subjective elements of the state's water quality specifications.

In Maryland, wetland bureaucrats have discretion to decide whether, "the [proposed] activity will avoid and minimize impacts [and the bureaucrat should do so] by considering topography, vegetation, fish and wildlife, and hydrological conditions" (ELI 2008, 7). The joint permit application shared by Maryland and the Corps does not specify the ways in which permit reviewers will evaluate permit applications; they could use a rapid wetland assessment tool. Some wetlands not considered federally jurisdictional could be regulated by Maryland's state bureaucrats if they determine that the wetlands have "significant plant or wildlife value" (MDE n.d.a). State bureaucrats could use a rapid wetland assessment tool to inform this judgment. Similarly, those staff could use assessment tools to determine whether a proposed non-tidal impact could "cause an individual or cumulative effect that degrades: a) aquatic ecosystem diversity, productivity, and stability; b) plankton, fish, shellfish, and wildlife; c) recreational and economic values; and d) public welfare."[8]

[8] *Code of Maryland Regulations* Chapter 26, subtitle 23 (1991).

Current Ohio wetland bureaucrats have less discretion than officials in the other states because Ohio officially adopted a rapid wetland assessment tool for regulatory use in 2002. However, applicants do not always use this tool, despite the Ohio Environmental Protection Agency's preference for its use, and thus Ohio wetland staff members sometimes gain experience with tools other than the officially recommended one (A041: Nov. 18, 2010; B191: Feb. 17, 2011). Moreover, prior to 1998, Ohio wetland bureaucrats used more idiosyncratic approaches to wetland assessment (A230: Nov. 19, 2010). The Ohio Rapid Assessment Method (ORAM) was phased in between 1998 and 2002 and its use by state officials and/or regulated entities was not ubiquitous during that period (A041: Nov. 18, 2010). ORAM also is currently not used to evaluate wetland mitigation in the state (A230: Nov. 19, 2010). Ohio wetland bureaucrats may use other codified assessment approaches to evaluate mitigation, or they may develop and apply site- or project-specific approaches informed by a set of state-specific mitigation protocols which, while standardized, allow for some professional discretion (Mack 2006).

Pennsylvania bureaucrats deciding whether to grant Section 401 certification and state wetland permits are actually instructed by the state's primary environmental regulatory agency to use their best professional judgment, which could be informed by a bureaucrat's use of a rapid wetland assessment tool use or principles derived from tools:

> As to technical review procedure or review criteria, there is no detailed available guidance from EPA or other sources. This is where you need to use the best professional judgment. However, the Section 401 of CWA and regulations thereunder provide some specific information and procedural requirements. It is sketchy on technical evaluations guidance. (PADEP 1997, 7)

Also, applicants who wish to impact wetlands in Pennsylvania generally must complete the state's Environmental Assessment Form, which asks them to "provide a

written narrative . . . discussing the [site's] . . . ecological functions" (PADEP 2001, 2). The form does not instruct applicants to use a specific rapid wetland assessment tool to gather these data, but it provides information necessary for applicants to obtain copies of three such tools. State wetland staff members have incentive to be able to use these tools so they can understand the data applicants submit and potentially field-check them. Non-conventional wetland bureaucrats in Pennsylvania who sometimes play the applicant role (e.g., an environmental manager in the state's transportation agency who submits permit applications on behalf of that agency to the Pennsylvania Department of Environmental Protection) sometimes use assessment tools (A868: Nov. 15, 2010).

Virginia's joint permit application requires applicants proposing to impact more than one acre of wetlands to prepare a:

> . . . narrative description of the existing functions and values of the wetlands and waters being impacted, the impact that the project will have on these functions and values, and information on the following: surrounding land uses and cover types; nutrient, sediment, and pollutant trapping; flood control and flood storage capacity; erosion control and shoreline stabilization; groundwater recharge and discharge; aquatic and wildlife habitat; and unique or critical habitats. Functional values may also include: water quality, floodflow desynchronization, nutrient import or export, stormwater retention or detention, recreation, education, aesthetics, or other beneficial uses. Also include the assessment methodology that was used. (VDEQ VMRC USACE 2008)

The implied expectation is that wetland bureaucrats in Virginia will be sufficiently familiar with the assessment approach an applicant chooses that they will be able to evaluate the data the applicant supplies. State officials also could themselves use rapid wetland assessment tools on site visits.

Wetland bureaucrats in the West Virginia Department of Environmental Protection are charged with determining the nature of a proposed activity's "impact on water resources,

fish and wildlife, recreation, critical habitats, wetlands, and other natural resources under the [state] jurisdiction."[9] Bureaucrats could use rapid wetland assessment tools to evaluate that impact. Also, Section 401 certification applicants are required to describe the wetland functions their activity will affect (WVDEP 2005). The state's Section 401 application does not request that applicants use a specific rapid wetland assessment tool for this task, but applicants could do so, particularly if state officials request such use. Bureaucrats also could use such a tool to verify the expected impairments applicants report.

Overall, wetland bureaucrats engaged in regulatory activities in the six states studied have discretion with which to execute their professional mandates. This discretion enables them to use rapid wetland assessment tools, directly or indirectly, to inform their regulatory choices. The fact that these officials have discretion to choose whether they will use tools and which they will use allows for enough variation in bureaucrat behavior across the six states to permit a good test of Chapter 3's hypothesis concerning factors influencing individual-level tool use.

9.0 Contextual variables in the six states

This section provides general context for wetland regulatory action and potential use and adoption of rapid wetland assessment tools in the six states the dissertation examines. It gives a brief overview of some regulatory, organizational, political, economic, and biophysical influences on the policy outcomes at issue. The data offer a relatively current snapshot of the status of these potentially important factors; they do not necessarily reflect the status of the variables over the entire study time period (1995–2011).

[9] *West Virginia Code of State Rules* Title 47, series 5A, section 3.1 (2002).

Some of these contextual variables will be discussed in greater depth in subsequent chapters. The variables, data sources, and some problems with the data are described in this chapter's Appendix 1-1. In the table below, an X is used to indicate when a state has the attribute in question. The acronym CWA is used for the federal Clean Water Act.

Table 1-1. State contextual variables

Contextual variables	DE	MD	OH	PA	VA	WV
1) State handles CWA Section 401 certification	X	X	X	X	X	X
2) State has joint and programmatic general permitting arrangements with the Corps		X		X	X	
3) State explicitly regulates non-tidal federally non-jurisdictional wetlands		X	X	X	X	
4) State has officially adopted a tool into its non-tidal wetland regulatory program			X			
5) State-level progress towards official tool adoption	0	0.25	1.0	0.75	0.75	0.5
6) Number of Corps districts with effective jurisdiction over wetland issues in the state	1	1	3	3	1	2
7) Number of offices of the state's primary environmental regulatory agency,	1	5	6	7	7	6

Contextual variables	DE	MD	OH	PA	VA	WV
including headquarters						
8) Ratio of non-tidal wetland acreage to total land area	18.0	5.5	1.5	1.4	3.5	0.7
9) Staff in the state's primary environmental agency directly tasked with non-tidal wetland regulation	10 FTEs	25 FTEs	14 FTEs	n/a	37 FTEs	11–14 FTEs
10) 2009 budget of primary state environmental regulatory agency (millions)	$41.97	$274.59	$188.2	$217.51	$288.01	$139.01
11) U.S. Environmental Protection Agency Wetland Program Development Grant monies awarded to states for monitoring and assessment, 2001–2011 (millions)	$1.02	$1.84	$3.20	$2.67	$3.73	$1.40
12) When representatives from one or more state environmental agencies began attending meetings of the Mid-Atlantic Wetland Workgroup	2002	2002	2002	2002	2002	2005
13) Political party control of the governorship, 1995–2011	D 100%	D 75%, R 25%	D 20%, R 80%	D 40%, R 60%	D 40%, R 60%	D 80%, R 20%
14) Number of governors, 1995–2011	3	4	5	5	5	5
15) Political party of						

Contextual variables	DE	MD	OH	PA	VA	WV
presidential candidate winning the majority of votes in 1996, 2000, 2004, and 2008	D, D, D, D	D, D, D, D	D, R, R, D	D, D, D, D	R, R, R, D	D, R, R, R
16) Persons per square mile	460.8	594.8	282.3	283.9	202.6	77.1
17) Average state per-capita GDP, 1997–2010	$61,246	$42,116	$37,427	$37,809	$44,231	$28,105

10.0 Dissertation outline

Chapter 2 describes the methods used in this study. Chapter 3 explores the determinants of bureaucratic tool use choices. Chapter 4 explores determinants of state-level tool adoption. Chapter 5 argues that the bureaucrats who have played key roles in state tool adoption efforts pursue a unique type of policy entrepreneurship not substantially addressed in the literature. Chapter 6 concludes. Chapter 7 provides references.

Appendix 1-1. Data sources, caveats, and notes for Table 1-1

The notes below concern the data presented in Table 1-1. Other data would have been desirable to include but were not accessible or were not available in a manner amenable to cross-state comparison.

1–4) The sources for these data are ELI (2008) and ASWM (2011). Some states have programmatic general permitting arrangements with the Corps for activities not regulated under Section 404 of the Clean Water Act, but those arrangements are not considered here.

5) State progress toward tool adoption is categorized in five-level ordinal variable from zero (no appreciable progress) to 1.0 (tool adoption). This variable's construction is further described in Chapter 2, Appendix 2-1 Section 1.5.

6) The sources for these data are EPA (2012a) and USACE (2009).

7-8) These data come from ELI (2008), the U.S. Census Bureau (2010), and state environmental agency organizational charts.

9) These data come from ELI (2008). Staff tallies exclude individuals who work in voluntary or incentive-based wetland programs as well as state wetland bureaucrats outside the primary state wetland regulatory agency (e.g., staff at the state's department of transportation or fish and game agency). Pennsylvania data are not provided because the state does not differentiate among staff who do regulatory versus non-regulatory wetland work. Communication with a wetland manager at the agency affirmed that wetland staff handle issues in both arenas and separate tallies are not possible (A369: Oct. 27, 2011). These data are meant to give a snapshot of staffing in one of the relevant state environmental agencies; staff levels likely fluctuated over the time period examined in this dissertation.

10) These data come from ECOS (2010) and state budget documents for the fiscal year ending 2009. They come from final/enacted/adopted budgets. Like the staffing data, the budget information is meant to provide a snapshot of relative state capacity. Environmental budgets likely fluctuated over the study period.

11) These data come from the EPA's Wetland Program Development Grants database (Wetland Grants Database n.d.). The start year is 2001 because data for Ohio are only available beginning in that year, even though data for other states are available for a few years earlier. The figures were calculated by summing grants received by states for monitoring and assessment, excluding any grants specifically for tidal wetland projects and including grants for cross-category projects that included monitoring and assessment elements and grants for general program support wherein the application summary mentioned monitoring and assessment. The database does not indicate whether the funds are in current dollars. The Pennsylvania figure may be inflated because the state received funds to coordinate the activities of the Mid-Atlantic Workgroup, a regional consortium devoted to wetland assessment science and policy in which representatives of all states in this investigation participate. Placing a dollar value on the amount Pennsylvania actually

gained from that funding is difficult because the state not only administered the funds for the workgroup, but also benefitted from workgroup activities.

12) This information is available to members of the Mid-Atlantic Wetland Workgroup.

13–14) These data are available from the National Governor's Association (NGA 2011).

15) These data come from Leip (2012).

16) These data come from the U.S. Census Bureau (2010).

17) State per-capita GDP figures were calculated using data from the U.S. Department of Commerce's Bureau of Economic Analysis. The figures are totals across all North American Industry Classification System codes. They are chained 2005 dollars (BEA 2011).

Chapter 2: Methods

1.0 Methodological approach

I use data from a six-state survey of state wetland bureaucrats (n=149) to explore the determinants of rapid wetland assessment tool use by those bureaucrats (Chapter 3). I use interviews (n=98), ethnographic research, and secondary sources to examine why state environmental bureaucracies do or do not adopt these tools (Chapter 4).[10] I also rely on these latter three sources when analyzing street-level policy entrepreneurship in tool adoption (Chapter 5).

The following chapter describes the data-gathering process, basic aspects of the data, potential threats to validity, and the ways in which I address those threats. Four appendices follow. Appendix 2-1 describes the nature, construction, and analysis of variables used in statistical analysis in Chapter 3; Appendix 2-2 presents the survey questions; Appendix 2-3 presents questions used during interviews; and Appendix 2-4 shows an abbreviated version of the Qualtrics coding tree I developed to analyze interview data.

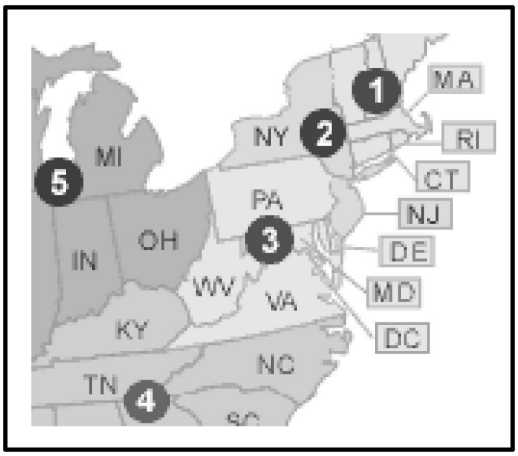
1.1 Geographic scope

I investigate rapid wetland assessment tool use and adoption in Maryland, Delaware, Ohio, Pennsylvania, Virginia, and West Virginia. These states, with the exception of Ohio, are within the jurisdiction of the Region 3 office of the U.S. Environmental Protection Agency. (Ohio is in EPA Region 5's jurisdiction.) The U.S. Army Corps of Engineers

[10] I also implemented a survey of rapid wetland assessment tool developers (n=73), but do not draw on data from that survey in this research.

districts with de facto jurisdiction in these states are the Baltimore, Buffalo, Philadelphia, Pittsburgh, Huntington, and Norfolk Districts.[11] Figure 2-1 shows the EPA regions covering the states in this investigation, Figure 2-2 shows the states themselves, and Figure 2-3 shows the Corps districts:

Figure 2-1. EPA regions[12]



[11] The Louisville District technically has jurisdiction in Ohio, but does not handle wetland regulatory issues there. The Buffalo district technically has jurisdiction in Pennsylvania but does not handle wetland regulation in that state. The Baltimore, Wilmington, Huntington, and Nashville districts technically have jurisdiction in Virginia but do not handle wetland regulatory issues there (B333: Oct. 24, 2011).

[12] U.S. Environmental Protection Agency Underground Storage Tank Protection Office, http://www.epa.gov/oust/regions/regmap.htm.

Figure 2-2. States studied **2.3 Corps districts**[13]

I chose these states for two reasons. First, the states in Region 3 can be understood as "most likely" cases for bureaucratic wetland assessment tool use and bureaucracy tool adoption (George and Bennett 2005, 75). The wetland policy community considers many of the Region 3 states, along with Ohio, as having some of the best and most advanced wetland assessment initiatives nationwide (C104, C193: Oct. 30, 2010). This reputation makes them

[13] U.S. Army Corps of Engineers New Orleans District, http://www.mvn.usace.army.mil/PAO/whoweare/USACE-Divisions-Map-2007.jpg. I was able to find no better map of the Corps districts and modified this one to make the lines clearer. The diamonds indicate district offices, while the circles indicate division offices, one step up in the agency's hierarchy. The thick gray lines indicate a division boundary. The thinner gray lines show district boundaries except where they are covered by a division line. The black lines show state boundaries. While the district boundaries appear to show that some states are covered by districts not discussed in this dissertation, wetland regulatory jurisdiction is traded among districts; see footnote 11. Also note that districts, not divisions, generally implement wetland regulations.

data-rich targets. Representatives from these states participate in a regional workgroup on the science and policy of wetland assessment. Two public research institutions whose scientists work with state policy actors, the Virginia Institute of Marine Science and the Pennsylvania State Cooperative Wetlands Center,[14] are well-respected nationally for the quality of their wetland research, including research on assessment. These facts suggest that tool use and adoption should be more likely in these states than elsewhere. If these outcomes do not obtain, the reasons for their absence should be particularly informative for policymakers and for theorizing about the integration of science into on-the-ground policy.

I analyzed Ohio along with the Region 3 states because, although Ohio is in a separate EPA region, two of three U.S. Army Corps of Engineers districts which regulate wetlands in Region 3 also have jurisdiction in Ohio (the Huntington and Pittsburgh Districts). Wetland bureaucrats from Ohio have participated in the above-noted wetland assessment workgroup for years. Ohio wetlands, particularly in the southern and eastern parts of the state, share many biophysical similarities with wetlands in West Virginia and Pennsylvania. Finally, I selected Ohio in part because of the value the state would take on the official tool adoption dependent variable. Ohio is the only state among the six to have officially adopted a rapid wetland assessment tool. Including Ohio allowed my sample of states to include a full range of official tool adoption variability.

Second, I selected the Region 3 states plus Ohio because of my familiarity with wetland policy implementation in those states gained during the time I spent working with federal wetland bureaucrats at EPA Region 3. I spent a total of 18 months over a little more than three years (2008–2011) working at the regional office as a fellow or volunteer. EPA

[14] Now called Riparia.

wetland bureaucrats work closely with their state counterparts and have extensive knowledge, often going back decades, of the policies, trends, and personalities that have driven wetland policy implementation in the states within their purview. I had access to this knowledge as well as to reports and data submitted by the states to the EPA concerning the status of the states' wetland programs and use of EPA grant monies. My EPA colleagues helped me identify interviewees and survey sample members and facilitated my research in numerous ways.

1.2 Biophysical scope

Although three of the six states have tidal wetlands, there are three reasons why my research focuses only on non-tidal wetlands and tools and programs that concern them. First, this focus made the scope of the project more manageable. Second, rapid wetland assessment is not widely recognized among tidal wetland managers as an innovative best practice (A159: Nov. 3, 2010). Third, my dissertation research was supported by an EPA Science to Achieve Results (STAR) fellowship awarded in the Water Quality: Hydrogeology and Surface Water category, which explicitly excludes research on coastal (tidal) systems.

Wetlands are "those areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs and similar areas."[15] A non-tidal wetland is "not subject to the ebb and flow of tidal waters. . . . Non-tidal wetlands contiguous to tidal waters are located landward of the high tide line" (USACE 2010a, online). These wetlands

[15] *Code of Federal Regulations* 40 Part 230.3(t).

"are most common on floodplains along rivers and streams (riparian wetlands), in isolated depressions surrounded by dry land (for example, playas, basins, and 'potholes'), along the margins of lakes and ponds, and in other low-lying areas where the groundwater intercepts the soil surface or where precipitation sufficiently saturates the soil (vernal pools and bogs)" (EPA 2012c). Figure 2-4 depicts a non-tidal wetland in the Cincinnati, Ohio, area:

Figure 2-4. Powel Crosley Lake wetland area in Rowe Woods at the Cincinnati Nature Center[16]

1.3 Temporal scope

The time period over which I examine rapid wetland assessment tool use and adoption is 1995–2011. I chose 1995 as the starting point upon the recommendation of

[16] Source: Nina Harfmann, http://natureremains.blogspot.com/2008/11/watercolor-painting.html. Used with permission.

Regina Poeske, Team Leader of the EPA Region 3 Wetland Science Team.[17] Poeske observed that state bureaucrats nationwide largely did not begin using rapid wetland assessment tools until at least 1995, and a number of state bureaucracies did not "catch on" to the idea of rapid wetland assessment until the 2000s.

2.0 State bureaucrat survey methods

2.1 Surveys versus interviews

The surveys and interviews accessed different subsets in the populations of individuals with relevant rapid wetland assessment insight. I conducted interviews with elites who would or presumably should have had something to say about the research topic given their experience or status.[18] In contrast, the surveys were meant to gain insight about tool usage and tool-related perceptions of street-level state wetland bureaucrats. Data from the latter are important because street-level bureaucrats might know better than elites about the degree of tool use occurring on the ground and the challenges associated with such use. Obtaining data from street-level bureaucrats via interviews rather than surveys was difficult for three reasons.

First, I did not always know who the bureaucrats were. In some cases, the formats of the organizational charts and staff directories of bureaucratic units I suspected contained staff involved in state wetland regulation were too ambiguous for me to determine with

[17] Poeske is involved in NWCA, discussed in Chapter 1, and has extensive relevant expertise.

[18] I did not define elites in the classic sense, that is, elected political leaders or high-level agency officials roundly understood as important figures. I considered as elites those individuals with expert knowledge about assessment and first-hand experience with state assessment efforts. Some of the actors interviewed did have high-level positions in government or outside it, but others were street-level bureaucrats with extensive assessment knowledge. The surveys, in contrast, targeted the "average Joe" street-level bureaucrat who did not necessarily possess such expertise.

confidence the relevant individuals. While elite interviewees could direct me to some bureaucrats implementing state wetland regulations, different elites pointed to different individuals and I was able to find independently other regulatory staff not mentioned by elites. Thus, I opted to send a survey invitation to all the individuals I thought could potentially be (or have been since 1995) street-level wetland bureaucrats in each state.

Second, street-level state wetland bureaucrats spend less time behind their desks than in the field. They review and process permits, work that is generally burdensome and time sensitive. Street-level bureaucrats thus might not have time or be accessible for an interview, whereas elite experts might be more accessible and be particularly interested in talking about their knowledge. In contrast to a typical interview, a survey could be completed by a street-level bureaucrat in bits and pieces, from a home or work computer, at whatever time happened to be convenient for the bureaucrat.

Third, my interactions with EPA and state wetland bureaucrats convinced me that some lower-level wetland staff would be hesitant to be interviewed about policies managed by their superiors or their own informal (not necessarily superior-sanctioned) regulatory practices, even though interviewees were promised anonymity if they wanted it. I anticipated that street-level wetland bureaucrats would be more willing to answer questions about these topics in an anonymous survey.

2.2 Building the survey

In the late summer and early fall of 2010, I used Qualtrics, an online survey platform, to design the survey for state bureaucrats. The survey construction process took roughly three months. Indiana University graduate students and EPA wetland bureaucrats pre-tested

draft versions of the survey in September 2010. I secured institutional review board approval of the survey in October 2010 and launched it in February 2011.

2.3 The sample frame problem

There was no easily identifiable sample frame. This section discusses that problem and its implications for construction of the survey and the state-specific survey samples.

The survey was intended for all state bureaucrats who had been involved in state-level wetland regulation in the six states at some point since 1995. It was not targeted only at those who had used rapid wetland assessment tools because sound analysis requires variability on the outcome variable: tool usage. The survey defined state-level "wetland regulation" and the involvement of state bureaucrats in it in this manner:

> *This survey asks you about your experience with wetland assessment for regulatory purposes at the state level at some point since 1995. . . .*
>
> *Wetland regulation or regulatory activities refer to state policies affecting wetlands that are implemented and enforced by state employees. If someone violates a state wetland regulation, he could be penalized under state law. Examples include state prohibitions on fill of wetlands, requirements that applicants obtain state permits before impacting wetlands, or rules states make governing the activities of wetland mitigation banks. Wetland regulation does not refer to purely incentive-based or purely voluntary wetland programs.*
>
> *You could have been involved in state-level wetland regulation in two ways: By having a job where wetland regulation is one of your main tasks, or by participating in one or more projects where wetland regulations affected the project.*

The definition's inclusiveness created three challenges that prevented me from developing a sample frame with specific boundaries and easily identifiable members. First, eligible respondents could be or have been employed in a wide variety of state agencies and positions, bearing job titles that would not necessarily indicate that the individual was involved in wetland regulation. Second, two individuals could share the same job title and

work in the same state agency, but one might do wetland regulatory work while the other might not. Third, individuals who worked in state wetland regulation at some point since 1995 might not work in the same job now or might not work for the state at all anymore.

I took three steps to address the sample frame problem. First, with input from my EPA colleagues and feedback from interviewees, I created and then repeatedly revised a screening tool that listed which state agencies, units, and positions I would include or exclude from my searches for potential survey contacts. Whenever I revised the screening tool, I reviewed the agencies, units, and positions that had previously been excluded or included to ensure that those choices were still appropriate. These screening tool revisions all occurred before the survey effort began.

Second, I rejected probabilistic sampling in favor of attempting to approximate an exhaustive population sample in each of the six states. To construct these samples, I asked my EPA colleagues about their current and former state contacts and searched through organizational charts, regulatory letters and guidances, resource monitoring reports, wetland publications and papers, scientific and gray literature, other print and online secondary sources, permit files, meeting minutes and notes available in EPA files, state progress and grant reports submitted to the EPA, current and former staff directories, and other relevant materials. My search lasted from October 2010 through March 2011.

Third, in constructing the samples, I prioritized comprehensiveness over efficiency. Within the parameters of the screening protocol, I found large numbers of individuals who could have been involved in wetland regulatory activities in the six states. Some ineligible individuals were unquestionably included. Consequently, the survey had an initial screening question meant to ensure that only eligible individuals were queried:

Have you been involved in state-level wetland regulation in Delaware, Maryland, Ohio, Pennsylvania, Virginia, or West Virginia at some point since 1995?

If an individual answered "no," he or she was funneled out of the survey. As described in Section 2.5, the percentage of screen-outs allowed me to use proportional allocation to estimate outcome rates.

To construct the state-specific survey samples, I searched the sources described above for bureaucrat email addresses. When I could not locate an email address, or a potential respondent's email bounced, I searched for a postal mailing address by entering data I had about the individual's present or past work location into the subscription people search engine Intelius.com, cross-checking with the free people search engine 411.com.

Invitations to the survey via postal mail were sent roughly one to two weeks following the email invitations. When I could not determine with relative certainty the postal address of an individual, I either mailed a survey invitation to up to three postal addresses that were best guesses based on Intelius and 411.com cross-checking, or I did not contact the individual but still counted him or her in the full sample as a potentially eligible respondent. I followed the latter course only when Intelius and 411.com cross-checking did not provide any confirmatory clues and there were more than 10 potential postal addresses. As shown in Section 2.5, this latter course resulted in lower response than contact rates.

2.4 Administering the survey

The surveys were administered in per-state waves rather than all at once for two reasons. First, each email survey launch generated a number of bounced emails and questions from potential respondents. I recorded each bounced email so that I could attempt

to track down alternate email addresses or postal addresses, and I responded to the potential respondent queries. Both activities took time and would have been difficult to manage had I been pursuing them across all six samples at once. Second, when I launched each survey except the last, I was still constructing the survey sample for the ones I was to administer subsequently. (However, neither the survey instrument nor the approach for sample construction changed as I administered the per-state survey waves; both were set before surveying began.)

In my initial contact with potential respondents, I provided them information about the survey and told them that the survey took pre-testers 30 minutes to complete, on average. I described ways in which respondent anonymity and confidentiality would be respected. Respondents had the option of providing their names at the end of the survey to facilitate follow-up questioning. The email invitation provided potential respondents a survey hyperlink. The postal mailing asked potential respondents to type a URL into a web browser; the URL took them to the same survey as individuals contacted via email, though email and postal responses were collected separately. All potential respondents had approximately one month to complete the survey. Potential respondents contacted via email received two reminders, while those contacted via postal mail received one reminder due to the costs associated with mailing. In reminders, sample members were urged to respond to the survey even if they believed it did not apply to them because they would be quickly screened out and their screen-out would improve the quality of the research.

2.5 Outcome rates and summary statistics

This section presents descriptive statistics concerning the state-specific survey samples and response rates calculated in different ways, heeding suggestions from AAPOR (2011) and Smith (2009). Table 2-1 highlights summary statistics. The table's column headings are explained in the comprehensive description of survey metrics presented below Table 2-1, as well as in footnote 19. The data in Table 2-1 come from Tables 2-2 through 2-4.

Table 2-1. Survey outcome rate summary statistics[19]

	Proportional allocation-estimated response rate, weighted average across states	**Proportional allocation-estimated cooperation rate, weighted average across states**	**Best estimate response rate range, weighted average across states**	**Best estimate cooperation rate range, weighted average across states**
Combined invitation modes	24.1%	28.6%	24.1–40.2%	28.6–40.4%
Email invitation survey	27.3%	28.8%	27.3–41.5%	28.8–41.8%
Postal invitation survey	20.0%	19.6%	20.0–36.0%	19.6–35.7%

[19] The proportional allocation-estimated response rate (weighted average across states) for both survey invitation modes combined is lower than might be inferred by the combination, via weighted averaging, of the proportional allocation-estimated response rates for email and postal modes. This is because the response rate for combined modes accounts for individuals ostensibly eligible but never contacted. The proportional allocation calculation is described in (k) below. The state weighting merely indicates that, rather than taking a straight average of outcome rates for each state, each state's outcome rate was weighted in the averaging process such that it counted for proportionally more if the state had more respondents and it counted for proportionally less if the state had fewer respondents.

The following details are necessary to understand the data presented in Tables 2-1 through 2-4:

a) Full sample: All individuals identified as potentially having worked in wetland regulation in the state at some point since 1995.

b) Contact sample: Individuals for whom email addresses did not bounce and/or postal addresses did not result in returned letters.

c) Returns: Surveys entries entered into the Qualitrics system by respondents.

d) Unknown eligibility FS: This value is the full sample minus the number of returns. AAPOR (2011, 28) indicates that when "nothing is learned about whether the mailing could or did reach the sampled respondent," respondents have unknown eligibility. Because I could not be sure that email invitations were opened, nor be sure that all the postal addresses were correct, all respondents in the full sample who did not complete the survey fell into this category.

e) Unknown eligibility CS: Unknown eligibility calculated using the contact sample rather than the full sample.

f) Eligible A: Respondents who answered "yes" to the screening question described in Section 2.3. Eligible cases exclude respondents whom I considered "effective screen-outs,"

individuals who entered the survey but whose very limited engagement suggested they quickly realized that they were not actually eligible. These individuals answered fewer than 20% of the questions and also indicated, in response to specific survey questions, that they had never heard of rapid wetland assessment tools and/or had spent 0% of their time on wetland regulatory work in any of the environmental jobs they had ever held.

g) Eligible B: Respondents in "Eligible A" plus effective screen-outs.[20]

h) Maximum response rate (RR) and cooperation rate (CR): Smith (2009) suggests that the maximum response rate be calculated as number of eligible respondents divided by the full sample minus all sample members of unknown eligibility. This approach assumes that all of the non-respondents were ineligible. The maximum cooperation rate is the number of eligible respondents divided by the contact sample minus all sample members of unknown eligibility as calculated for (e) above. The values for the maximum RR and CR are the same.

I) Minimum RR: Following Smith (2009), this value is the number of eligible respondents divided by the full sample. This approach assumes all the non-respondents were eligible.

j) Minimum CR: The minimum RR calculated using the contact sample.

k) Proportional allocation (PA) RR: The product of an estimation procedure which assumes that the proportion of respondents who screened themselves out of the survey due to

[20] This eligibility measure is not used in subsequent analysis.

ineligibility is the same as the proportion of non-respondents who were ineligible. Specifically, in a given state, the number of eligible returns was multiplied by the number of returns with unknown status, and the product was divided by the number of returns. The resulting figure was an estimate of the number of unknown returns which actually would have been eligible. The number of eligible returns and the estimated number of eligible returns among the unknowns were summed. Then, the number of eligible returns was divided by the resulting figure to produce an estimate of the percentage of eligible returns actually returned, or the proportional-allocation estimated response rate. This is best-guess approach for determining the response rate of eligible individuals when minimal other data about non-respondents are available. This rate is conservative because it is likely that ineligibility is higher among non-respondents than among respondents (Smith 2009).

l) PA CR: The PA RR calculated using the contact sample.

m) Best estimate RR range: The most accurately estimated response rate likely lies between the proportional allocation-estimated response rate and the maximum response rate.

n) Best estimate CR range: The most accurately estimated cooperation rate range likely lies between the proportional allocation-estimated cooperation rate and the maximum cooperation rate.

o) Eligible complete cases: Not all survey returns were complete; some respondents answered few questions. AAPOR (2011) suggests that researchers select completion

thresholds appropriate to their investigations. I chose 70% as the cut-point because this value was a natural break in the data and did not exclude individuals who had provided useful data but had not been entirely comprehensive in their responses. I do not calculate the response and cooperation rates associated with eligible complete cases because AAPOR (2011) indicates that it is acceptable to combine incomplete and complete cases when reporting outcome rates.

Table 2-2. Summary statistics and outcome rates for postal and email invitation surveys combined

Outcome Measure	DE	MD	OH	PA	VA	WV	Total
a) Full sample	179	359	415	320	325	406	2004
b) Contact sample	155	303	344	259	286	321	1668
c) Returns	38	95	119	74	71	78	475
d) Unknown eligibility FS	141	264	296	246	254	328	1529
e) Unknown eligibility CS	117	208	225	185	215	243	1193
f) Eligible A	10	40	52	34	28	30	194
g) Eligible B	10	50	57	36	32	35	220
h) Maximum RR and CR	26.3%	42.1%	43.7%	45.9%	39.4%	38.5%	40.5%* (RR); 40.4%$^{+}$ (CR)
I) Minimum RR	5.6%	11.1%	12.5%	10.6%	8.6%	7.4%	9.6%*
j) Minimum CR	6.5%	13.2%	15.1%	13.1%	15.1%	9.3%	12.5%$^{+}$
k) PA RR	21.2%	26.5%	28.7%	23.1%	21.8%	19.2%	24.1%*

Outcome Measure	DE	MD	OH	PA	VA	WV	Total
l) PA CR	24.5%	31.3%	34.6%	28.7%	24.8%	24.3%	28.6%+
m) Best estimate RR range	21.2–26.3%	26.5–42.1%	28.7–43.7%	23.1–45.9%	21.8–39.4%	19.2–38.5%	24.1–40.2%*
n) Best estimate CR range	24.5–26.3%	31.3–42.1%	34.6–43.7%	28.6–46.0%	24.8–39.4%	24.3–38.6%	28.6–40.4%+
o) Eligible complete cases	10	29	35	34	19	22	149

*This is an average weighted by the size of each state's full sample.
+This is an average weighted by the size of each state's contact sample.

The next two tables present summary statistics and response rates for the surveys with postal invitations and email invitations respectively. The full postal sample contains individuals for whom the only contact attempt was postal mail and individuals contacted via postal mail after email failed. The email sample contains individuals for whom email was the only mechanism of contact and those individuals for whom email contact failed and who were then subject to postal attempts. There is thus some overlap between the email and postal full samples and, accordingly, between the statistics calculated using their respective full sample values: unknown eligibility (FS and CS) and all outcome rate calculations.[21]

[21] The total number of individuals in the combined full sample does not sum to the total number of postal and email sample members in their respective full samples because the combined full sample includes every potential respondent regardless of invitation mode, counted just once, plus all those individuals who appeared eligible for the survey but for whom I could find neither postal nor email addresses. Eligibility values in Table 2-2 are calculated using the total combined sample values and so also are larger than the sums of the eligibility values in the postal and email invitation samples. The contact sample values in the postal and email invitation samples sum to more than the contact sample values in Table 2-2 because the values in Table 2-2 are based on the combined full sample values that include never-contacted individuals.

Table 2-3. Summary statistics and outcome rates for postal invitation survey

Outcome Measure	DE	MD	OH	PA	VA	WV	Total
a) Full sample	32	94	83	82	76	78	445
b) Contact sample	23	81	71	62	55	53	345
c) Returns	2	23	20	19	10	10	84
d) Unknown eligibility FS	29	71	63	63	66	68	360
e) Unknown eligibility CS	21	58	51	43	45	43	261
f) Eligible A	0	5	8	7	7	3	30
g) Eligible B	0	7	9	9	7	3	35
h) Maximum RR and CR	0	21.7%	40.0%	36.8%	70.0%	30.0%	36.0%* (RR); 35.7% (CR)[+]
I) Minimum RR	0	5.3%	9.6%	8.5%	9.2%	3.8%	7.9%
j) Minimum CR	0	6.2%	11.3%	11.3%	12.7%	5.7%	10.4%[+]
k) PA RR	0	24.5%	24.1%	23.2%	13.2%	12.8%	20.0%*
l) PA CR	0	28.5%	28.2%	30.6%	18.2%	18.9%	19.6%[+]
m) Best estimate RR range	0	21.7%–24.5%	24.1–40.0%	23.2–36.8%	13.2–70.0%	12.8–30.0%	20.0–36.0%
n) Best estimate CR range	0	21.7–28.4%	28.2–40.0%	30.6–36.8%	18.2–70.0%	18.9–30.0%	19.6–35.7%[+]
o) Eligible complete cases	0	4	5	7	6	3	25

*This is an average weighted by the size of each state's full sample.
[+]This is an average weighted by the size of each state's contact sample.

Table 2-4. Summary statistics and outcome rates for email invitation survey

Outcome Measure	DE	MD	OH	PA	VA	WV	Total
a) Full sample	183	239	290	279	226	288	1505
b) Contact sample[†]	134	251	283	220	214	269	1371
c) Returns	36	72	99	55	61	68	391
d) Unknown eligibility FS	147	167	191	224	165	220	1114
e) Unknown CS	98	179	184	165	153	201	980
f) Eligible A	10	35	44	27	21	27	164
g) Eligible B	10	43	48	27	25	32	185
h) Maximum RR and CR	27.8%	48.6%	44.4%	49.1%	34.4%	39.7%	41.5%* (RR); 41.8% (CR)[+]
I) Minimum RR	5.6%	14.6%	15.2%	9.7%	9.3%	9.4%	11.2%*
j) Minimum CR	7.5%	13.9%	15.5%	12.3%	9.8%	10.0%	11.9%[+]
k) PA RR	20.5%	30.1%	34.1%	19.7%	27.0%	23.6%	27.3%*
l) PA CR	27.9%	28.7%	35.0%	25.0%	28.5%	25.3%	28.8%[+]
m) Best estimate RR range	20.5–27.8%	30.1–48.6%	34.1–44.4%	19.7–49.1%	27.0–34.4%	23.6–39.7%	27.3–41.5%*
n) Best estimate CR range	27.8–27.9%	28.7–48.6%	35.0–44.4%	25.0–49.1%	28.5–34.4%	25.3–39.7%	28.8–41.8%[+]

Outcome Measure	DE	MD	OH	PA	VA	WV	Total
j) Eligible complete cases	10	25	30	27	13	19	124

† Individuals whose email invitations did not bounce. Individuals may be excluded from the email contact sample but may still have received a survey via postal mail.
*This is an average weighted by the size of each state's full sample.
+This is an average weighted by the size of each state's contact sample.

2.6 Understanding outcome rates

This investigation's across-state weighted average proportional allocation-estimated response rate of 24.1% is somewhat low relative to rates reported in the relevant literature. In a recent meta-analysis of 39 web-based studies, Shih and Fan (2008) found a mean survey response rate of 34%. Cook, Heath, and Thompson (2000) did a meta-analysis of 56 online surveys reported in 39 studies and found a mean response rate of 34.6% for surveys with no missing data. Sheehan (2001) reviewed 31 online surveys administered from 1986 to 2000. She calculated an average response rate of 36.8%, but noted that the response rate fell over the period of analysis. The 13 surveys in her sample administered latest in the study period, from 1998 to 1999, had an average response rate of roughly 31% (ibid.). Sax, Gilmartin, and Bryan (2003), who used an internet platform to survey 1,503 first-year college students at 14 universities nationwide about their freshmen year experiences, found rates that more closely mirror the rates of those in this research: a 17.1% response rate for web surveys with no completion incentive and a 19.8% rate for web surveys with such an incentive.

There are at least five reasons why the response rate is relatively low. First, the sample frame problem led me to put into the survey samples some individuals who were ineligible. It is likely that some ineligible individuals did not bother to enter the survey to

screen themselves out and that these ineligible individuals are over-represented among non-respondents.

Second, potential respondents who received postal invitations had greater entry barriers than those who received email invitations. The former had to remember to take the letter to their home or work computer (if they had access to one), go online (if they had internet access), and then type in a URL which allowed them to click on a survey hyperlink. Individuals who received email invitations were already online and had only to click on a link in their inbox. Respondents in the postal mail invitation samples received one survey reminder; respondents in the email invitation samples received two. These differences partly explain why the response rates for the postal invitation surveys are substantially lower than the rates for the email invitation surveys, thereby lowering the rates for combined modes.

Third, locating postal addresses of potential respondents was more challenging than locating email addresses.[22] The Intelius and 411.com cross-checking procedure described above was a very rough search mechanism that often yielded many addresses that did not appear reasonable or match across the two search engines. Although I frequently used postal addresses these search engines provided, there seems to be a much larger chance, relative to the email invitation mode, that some postal invitations were received by individuals who were ineligible. This issue also explains why the rates for postal invitation surveys were low relative to the rates for email invitations.

[22] For example, I may know that Sally Smith worked for the Maryland Department of the Environment, but this fact does not indicate whether she lives in Baltimore, Annapolis, or a suburb of either city (meaning that selecting the correct phone book is not simple) and it does not indicate which Sally Smith, among multiple pages in each phone book of people possessing the same name, is the correct one.

Fourth, some bureaucratic units appointed one person to take the survey on behalf of others. More than once, a potential respondent replied to my email invitation by saying that "X from our office is answering for us." I did not anticipate this problem. I tried to encourage individuals who emailed me to take the survey anyhow and encouraged higher-level staff to allow their subordinates to do so. However, I do not know how many bureaucratic units were affected by this problem or how many potential respondents were in those units. A bright point is that any survey entries wherein an individual tried to answer on behalf of a bureaucratic unit appear to have been screened out during data cleaning.[23]

Fifth, there were some individuals who appeared eligible for the survey based on secondary-source research but whom I could not find any way to contact. Including them in the denominator when calculating the response rates lowered these rates. When those individuals are excluded, as in the cooperation rate calculations, the rates in this study are closer to the average outcome rates in the literature.

2.7 Threats to survey data validity, how they were addressed, and their implications

Fowler (2009) discusses four types of bias that affect survey research: errors respondents make when answering questions, sampling error, non-response error, and error in non-probability samples. This section discusses the extent to which bias appears to affect this research, ways that bias was addressed, and why the nature of that bias does not appear to affect the sample and inferences based on it in damaging ways.

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[23] The bulk of the survey questions did not make sense for answers at any level but the individual and a respondent answering for a group would have had to skip them, generating a substantially incomplete entry that would have fallen below the 70% completion threshold. I also inspected each case during data cleaning. Among those cases above the 70% threshold, none gave any clues that the respondent was talking about the behaviors or perceptions of a group of people.

First, respondents may answer questions in ways that do not reflect objective truth, and may do so in systematic ways. For example, the survey asked tool users to rate how complex they found rapid wetland assessment tools. Respondents may have systematically rated their complexity perceptions as lower than they truly were because they did not want to appear inexpert. I addressed this problem by asking multiple survey questions designed to access the same concepts.

Respondents also may commit errors when answering questions about activities that occurred in the past. Recent events and perceptions are easier to recall than more distant ones. Since the research covered the period from 1995 through 2011, this problem is relevant. For example, there was a meaningful level of non-response when the survey asked respondents to indicate the dates on which they began relying on policy network contacts for wetland regulatory advice. The answers respondents did provide to these questions may be less accurate the further back in time they were recalling. I recognize this potential problem in the research but cannot mitigate it except by relying in the quantitative analysis, when possible, on measures constructed using survey data that were not time sensitive.

The issue of construct validity relates to the first type of bias. It is possible that survey respondents understood questions and terms in different ways than I intended, and thus the data they provided might not actually address issues I was trying to investigate. I sought to mitigate this problem via pre-testing. However, some potential respondents still emailed me with questions which suggested that they were confused by some terms in the survey. Also, some survey questions designed to measure one quantity actually might have been measuring others. For example, two survey questions asked respondents to estimate how complex and difficult applicants found rapid wetland assessment tools. These questions

could have been measuring the extent to which bureaucrats were aware of applicant perceptions rather than, or in addition to, capturing information about applicants. In the quantitative analysis using survey data, I used questions and associated data which appeared to have the most robust construct validity.

The second mechanism for introducing bias, sampling error, can be created three ways. First, the sample frame may be constructed such that there are some individuals in the target population who do not have any opportunity to be selected into the sample. If those individuals are systematically different than individuals who can be selected, bias is introduced (Fowler 2009). As noted in Section 2.3, there were some individuals who appeared to be in the target population whom I could not find a way to contact. These individuals probably do differ from sample members in systematic ways. For example, it was easier to find email addresses for current state employees than for individuals who had left state employment. It was easier to find postal addresses for people who lived somewhere near where secondary sources suggested they had been employed than those who had moved. The longer an individual had been away from state employment, the less likely were people in current state employment to be able to give me useful contact information for him.

This first type of sampling error appears to have biased the survey samples toward current or recent state bureaucrats and away from bureaucrats involved in wetland regulation in the earlier portion of my target time period or who no longer worked for the state. The time period bias might not be acute, while the state employment bias appears more so.

Table 2-5 indicates the time periods in which survey respondents reported working in a state wetland regulatory job.[24] It is promising that my research begins with the year 1995 and more than 66% of respondents were employed in state wetland regulation by 1996–2000. Having more than 75% of the combined sample employed in state wetland regulation in 2001–2005, and an even higher number for the final time period, suggests that a large number of respondents had wetland regulatory experience over the majority of my target time period. These findings reduce concerns about the survey samples under-representing individuals employed in the earlier part of the study period.

Table 2-5. When survey respondents were employed in state wetland regulation

Time period	Frequency (n)
pre-1980	4.1% (6)
1980–1985	7.6% (11)
1986–1990	30.3% (44)
1991–1995	50.3% (73)
1996–2000	66.2% (96)
2001–2005	75.9% (110)
2006–2011	91.0% (132)

(n=145)

Table 2-6 suggests that the sample is biased towards individuals currently employed in state wetland regulation and away from individuals who left state wetland regulatory

[24] The values in Table 2-5 do not sum vertically to the number of respondents who answered this question, 145, because a respondent could have held a wetland regulatory job during more than one time period. The percentages are calculated using 145 as the denominator because the n value for each row indicates the number of survey respondents who were working in state wetland regulation during each time period. The percentages thus do not sum vertically to 100%.

positions during the target time period. It is possible, however, that there simply was a low rate of turnover among wetland bureaucrats during the target time period and thus the distribution in Table 2-6 reflects those employment dynamics. My data cannot address that issue.

Table 2-6. Employment status of survey respondents

Job status	Frequency (n)
Currently employed in a state wetland regulatory job	91.0% (132)
Employed in such a job in the past but not now	8.9% (13)

(n=145)

The second way sampling error can be created is if the process of selecting individuals into the sample is not random, and those selected are systematically different from those not selected (Fowler 2009). Potential respondents were not selected randomly from a defined sample frame, but rather were included in the sample if secondary or primary sources indicated that the individual could be eligible for the survey. This process likely biased the sample toward current or recent state bureaucrats (as indicated in Table 2-6), since the resources on which I relied to find respondents were more difficult to access for the earlier portion of the study time period. Potentially useful but older documents were not necessarily online and state and federal resource agency staff members did not necessarily know how to locate all of them.

The third way sampling error can be generated is if not everyone selected into the sample completes the survey, and individuals who do not respond are systematically different from those who do (Fowler 2009). I have anecdotal evidence that individuals who

were tangentially involved in wetland regulatory activities were less likely than those more centrally involved to respond or fill out the survey completely. When individuals emailed me with questions about the survey, one of the most common queries was about eligibility: If they had only worked on a wetland project, and they were not a wetland regulators *per se*, should they still complete the survey?[25] Some individuals probably had the same hesitation but did not email me and instead opted not to complete the survey. Individuals more interested in wetland assessment or wetland regulation and with more experience in either area were probably more likely to complete the survey (see Fowler 2009). Individuals who received postal invitations were less likely to complete the survey than those who received email invitations, and the former tended to be individuals who had left state employment; they often were in the postal samples because their state email addresses no longer worked. Individuals with regular access to a computer and a good internet connection were probably more likely to respond to an email invitation than those without, and those without such access could be reasonably suspected of being older and/or retired.[26] The sample again appears to be biased toward individuals currently or recently involved in state wetland regulation, and who have played a more central rather than more tangential role in wetland activities.

Finally, although the anonymity promised to survey respondents made systematic analysis of non-response bias difficult, the data do show that the number of survey returns as

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[25] The definition presented to potential respondents at the start of the survey (see Section 2.3) and available to them throughout indicated that such individuals were eligible. However, this definition was not sufficiently reassuring for some.

[26] For example, an older gentleman who received a postal invitation called the Indiana University IRB phone number on the study information sheet to try to reach me and explain that he did not have a computer and so could not complete the survey.

a proportion of survey contacts were fairly comparable across states. These rates generally suggest that geography was not a major influence on non-response.

Table 2-7. Survey returns as a proportion of survey contacts by state

	DE	MD	OH	PA	VA	WV
Survey contacts as proportion of survey returns	24.5%	31.3%	34.6%	28.6%	24.8%	24.3%

(n=149)

The next type of bias Fowler (2009) discusses is non-response, which was substantially addressed above. Fowler does present some promising findings concerning the impact of non-response bias, and response rates more generally, on survey estimates. Keeter and co-authors (2000, 2006) completed two telephone surveys concerning political and social attitudes, one with a 60% response rate and the other with a 36% response rate. The authors found few statistical differences between the surveys on the main variables of interest. Groves (2006) examined more than 200 estimates from 30 surveys with varying response rates and data collection modes. While Groves found significant non-response error, he also concluded there was a relatively low correlation between a survey's overall response rate and level of error associated with non-response ® = 0.33).

The final type of bias Fowler (2009) discusses is bias generally associated with samples which, like the ones in this research, were not constructed via a probabilistic sampling strategy. Fowler cautions:

> There are times when non-probability samples are useful. . . . If a researcher decides to use a non-probability sample, however, readers should be told how the sample was drawn, the fact that it likely is biased . . . and that normal assumptions for calculating sampling errors do not apply. Such warnings to readers are not common. (Fowler 2009, 67)

The manner in which the samples for this investigation were constructed was the best approach possible given time and resource constraints and the ambiguous nature of the population. I have described the sample construction and survey administration processes and their potential problems in extensive detail because of Fowler's advice.

To summarize the validity threats and their implications: The survey data best reflect the behaviors, attitudes, and perceptions of current or recent state bureaucrats directly involved in wetland regulation and/or assessment, and/or bureaucrats interested in these topics. The results of the quantitative analysis using these data best describe such individuals. The data more poorly reflect characteristics of bureaucrats no longer in state employment, more tangentially involved in wetland regulatory activities, uninterested in wetland regulation or wetland assessment, or unable or unwilling to complete a survey administered via the internet. The quantitative analysis is less useful for inference about these types of individuals. Overall, these biases do not substantially damage this research endeavor because in the puzzle I investigate primarily with the survey data—the determinants of bureaucrat tool use—my main concerns are the behaviors of individuals positioned to use rapid wetland assessment tools regularly and current efforts to improve the integration of best scientific practices into science policy implementation.

3.0 Interview methods

I interviewed more than 98 wetland professionals in the six target states between September 2010 and April 2011.[27] The interviewees were state bureaucrats directly involved

[27] While working at EPA Region 3, I interacted informally with a much larger number of individuals. Because those informal interactions were not explicitly IRB approved, I used what I learned from them to enhance my general understanding of wetland policy dynamics in the region.

in wetland regulation; federal wetland regulators from the U.S. Environmental Protection Agency and the U.S. Army Corps of Engineers; state, regional, and national wetland scientists and policy experts; and environmental consultants who regularly worked in the six states. These were elite interviews which targeted actors plainly involved in wetland assessment, wetland policy experts, and members of the wetland regulated community deemed by my EPA colleagues or their Corps contacts as reputable, knowledgeable, or highly active in the region.

I chose to interview expert elites because I wanted to trace the complex mechanisms that cause state bureaucracies to adopt or fail to adopt rapid wetland assessment tools. Individuals intimately involved in adoption efforts appeared best suited to providing relevant accounts, an argument affirmed by Tansy (2007) and Phillips (1998). This kind of process-tracing benefits from first-hand narratives (George and Bennet 2005). The interviewees were individuals who likely were in the room when adoption decisions were made, were the ones making the decisions, or knew as peers and colleagues the people who made the decisions and could comment on their motivations and behaviors.

3.1 Building the interview protocol

The interviews were semi-structured and relied heavily on open-ended questions, an approach Berry (2002) describes both as highly desirable and highly risky—desirable because it can yield rich, detailed information and risky because it requires more pre-interview research and allows more potential for interviewee bias, exaggeration, and other forms of "slant" to enter the data (ibid.; Aberbach and Rockman 2002). Aberbach and Rockman (2002) particularly recommend open-ended questioning for elite interviews because,

although the approach sets up coding challenges, it appeals to the expert interviewee's dislike for being "strait-jacketed" by close-ended questions.

I constructed an interview protocol based on the hypotheses in my dissertation proposal. The protocol was approved by the Indiana University Institutional Review Board in September 2010. The protocol is included in Appendix 2-3. The protocol is long because it encompasses all the questions I anticipated possibly asking any interviewee. I did not ask all interviewees all the questions, ask them in the listed order, or ask them word-for-word. Rather, I selected the questions most applicable based on the interviewee's expertise and worked them into the conversational flow, per the recommendations of Berry (2002), Phillips (1998), Aberbach and Rockman (2002), and others. Sometimes interviewees brought up topics I had not anticipated we would discuss, and I allowed those conversations to proceed so I could understand how these different topics connected to my central questions.

3.2 Building the interview sample

Interviewees were initially selected because of their membership in a regional workgroup devoted to advancing the science and policy of wetland assessment; because their names were located in guidance documents, permit files, published versions of rapid wetland assessment tools, current and past organizational charts of state bureaucratic units, and other secondary sources; or because they were recommended by EPA wetland regulators. Subsequent interviewees were selected because they were mentioned by initial interviewees (snowballing). Table 2-8 presents the interviewees by job sector:

Table 2-8. Interviewees by job sector

Interviewee sector	Frequency (n)
Corps bureaucracy	13.3% (13)
EPA bureaucracy*	7.1% (7)
Regulated sector (consultants, applicants)	20.4% (20)
State bureaucracy	39.8% (39)
Academia	6.1% (6)
Other/mixed	13.3% (13)

n=98

*Many of my EPA contacts were informal and my interaction with them was part of day-to-day work. This low n does not reflect the extent of information I gained from EPA staff members.

Classic environmental debates frequently involve clashes between the regulated community and environmental groups such as the Sierra Club. In this research, the regulated community is represented by private-sector consultants because wetland regulations are usually sufficiently complex that applicants need to rely on consultant expertise. I chose not to interview individuals associated with environmental groups because my experience working with EPA wetland regulators and their state counterparts suggested that in most day-to-day wetland regulatory activities, these groups do not play a major role. Their limited importance in the processes examined in this research relates to the activities being regulated and the capacities of most such groups.

Environmental groups tend to get involved in high-profile situations where large, pristine wetlands stand to be impacted or have been egregiously damaged, or where the wetland impact is associated with damage to a large watershed or community. They less frequently intervene in regulatory actions concerning the smaller impacts that are the bread-and-butter of wetland regulators. While at the EPA, I witnessed few wetland regulatory

actions where an environmental group played a role in the regulatory process.[28] Moreover, when I asked interviewees about factors that influenced the tool adoption choices of their bureaucratic units, the influence of environmental groups was mentioned by only a handful of interviewees—and not necessarily because the groups played key roles. One interviewee describing the tool adoption process in Ohio said "a lot of environmental groups were not well-represented . . . although we tried to get them in, they just couldn't give us the time that other people [specifically, members of the regulated community] could. . . . It's kind of a sad part of the whole regulatory process" (A230: Nov 19, 2010). The interviewee's primary argument was that members of the regulated community have a vested interest in the use and adoption of rapid wetland assessment tools and make it their business to influence those processes, but environmental groups have other priorities and much more limited resources.

I attempted to interview all state staff members who appeared to have high levels of responsibility for wetland regulatory activities in each state during the target time period. Some individuals were unwilling to be interviewed (most notably in Virginia), but most were cooperative. Beyond the state level, I sought to interview at least two individuals with expertise in each state and who were positioned in each relevant job sector, excluding

[28] When I did observe environmental group involvement, it was of two types. Most common was environmental group involvement at the back end of the regulatory process, where permits had already been granted, mitigation had already been pursued, and the permittee partnered with a local land trust or similar organization to protect wetlands pursuant to regulatory mandate. Since most of the regulatory work was over at their point of insertion into the process, I suspected these environmental groups would not have much to say about regulatory wetland assessment. Less common, but notable when it occurred, was environmental group intervention in "hot" cases. The EPA regional office where I worked led the agency's challenge of a Corps permit that would have allowed Spruce Mine 1, a mountaintop mining operation in West Virginia, to affect wetlands and other water resources. This was a major action and environmental groups certainly inserted pressure into the regulatory process where they could. Spruce Mine 1-type events, however, appeared relatively rare at the federal and state levels.

academia.[29] That is, I sought to interview at least two consultants with expertise per state, two Corps regulators with expertise per state, and so on. I was largely successful in this endeavor.

The table below highlights the coverage of interviewee expertise by job sector and state. The total in the bottom right does not sum to the number of interviewees because multiple interviewees had experience in more than one state. Some states had more interviewee coverage than others. However, the states with less coverage, such as Delaware and Maryland, also are physically smaller. While it was necessary in a large state like Pennsylvania to talk to multiple bureaucrats to understand wetland assessment practices in the state because bureaucrats there work out of relatively autonomous and geographically separate regional offices, in smaller states a smaller number of interviewees could describe wetland regulatory practices across the entire state.

[29] I interviewed academics who worked in the regional wetland assessment workgroup or who were identified as important by other interviewees. I did not attempt to fill an academic interviewee quota as I did with the other sectors because state and federal bureaucrats have a regulatory mandate for involvement in certain wetland activities, and those activities frequently are driven by members of the regulated community. Academics do not necessarily play similarly integral roles in the processes being studied.

Table 2-9. Coverage of interviewee expertise by sector and state

	DE	MD	OH	PA	VA	WV	Nation-wide	Total
Corps	5	7	4	11	3	5	0	35
EPA	4	4	4	3	3	3	2	23
State	4	6	9	10	3	7	0	39
Regulated	6	7	7	9	7	5	1	42
Academia	0	0	0	1	4	1	0	6
Other/ mixed	1	1	4	1	3	2	4	16
Total	20	25	28	35	23	23	7	161

3.3 Executing the interviews

Interviews were completed in person and over the phone. I emailed or postal mailed interviewees details about the research, including the IRB-approved study information sheet, before the interview. I took notes by hand during interviews and later typed them, or recorded and then transcribed the interview, depending on the interviewee's preference. Interviews ranged from roughly 20 minutes to more than an hour and a half, depending on the interviewee's level of knowledge and experience. The 98 interviews took approximately 58 hours.

Interviewees are anonymized in the text. They are cited with a number, letter, and date of the interview. They are not included in the reference list. The letter indicates the interviewee's job sector: A = state bureaucracy, B = U.S. Army Corps of Engineers bureaucracy, C = U.S. Environmental Protection Agency bureaucracy, D = regulated sector, E = academia, and F = other/mixed (nonprofit sector, other policy expert, or mixed

experience among multiple sectors). The number is randomly assigned and its only purpose is to distinguish one interviewee from another.

3.4 Analyzing interview data

I used NVivo, a software program designed to facilitate qualitative analysis, to code the interview transcripts and notes. My coding approach was both deductive and inductive. I applied a series of queries based on my research hypotheses. However, I also was open to discovering new ideas and themes during the coding process. In initial stages of coding, I selected interview transcripts and notes from interviewees in all the different sectors noted in Table 2-7, representing all six states, so I could intelligently evaluate the breadth of new concepts I was likely to uncover. I reevaluated my coding scheme after coding three, six, nine, twelve, and then fifteen interviewees, recoding previous interviews as necessary. After this point the coding scheme required few additional modifications, though when modifications occurred, previously coded cases were recoded as necessary.

I followed a modified version of the elite interview coding protocol sketched by Aberbach and Rockman (2002) for interviews that rely heavily on open-ended queries. Those authors coded in three tiers: (1) manifest codes indicating direct responses to specific interview questions, (2) latent codes indicating characteristics of the response (e.g., positive or negative valence), and (3) global codes indicating judgments the researcher forms, based on the whole interview transcript or set of notes, about general characteristics of the interviewee.

I relied most heavily on manifest codes, which I categorized into explicit manifest codes (responses to direct interview questions) and implicit manifest codes (responses that

hit on topics I intended interviewees to address, even though these topics may not have been directly addressed by a question). I used latent codes in certain instances, as when I categorized some reasons why consultants wanted to use rapid wetland assessment tools as "strategic," indicating a desire by consultants to use tools as mechanisms to game the regulatory system in favor of their clients and at the possible expense of environmental stewardship. However, I largely did not use latent codes because I relied on modified global codes to condition my interpretation of interviewee statements. I modified the global coding approach such that I coded some specific attributes of interviewees (e.g., extent of professional wetland experience) and then coded interviewee statements into general global codes such as "applicant culture" and "regulator preferences." General attributes of interviewees were thus collected by sector rather than by individual.

3.5 Threats to interview data validity and how they were addressed

There are two central rationales for elite interviews, and they have different implications for the validity of interview data. When the researcher wants to use interview data to make inferences about a larger population of elites, it is critical that the sample frame be defined precisely and that the researcher randomly sample within that frame to select interviewees (Aberbach and Rockman 2002; Berry 2002).

In contrast, when the purpose of elite interviewing is to learn about complex events from the people involved in them and get the "inside story" not available from secondary sources (i.e., process tracing; see George and Bennett 2005), random selection is not desirable; in fact, the researcher should avoid randomness in interviewee selection to the greatest extent possible (Tansy 2007). Rather, interviewees should be selected carefully, after

the researcher has already investigated the phenomena using secondary sources and has identified the key players whose insights would provide the most leverage (ibid.; Phillips 1998). My investigation fits this profile. Consequently, the fact that I selected interviewees in a purposive, non-random manner largely enhances rather than damages the validity of the interview data, albeit with the caveats discussed next.

There are three main threats to interview data validity relevant in this research. First is the issue of "discursive truth," as Phillips (1998) describes the problem wherein interviewees bring to the conversation their own agendas and narratives and cannot be relied upon for a full and objective accounting of events (see also Berry 2002). Tansy (2007) notes that politicians may slant their comments to take advantage of political capital or some other boon, while civil servants may under-represent their roles in some policy decisions because of a desire to appear apolitical. Interviewees of all stripes may exaggerate their own roles in the processes they are describing (Berry 2002). Relying on open-ended interviews exacerbates the discursive truth problem. Open-ended interview questions yield rich explanatory data that give insight into phenomena the interviewer might not even know she should be asking about, and thus have clear advantages over close-ended questions when the interviewer is trying to explore or reconstruct complex events (Aberbach and Rockman 2002; George and Bennett 2005). Open-ended queries yield greater response validity than closed-ended approaches because interviewees construct answers that make sense to them given their own worldviews and perspectives. However, those same worldviews and perspectives can create problems for researchers who must in subsequent coding try to disentangle them from actual facts, if this is even possible (Aberbach and Rockman 2002).

The second threat to validity is that non-random interviewee selection creates more opportunities for selection bias than a random approach and limits generalizability of findings (Tansy 2007). The researcher may miss interviewing critical players in the phenomena she is investigating if secondary source research did not highlight the role of these actors (Phillips 1998) and initial interviewees did not direct the researcher to them. Snowball sampling will yield policy actors familiar with one another; this may or may not be the entire set of actors who mattered in the process being investigated. This sampling technique is particularly vulnerable to missing individuals who are less well-integrated into policy networks (Sudman 1976). Also, if the processes the investigator learns about via interviews are sufficiently idiosyncratic, the findings will not necessarily generalize to ostensibly similar processes in other situations.

The third threat is perhaps the simplest: Interviewees may have lapses in memory that prevent them from accurately answering questions even if they do not intentionally slant their answers (Tansy 2007). This is particularly true when they are being asked to remember events that happened years ago, as was the case for some interviewees in this investigation.

I used multiple strategies to reduce the influence of these validity threats. One way to address the discursive truth problem is simply to identify, explicitly and to the greatest degree possible, the biases interviewees appear to bring to the research (Aberbach and Rockman 2002). One of the reasons I set a quota of interviewees from each relevant sector of actors was that, given my experience at the EPA, I knew that there were characteristic attitudes in each sector towards rapid wetland assessment, shaped by actors' training and professional experiences. During interviews, I followed the advice of Berry (2002) to ask interviewees to reflect critically on their own statements and comment on the behaviors and

attitudes of others vis-a-vis the topic of discussion, both strategies meant to minimize interviewee exaggeration and bias. During interview coding, I also noted any personal biases that appeared to shape interviewees' perspectives.

Another way to address the discursive truth issue is not to rely solely on interviews for constructing factual accounts of events (Berry 2002; Phillips 1998; Tansy 2007). Pre- and post-interview research is critical. Pre-interview research focuses on the events the interviewee likely will discuss in the interview and on the interviewee himself. This research helps the investigator understand what kinds of information the interviewee can usefully provide and the biases that may influence his narrative. Post-interview research helps verify the data the interviewee provided, contextualizes the data, and potentially highlights previously unanticipated biases (Berry 2002; Phillips 1998). I was aware of the importance of these activities and pursued pre- and post-interview research.

A third way of mitigating the discursive truth problem is to rely on multiple interviewees and multiple kinds of data when trying to construct factual accounts of policy adoption attempts (Phillips 1998). Triangulation is a best practice in social science data collection and analysis (Tarrow 1995). Triangulation is particularly appropriate when quantitative data are partial, as in this case (accounts of tool adoption processes were difficult to access with an internet survey), and qualitative-data gathering is obstructed for some reason, as in this case (street-level bureaucrats were more difficult to interview than elites, some elites were inaccessible for various reasons, and some secondary sources also were inaccessible) (ibid.). Multiple data-gathering approaches can shore up the problems of each; for example, secondary-source research can help mitigate the problems of interviewee

and survey respondent memory lapses. I relied on survey research and secondary source data to complement, contextualize, and verify data provided by interviewees, and vice-versa.

Comprehensive pre-interview research also is one of the best ways to reduce selection bias caused by non-random interviewee selection. Although the researcher can never be sure she has accessed every individual with important insight into the processes being investigated (and, moreover, some interviewees who appear to matter will inevitably be unavailable for an interview), in-depth research which seeks to identify the relevant population of interviewees is a best practice upon which interview data validity is built (Phillips 1998; Tansy 2007). By working at the EPA for three summers prior to beginning my dissertation research, with federal wetland bureaucrats who work closely with the state bureaucrats and bureaucracies I intended to study, I learned a great deal about the people and processes I would later investigate. I opted to volunteer at the EPA during the academic year in which I pursued my research precisely because my EPA contacts (and the data to which they were privy) could help me learn who was best to interview and why.

Finally, while non-random interviewee selection and a focus on specific events that affected policy adoption attempts limit the generalizability of my findings, I bolster generalizability by pursuing across-case analysis as well as within-case process tracing (George and Bennett 2005). Because I employed the same careful research and interviewing strategies in each of the six states, I am able to draw inferences that at least are applicable to states in the Mid-Atlantic and may potentially be applicable elsewhere.

4.0 Conclusion

This chapter has described the methods used in a survey of state wetland bureaucrats in six Mid-Atlantic states and protocols associated with interviewing elite wetland policy actors with assessment expertise in that region. It identified the strengths and weaknesses of these approaches, both in theory and as implemented. The combination of these approaches allows me to analyze quantitatively and qualitatively the puzzle of why state bureaucrats and bureaucracies do or do not use and adopt rapid wetland assessment tools, a type of science policy innovation. Leveraging both modes of analysis allows me to explore these phenomena more completely and in greater depth than I would have achieved using only one mode.

Appendix 2-1. Variables created from state bureaucrat survey data and their statistical analysis

This appendix describes each variable used in statistical analysis in Chapter 3, provides relevant descriptive statistics, and describes in detail supplementary statistical analyses referenced in that chapter.

1.0 Variables used in primary analysis of Chapter 3

1.1 Tool usage

This is a binary variable indicating whether a survey respondent used a rapid wetland assessment tool in state-level wetland regulatory activities at some point since 1995.

Used (1)	52
Did not use (0)	97

(n=149)

1.2 Job experience

The values of this continuous variable are the sums of years respondents reported spending in all wetland regulatory jobs they had held since 1995, multiplied by the percent of time (per job) they reported devoting to wetland activities. Thus, this variable measures *effective* years spent on wetland regulatory work.

Minimum	0.0008
Median	2.10
Mean	4.86
Standard deviation	6.04
Maximum	32

(n=144)

1.3 Annual training

This is an ordinal variable treated as continuous. This treatment is necessary, though not desirable, because some survey respondents answered the training question more than once with respect to more than one job during which training occurred. The Qualtrics survey was programmed to loop such that, if respondents indicated that they had held a second or third wetland regulatory job (and so on), they were presented with the same battery of questions that they had answered about their first job. While this approach yielded comprehensive data about each respondent's experiences, it made comparisons of respondents across the looped variables problematic. To address this problem, I could either have considered each response to the tool battery a separate case, ignoring that the cases clearly would not be independent because some of them came from the same respondent, or I could have averaged the values of looped variables so that each respondent had one value per variable. I chose the second option. The training variable is the average of the number of

annual training events a respondent attended during his tenure in all the wetland regulatory jobs he held.

Minimum	1
Median	2
Mean	1.90
Standard deviation	0.59
Maximum	5

(n=147)

1.4 Network communication

This binary variable indicates whether a respondent discussed rapid wetland assessment tools with one or more alters in his wetland policy network.

Yes (1)	56
No (0)	75

(n=131)

1.5 Adoption progress

This ordinal variable indicates the progress that state environmental bureaucracies have made toward official adoption of a rapid wetland assessment tool for regulatory work. It is a rough-cut evaluation made using the thresholds listed in the table below, where "state" means "state bureaucracies involved in wetland regulation." Data for classifying states into these categories came from secondary sources and interviews.

The state has not had meaningful discussions about adopting a specific tool (0)	29 (Maryland respondents)
The state has discussed and tentatively committed to adopting a specific tool but there has been minimal further progress (0.25)	10 (Delaware respondents)
The state is in early stages of field-testing and refining a specific tool (0.50)	22 (West Virginia respondents)
The state is in latter stages of piloting and making final modifications to a specific tool (0.75)	55 (Pennsylvania and Virginia respondents)
The state has adopted a tool into the state wetland regulatory program (1)	35 (Ohio respondents)

(n=149)

1.6 Wetland scarcity

This continuous variable, applied to all respondents in a state, is the ratio of non-tidal wetland land area in a state to total land area. Data on state land area come from the U.S. Census (2010) and data on non-tidal wetland land area come from the Environmental Law Institute (ELI 2008) and the Maryland Department of the Environment (MDE n.d.b). Land area is in acres.

17.99	Delaware (10)
5.55	Maryland (29)
1.53	Ohio (35)
1.39	Pennsylvania (34)
3.55	Virginia (19)
0.67	West Virginia (22)

(n=149)

1.7 Regulatory structure[30]

This ordinal variable characterizes the level of de jure leverage a state has to regulate its wetlands. Each variable level assumes increasingly rigorous state wetland regulatory activity, averaged over the entire study time period.

Only Section 401 certification during entire study period (1)	32 (Delaware and West Virginia respondents)
401 certification before SWANCC and isolated state wetland protections after (2)	35 (Ohio respondents)
401 certification before SWANCC and comprehensive state wetland protections after (3)	19 (Virginia respondents)
Comprehensive state wetland protections during entire study period (4)	63 (Maryland and Pennsylvania respondents)

(n=149)

[30] SWANCC is a common referent in the wetland policy community for *Solid Waste Agency of Northern Cook County v. U.S. Army Corps of Engineers*, 531 U.S. 159 (2001), a U.S. Supreme Court case that limited federal jurisdiction over some intra-state, non-navigable wetlands and bodies of water, termed "isolated." After the ruling, some states passed laws protecting these isolated resources, while others used the event as an opportunity to pass more comprehensive state wetland laws.

1.8 Education

Respondents could categorize themselves into one of nine levels of education or an "other" designation.

High school degree	0
Some college	1
Associate's degree	1
College degree	50
Some graduate school	21
Graduate-level certification	2
Master's degree	60
More than one master's degree	5
Doctorate	6
Other	1

(n=147)

1.9 Education preparation

This ordinal variable indicates how well the respondent thought his or her formal education prepared him or her for wetland regulatory work.

Not at all	29
Somewhat	90
Substantially	28

(n=147)

1.10 Applicant connection

This binary variable indicates whether a respondent answered "I don't know" when asked about applicant perceptions of tool utility and tool complexity. If the respondent gave a substantive answer to either question, the variable's value was 1, but otherwise it was zero.

Substantive (1)	73
Non-substantive (0)	72

(n=145)

2.0 Supplementary statistical analyses and models

The robustness of Chapter 3's findings were evaluated using alternate model specifications. The first set of alternate models were created using a different assumption about missing network data. The network communication variable described in Appendix 2-1 Section 1.4 and used in Chapter 3's analysis was constructed under the assumption that if a

respondent did not answer questions about his network ties, he had no ties. That respondent received a zero value for the variable rather than a missing value code.[31] However, respondents may have skipped some or all network questions because of factors such as time constraints that were unrelated to the actual status of their network relationships.

To address this issue, the network communication variable was recoded so that non-response indicated missing data (descriptive statistics are provided in Appendix 2-1 Section 3.3 below). Model A duplicates Model 1.0 in Chapter 3 except Model A uses the recoded network communication variable. Model A used only 96 observations; it yielded a pseudo R2 of 0.2503. As in Model 1.0, job experience ($p < 0.019$), network communication ($p < 0.002$), and the constant ($p < 0.007$) were statistically significant. However, adoption progress was not significant ($p < 0.144$). Model B pared down Model A to just the significant variables ($p \leq 0.05$). Model B used 96 observations, had a pseudo R2 of 0.1693, and found network communication ($p < 0.000$) and the constant ($p < 0.000$) statistically significant; job experience only hovered on the edge of significance ($p < 0.053$). Multiple imputation (a process further described below) to infer values for the recoded network communication variable was applied to Model A to produce Model C. Model C used 142 observations and found statistically significant the same variables as in Models 1.0 and 1.1: job experience ($p < 0.002$), network communication ($p < 0.001$), adoption progress ($p < 0.033$), and the constant ($p < 0.000$).

The Bayesian information criterion (BIC) for Model A was -306.576 and the Aikaike information criterion (AIC) was 1.184; for Model B, the values were -314.071 and 1.123 respectively. The fit statistics for Models 1.0 and 1.1 (documented in Chapter 3) are superior. Similar statistics cannot be easily computed for Model C, but there are reasons articulated below for preferring a model not subject to imputation. More importantly, there are legitimate reasons for interpreting non-response on the network communication variable as signifying a lack of network ties rather than missingness.

For a survey respondent to meet the 70% question completion threshold for survey eligibility and skip the battery of network questions (of which the network communication variable was one, the answer to which determined whether most of the other network questions applied to the respondent), he or she would have had to answer most of the other survey questions. The network questions appeared in the middle of the survey. Respondents who decided at that point that they were tired of completing the survey likely would have skipped the network questions and many or all subsequent questions, pushing the respondent below the completion threshold and out of the set of cases subject to analysis. It seems plausible that respondents who skipped the network questions but remained in the dataset were generally committed to answering the survey as best they could, but perhaps could not answer the network questions because they had no network data to provide. This logic suggests that it is appropriate for Chapter 3's inferences to be based on Model 1.1 rather than on Models A or B.

Models D and E recognize problems potentially caused by missing values. Models 1.0 and 1.1 use 132 observations, but there were 149 respondents. When running a

[31] The network communication variable used in Chapter 3's main analysis still has 17 missing values. In those cases the respondents evidenced a clear pattern of non-response, skipping questions before and after the battery of network questions.

regression, the statistical program used for this analysis, Stata, omits any observation for which any variables in the model have missing values (Long and Freese 2006).

To probe whether missing values appear to affect the results of this analysis, multiple imputation was used to re-estimate Models 1.0 and 1.1.[32] Multiple imputation generally results in coefficients less biased than those produced with analyses that rely on listwise deletion, so long as certain assumptions are met (UCLA n.d.). The most critical assumption is that the probability that values are missing depends entirely on chance, or at least depends only on data the researcher observes and not on the missing values that are unobserved (Carlin et al. 2003; Rubin 1976). Multiple imputation becomes problematic when the values of the missing data themselves affect missingness (Howell 2007). It is frequently quite difficult to know whether this problem exists, however, precisely because the missing values are unobserved (ibid.). It is not clear whether this problem affects the data in this investigation.

Graham and co-authors (1997) and Graham and Hofer (2000) suggest that missing data often are explained both by accessible mechanisms (e.g., inferences that can be made from observed data) and inaccessible ones (e.g., inferences that could only be made from unobserved data). The impact of inaccessible mechanisms on the results of multiple imputation are not always large (Graham et al. 1997). Wayman (2003, 4) argues that "encountering a situation where a portion of the missing data is inaccessible should not discourage the researcher from applying a statistically principled method. Rather, the attitude should be to account for as much of the mechanism as possible, knowing that these results will likely be better than those produced by naive methods such as listwise deletion." This recommendation prompted the use of multiple imputation in this analysis.

The Stata mi package was employed to generate 20 imputation datasets and estimate values for the network communication variable as originally coded and as recoded for Model C. The other independent variables in Model 1.0 were used to inform the imputation calculation, along with variables evaluated in the correlation analysis that preceded Model 1.0. The mi multiple imputation procedure uses the joint distribution of all the variables in the model—the variable being imputed and those that inform the imputation—and assumes that this distribution is multivariate normal; this assumption is generally robust to some non-normality and often even holds up reasonably well when applied to categorical or binary variables, as in this research (UCLA n.d.). Because there was some level of missingness in the independent variables, the missing values for network communication could not be completely replaced. Eleven out of 18 missing values were imputed in the original network communication variable, bringing the usable n from 132 to 143.

Model D, the re-estimation of Model 1.0 using the imputed network communication variable, used 143 observations. Job experience remained significant ($p < 0.006$), as did network communication ($p < 0.000$) and the constant ($p < 0.000$). Adoption progress hovered on the edge of significance ($p < 0.059$), and was retained in the subsequent iteration. Model E, the complement to Model 1.1, pared down Model D to yield as significant the same variables as in Model 1.1, at the same thresholds and with similarly signed coefficients.

[32] Multiple imputation was also used in Model C described above.

The potentially tenuous assumptions associated with multiple imputation suggest that using the procedure may not be advisable. In any case, using imputed values does not substantively change the findings associated with Model 1.1. Therefore, Chapter 3's inferences rely on Model 1.1 rather than on Model E.

Models A through E were run because the way in which non-response was interpreted and the extent of missing variables could have affected the results of the analysis in Chapter 3. However, the alternate specifications largely suggest that the non-response and missing value issues do not meaningfully affect those results.

Finally, footnote 37 in Chapter 3 notes that Ohio was dropped from the analysis and Models 1.0 and 1.1 were re-run. In the Ohio-omitted version of Model 1.0, Model F (102 observations used out of a total of 113, LR chi2(6): 27.89, prob > chi2: 0.0001, pseudo R2 0.2366), job experience ($p < 0.037$), network communication ($p < 0.001$), and the constant ($p < 0.000$) were statistically significant. Adoption progress was not ($p < 0.137$). The latter variable's lack of significance makes substantive sense, since Ohio arguably sent the clearest signal to its bureaucrats concerning the appropriateness of tool use when the state officially adopted a tool. Cues from the administrative hierarchy may be more difficult for street-level bureaucrats in other states to detect because their political and administrative superiors have not reached consensus on the information that ought to be transmitted downward. Nonetheless, because the variable was close to statistical significance at $p \leq 0.10$ and because it is substantively importance, it was included in the subsequent nested model. Model G, the complement to Model 1.1, pared down Model F to yield as significant the same variables as in Model 1.1, with similarly signed coefficients. Model G found the adoption progress variable statistically significant ($p < 0.038$).

3.0 Variables used in post-hoc and supplementary analyses of Chapter 3

The variables described next were used in the post-hoc and supplementary analyses presented in Chapter 3.

3.1 Use of best professional judgment

Bureaucrats were asked whether they had used best professional judgment to assess a wetland for regulatory purposes at some point since 1995.

Yes (1)	81
No (0)	67

(n=148)

3.2 Tool discard

This categorical variable gives a more nuanced picture of bureaucrat tool usage.

Never used a tool	97
Used a tool and never discarded it, or discarded one tool but replaced it with another	41
Used a tool but then discarded it and did not use another	11

(n=149)

3.3 Network communication (recoded under alternate assumption concerning missing values)

This variable is used in Models A, B, and C, and is described in Appendix 2-1 Section 2.0. For a description of the original variable, see Appendix 2-1 Section 1.4.

Yes (1)	56
No (0)	41

(n=97)

3.4 Comparison of means for variables subject to multiple imputation

Some specifications in Appendix 2-1 Section 2.0 used multiple imputation to estimate missing values in the variables noted in the first column of the table below. Reporting descriptive statistics for the variables subject to imputation is not straightforward. However, the table below compares the mean values and confidence intervals for the original variables and those variables after imputation.

Variable	**Original mean**	**Original confidence interval**	**Mean post-imputation**	**Confidence interval post-imputation**
Network communication	0.41	(0.3306, 0.4990)	0.50	(0.4438, 0.5491)
Network communication recoded (non-response as missing)	0.58	(0.4772, 0.6774)	0.37	(0.3344, 0.3975)

Appendix 2-2. Survey questions

The text below shows the questions survey respondents answered and the instructions they were given; the latter are in italics. (In the survey the instructions were in a different color font than the questions and the definitions and examples were italicized.) The text does not show the skips, logics, and loops associated with the survey. Skips applied to questions that would not have been sensible for a respondent to answer based on his previous answers and so were not presented to the respondent. For example, if the respondent indicated that he had never heard of a rapid wetland assessment tool, the respondent was not presented with the battery of tool-related questions. For many respondents, the survey was significantly shorter than the full text below because they did not view or answer non-applicable questions. Logics applied to questions where a blank appears; Qualtrics filled in the blank with a response the respondent had previously provided, such as the name of a tool or of a network contact.

Loops applied when a respondent's answers indicated that he had more to say on a particular topic. For example, if a respondent answered "yes" when asked whether he had used a second rapid wetland assessment tool since 1995, he was then presented with the entire battery of tool-related questions for a second time. Similarly, if he said "yes" when asked about holding a second wetland regulatory job at some point since 1995, the respondent was then presented with the entire battery of job-related queries for a second time.

Respondents could describe in detail up to five tools used, wetland regulatory jobs held, and environmental jobs held, and then could more briefly and qualitatively describe any additional tools used and wetland regulatory and environmental jobs held. They could describe up to four revisions to any of the five tools and then could more briefly and qualitatively describe additional revisions. Respondents could describe in detail up to four network contacts (alters) and up to seven tools they had discussed with those alters, and then could indicate and briefly comment on whether they had one or more additional alters with whom they discussed tools. They could describe in detail up to six tools whose adoption, implementation, or revision they facilitated, then more briefly and qualitatively describe involvement of that nature for any additional tools.

Survey of State Regulator Experiences with Wetland Assessment

This survey asks you about your experience with wetland assessment for regulatory purposes at the state level at some point since 1995.

Below are some definitions useful for this survey. Definitions and examples will always appear in italics. You can return to any definition by pressing the back arrow on the bottom right of your screen, or by clicking the link in the survey header. When completing the survey, please use the arrows on the bottom right of your screen to move forwards and backwards rather than using the arrows on your web browser.

Wetland regulation or regulatory activities refer to state policies affecting wetlands that are implemented and enforced by state employees. If someone violates a state wetland regulation, he could be penalized under state law. Examples include state prohibitions on fill of wetlands, requirements that applicants obtain state permits before impacting wetlands, or rules states make governing the activities of

wetland mitigation banks. Wetland regulation does not refer to purely incentive-based or purely voluntary wetland programs.

You could have been involved in state-level wetland regulation in two ways: By having a job where wetland regulation is one of your main tasks, or by participating in one or more projects where wetland regulations affected the project.

1) Have you been involved in state-level wetland regulation in Delaware, Maryland, Ohio, Pennsylvania, Virginia, or West Virginia at some point since 1995?

1=Yes
2=No

2a) Which statement(s) best describe you professionally? (Check all that apply.)

1=I have been involved in state wetland activities, but not in one of the states mentioned.
2=I have been involved in wetland regulation, but not at the state level.
3=I have worked in one or more non-regulatory jobs related to wetlands, but not in regulatory ones.
4=I have worked in one or more environmental jobs, but my work has not been specific to wetlands.
5=I have been employed by one of the states mentioned, but my work has not involved the environment.
6=I have never been employed by one of the states mentioned.

A formal rapid wetland assessment tool is a tool for wetland evaluation developed by experts and recognized, at the state, regional, or national levels, as a more or less legitimate technique for wetland evaluation. This tool (1) measures wetland condition, functions, or value, (2) includes a site visit, and (3) takes two people no more than a half day in the field and another half day in the office to complete. Examples include the Wetland Evaluation Technique (WET), the VIMS Method, and the Method for the Comparative Evaluation of Nontidal Wetlands in New Hampshire.*

2) Before reading this definition, had you heard of formal rapid wetland assessment tools?

1=Yes
2=No

3a) Do you think that a formal wetland assessment tool could be applicable to your work as a state environmental employee?

1=Yes
2=Maybe
3=No
4=I don't know

4) How did you first hear about formal rapid wetland assessment tools? (Check one.)

1=I heard about them at a professional gathering such as a conference or workgroup.
2=I read about them in scientific literature.
3=I read about them in a government document, technical report, grant proposal, or other piece of "gray" literature.
4=I heard about them from government agencies that were developing or supporting the development of such tools.
5=I heard about them from another state environmental employee.
6=I heard about them from someone in the scientific/academic community.
7=I heard about them from someone in the regulated community.
8=I heard about them from another source (please describe):

This question asks about your usage of formal rapid wetland assessment tools.

You might have used a formal rapid wetland assessment tool to evaluate the functional impact of an unpermitted wetland fill. You might have used one to help determine the ratio at which mitigation should be required for a wetland disturbance. You might have used one to determine whether your state's wetland regulations apply to a site. You also may have used formal wetland assessment tools in other regulatory tasks.

5) At some point since 1995, have you used one or more formal rapid wetland assessment tools in state-level wetland regulatory activities?

1=Yes
2=No

When a question asks about your agency, this means the state bureaucratic unit you worked for when involved in wetland regulation.

6a) Why have you not used formal rapid wetland assessment tools in state regulatory activities at some point since 1995? Please respond to each statement.

For each statement below:
1=Yes
2=No

-I did not know enough about formal rapid wetland assessment tools to use one.
-No one else in my agency used a formal rapid wetland assessment tool for regulatory activities.
-I did not think that formal rapid wetland assessment tools could be used in regulatory programs.
-I thought that using formal rapid wetland assessment tools would be too time or resource consuming.
-There were one or more other reasons I did not use formal rapid wetland assessment tools (please describe):

6) Since 1995, how has your use of formal rapid wetland assessment tools in state wetland regulation changed? Please respond to each statement below.

For each statement below:
1=Yes
2=No

-Since 1995, I have used formal rapid wetland assessment tools more frequently.
-Since 1995, I have used formal rapid wetland assessment tools for more kinds of regulatory activities.
-Since 1995, I have used formal rapid wetland assessment tools less frequently .
-Since 1995, I have used formal rapid wetland assessment tools for fewer kinds of regulatory activities.
-Since 1995, my use of formal rapid wetland assessment tools has not changed.

The next questions ask you about your experiences with up to five formal rapid wetland assessment tools you may have used at some point since 1995 in state wetland regulatory activities. It is fine if you have used fewer than five tools. If you have used more than five tools, describe the tools with which you had the most experience.

If you do not know the full, official name of the tool, just put down as much of the name as you can.

If you used the same tool in more than one state, fill out one set of tool questions for each state. For example, if you used the same tool in Tennessee and South Carolina, put "Tennessee" in the first state field and answer all the subsequent questions concerning your usage of the tool in Tennessee. You will then be given a second set of tool questions. In that second set, write "South Carolina" in the state field and complete subsequent the questions about your usage of the tool in South Carolina.

7) Complete the questions below for the first formal rapid wetland assessment tool you have used at some point since 1995.

Tool name:
Year when you began using the tool (can pre-date 1995 as long as usage continued after 1995):
State where you used the tool:

Applicants are regulated or potentially regulated entities that you have dealt with as a state wetland regulator. Applicants can mean "consultants employed by applicants" as applicable. When a question asks about your agency, this means the state bureaucratic unit you worked for when involved in wetland regulation.

8) Why did you start using _____ in state wetland regulatory activities? Please respond to each statement below.

For each statement below:
1=Yes
2=No

-My agency began encouraging use of the tool.
-My agency did not officially adopt the tool, but other regulators in my agency started using it.
-Wetland regulators in other states were using the same tool or one very similar to it.
-New research suggested the using the tool was a "best practice" in wetland management.
-Applicants were using the tool or one very similar to it.
-I had additional or different reasons for using this tool (please describe):

9) Did you stop using _____?

1=Yes
2=No

10a1) When did you stop using _____? [year]

10a2) Why did you stop using _____? Please respond to each statement below.

For each statement below:
1=Yes
2=No

-My agency stopped encouraging use of the tool.
-My agency did not officially stop using the tool, but other regulators in my agency stopped using it.
-Wetland regulators in other states stopped using the tool.
-New research suggested that the tool should not be considered a "best practice" in wetland management.
-Revisions to the tool made it less useful.
-Applicants stopped using the tool.
-I had additional or different reasons for stopping using this tool (please describe):

10) Please estimate how often you have used _____ in state-level wetland regulatory activities.

Permitting
Enforcement
Mitigation
Other regulatory activities (please describe):

1=Never
2=<10% of time
3=10-25% of time
4=26-50% of time
5=51-75% of time
6=>76% of time

11) How complex was _____?

1=Not complex
2=Somewhat complex
3=Quite complex

12) Do you know the name of the person or group that gave _____ to your agency? (This tool source can be inside your agency.)

1=Yes
2=No

13a1) Please indicate the name of the person or group that gave _____ to your agency, or the part of your agency that developed the tool.

This person, group, or unit is subsequently referred to as the "tool source." Shorthand, abbreviations, and informal names of tool sources are all fine.

13a2) On average, how often did your agency initiate communication with the tool source about _____ during the time period you used the tool?

1=Never
2=Less frequently than once or twice a year
3=Once or twice a year
4=Every few months
5=Every few weeks
6=More frequently than every few weeks
7=I don't know

13a3) In general, do you know what types of tool-related issues the tool source discussed with your agency?

1=Yes
2=No

13a4) Please briefly explain what the tool source talked about with your agency.

13a5) How helpful was the communication the tool source initiated with your agency in answering questions about or resolving problems that people in your agency had with _____?

1=Not helpful
2=Somewhat helpful
3=Quite helpful
4=I don't know

13a6) On average, how often did the tool source initiate communication with your agency about _____ during the time period you used the tool?

1=Never
2=Less frequently than once or twice a year
3=Once or twice a year
4=Every few months
5=Every few weeks
6=More frequently than every few weeks
7=I don't know

13a7) In general, do you know what types of tool-related issues the tool source discussed with your agency?

1=Yes
2=No

13a8) Please briefly explain what the tool source talked about with your agency.

13a9) How helpful was the communication the tool source initiated with your agency in answering questions about or resolving problems that people in your agency had with _____?

1=Not helpful
2=Somewhat helpful
3=Quite helpful
4=I don't know

14) The statements below concern how _____ was constructed. Please respond to each statement.

For each statement below:
1=Yes
2=No
3=I don’t know

-The tool was first introduced as part of a pilot project.

-The tool was benchmarked to baseline conditions of the specific ecosystem(s) to which it was applied.
-Future evaluations of tool performance were scheduled when tool implementation began

-Mechanisms for gathering data on tool performance were in place when tool implementation began.
-The tool gave users options for tailoring its provisions to local needs.

15) How well did _____ meet your wetland regulatory data needs?

1=Not well
2=Somewhat well
3=Quite well

16a) What data did you require for a state wetland regulatory activity that _____ did not help you access?

16) How much difficulty did people in your agency encounter when using _____?

1=No difficulty
2=Some difficulty
3=Substantial difficulty
4=I don't know

17) How successful has _____ been in state-level wetland regulatory activities?

1=Not successful
2=Somewhat successful
3=Quite successful

18) Were there revisions to _____ during the time period that you used it?

1=Yes
2=No
3=I don't know

19a) Why was _____ not revised during the time period that you used it? Please respond to each statement below.

For each statement below:
1=Yes
2=No
3=I don't know

-Revisions were unnecessary because the tool was useful as it was.
-Regulators did not use the tool often enough to revise it.
-Regulators did not use the tool long enough to revise it.
-It did not seem like revisions would be able to correct the problems with the tool.
-The procedures for making revisions seemed too complicated or difficult.
-There were no agency processes or procedures for revising the tool.
-There were one or more other reasons the tool was not revised (please describe):

20) Was _____ revised more than once during the time period that you used the tool?

1=Yes
2=No
3=I don't know

21) How many times was _____ revised during the time period that you used the tool? (Check one.)

1=Twice
2=Three times
3=Four times
4=More than four times
5=I don't know

22) Which statement best describe the revisions? (Check one.)

1=Small changes made by individual regulators during day-to-day tool use.
2=Formal revisions made via a deliberate, official process.
3=Both individual changes and formal revisions made via deliberate, official processes.
4=I do not know enough about the tool to answer this question.

The next few questions concern the small changes made by individual regulators during day-to-day tool use.

23) Please estimate how many regulatory users made individual small changes to _____

1=<25%
2=25-50%
3=51-75%
4=>76%
5=I don't know

24) Please estimate how many regulatory users informally adopted the small changes made by other regulators.

1=<25%
2=25-50%
3=51-75%
4=>76%
5=I don't know

25) In general, how much did these small changes modify _____?

1=Minimally
2=Somewhat
3=Substantially
4=I don't know

26) How did these small changes affect the usability of _____? (Check all that apply.)

[Own check boxes]
1=They made the tool easier to use.
1=They did not change the usability of the tool.
1=They made the tool more difficult to use.
1=I don't know

27) Were some of these small changes eventually incorporated into formal revisions?

1=Yes
2=No
3=I don't know

28) Do you know why these small changes were generally made?

1=Yes
2=No

29) Why were these small changes generally made?

30) How successful were the small changes in achieving their goals?

1=Not successful
2=Somewhat successful
3=Quite successful
4=I don't know

The next few questions concern formal revisions made via a deliberate, official processes.

The suggestion to make formal revisions may have come from by your agency, another state agency, an academic institution, or another entity.

31) Do you know who suggested the formal revisions?

1=Yes
2=No

32) Who suggested making formal revisions?

33) The statements below concern how the revisions occurred. Please respond to each statement.

1=Yes
2=No
3=I don't know

-The revisions were planned ahead of time, when the tool was starting to be used.
-The revisions occurred as needed. They were not planned ahead of time.
-The revisions occurred because new data or scientific developments indicated they were necessary.
-The revisions occurred because other states, government agencies, or entities (such as consulting companies) using similar tools made similar revisions.
-The revisions occurred because they were recommended by experts.

34) How much did these formal revisions modify _____?

1=Minimally
2=Somewhat
3=Substantially
4=I don't know

35) How did these revisions affect the usability of _____? (Check all that apply.)

[Own check boxes]
1=They made the tool easier to use.
1=They did not change the usability of the tool.
1=They made the tool more difficult to use.
1=I don't know

36) Do you know why the formal revisions were generally made?

1=Yes
2=No

37) Why were these formal revisions generally made?

38) How successful were the revisions in achieving their goals?

1=Not successful
2=Somewhat successful
3=Quite successful
4=I don't know

The next few questions ask about your involvement in state wetland regulation. These questions cover the entire time you have been involved in state wetland regulation, not just the time period after 1995.

Fill in the blanks in the following sentence by inserting your answers into the boxes below. If you worked in more than one state (or a different wetland job in the same state), you will be given the option to complete a new set of fields for the other states/jobs in which you worked. Please describe your most recent job first, your next most recent job second, and so on.

39) I was involved in state wetland regulation as a _____ (job) in _____ (state) from _____ (start year) to _____ (end year). In this job, state wetland regulatory activities took up _____ percentage of my job time, on average.

Job:
State:
Year (start):
Year (end; leave blank if you still work in this state or job):
Percentage of job time:

Time period:
pre-1980 = 1
1980-1985 = 2
1986-1990 = 3
1991-1995 = 4
1996-2000 = 5
2001-2005 = 6
2006-2011 = 7

40) When working in this job, how many times per year on average did you attend wetland-related training sessions or professional enrichment activities related to your regulatory work?

1=0 times
2=1-2 times
3=3-4 times
4=5-6 times
5=7+ times

41) Did the frequency of training and enrichment opportunities available to you in this job vary over the time you held the job?

1=Yes
2=No

42a) Please briefly explain how the frequency of training and enrichment opportunities available to you in this job varied over the time you held the job.

[Note: subsequent repetitions have a "different state?" question, with associated Y/N options.]

43) Have you been involved in non-regulatory state programs affecting wetlands, such as restoration or conservation initiatives?

1=Yes
2=No

44) In what kinds of state wetland regulatory activities have you been involved? (Check all that apply.)

[Individual check boxes]
1=Permitting
1=Enforcement
1=Mitigation
1=Other (please describe):

45) Prior to working in state wetland regulation, did you work in other environment-related jobs, either within or outside your current agency?

1=Yes
2=N

If you worked in more than one environment-related job prior to working in state wetland regulation, you will be given the option to complete a new set of fields for the other job(s) in which you worked. Please describe your most recent job first, your next most recent job second, and so on.

46) Describe the other environment-related jobs you held prior to working in state wetland regulation.

Job:
State:
Year (start):
Year (end):

47) To what extent did this job prepare you for your work in state wetland regulation?

1=Not at all (for coding, multiplier of 0)
2=Somewhat (for coding, multiplier of 0.5)
3=Substantially (for coding, multiplier of 1)

48) Answer "yes" if you worked in another environment-related job before beginning work in state wetland regulation.

1=Yes
2=No

49) What is the highest level of education you attained?

1=High school degree
2=Some college
3=Associate's degree
4=College degree
5=Some graduate school

6=Graduate-level certification
7=Master's degree
8=More than one master's degree
9=Doctorate
10=Other (describe):

50) To what extent did your education prepare you for your work in state wetland regulation?

1=Not at all
2=Somewhat
3=Substantially

Independently chosen means that the applicant was not instructed by a regulator to use a formal rapid assessment tool when gathering data to inform state-level wetland regulatory processes.

51) How often have applicants with whom you interacted in state wetland regulation at some point since 1995 independently chosen to use formal rapid wetland assessment tools in activities connected to state wetland regulation?

1=Never
2=<25% of the time
3=25-50% of the time
4=51-75% of the time
5=>76% of the time
6=I don't know

52) Why do you think applicants sometimes do not independently choose to use formal rapid wetland assessment tools? (Check all that apply.)

[Individual check boxes]
-They are not aware that formal rapid wetland assessment tools exist.
-They do not know enough about formal rapid wetland assessment tools to use one.
-They think formal rapid wetland assessment tools seem too time or resource intensive.
-They do not think that formal rapid wetland assessment tools are useful for gathering much of the data they need in connection with state wetland regulatory processes.
-Other (please describe):
-I do not know enough about applicants' use of formal rapid wetland assessment tools to answer this question.

53) How complex do you think applicants who use formal rapid wetland assessment tools tend to find these tools?

1=Not complex
2=Somewhat complex
3=Quite complex

4=I don't know

54) Since 1995, has the frequency with which applicants appear to have independently chosen to use formal rapid wetland assessment tools in connection with state-regulated activities changed? Respond to each statement below.

For each statement below:
1=Yes
2=No
3=I don't know

-Applicants use formal rapid wetland assessment tools more frequently.
-Applicants use formal rapid wetland assessment tools for more activities.
-Applicants use formal rapid wetland assessment tools less frequently.
-Applicants use formal rapid wetland assessment tools for fewer activities.
-Applicants' use of formal rapid wetland assessment tools does not appear to have changed.

Applicants in different states may have used rapid formal wetland assessment tools in different ways. They might have used these tools more frequently in one state than another. They might have used different tools in one state versus another. They might have used them in different activities in different states, or in other ways may have used them differently in different states.

55a1) Has applicants' use of formal rapid wetland assessment tools appeared to have been different in the different states in which you worked at some point since 1995? (Check one.)

1=Yes
2=No
3=I don't know
4=Not applicable -- I did not work in a wetland regulatory job in more than one state.

55a2) Please briefly explain how applicants' use of formal rapid wetland assessment tools appears to have been different in the different states where you worked, and speculate on why.

Applicants with whom you interacted when your job mainly involved permitting may have used formal rapid wetland assessment tools different than applicants with whom you interacted when your job mainly involved enforcement. The ways in which you saw applicants use these tools may have been different when you were a field inspector as opposed to when you were reviewing mitigation bank proposals. Applicants' use of rapid wetland assessment tools might have appeared different in other ways depending on your job.

55a3) Has applicants' use of formal rapid wetland assessment tools appeared to have been different depending on the state wetland regulatory job in which you were working at some point since 1995?

1=Yes

2=No
3=I don't know
4=Not applicable -- I did not work in a wetland regulatory job in more than one state.

55a4) Please briefly explain how applicants' use of formal rapid wetland assessment tools appears to have been different in the different state wetland regulatory jobs in which you were working, and speculate on why.

56) Since 1995, how often have you requested that applicants use formal rapid wetland assessment tools in connection with state-regulated activities?

1=Never
2=<10% of time
3=10-25% of time
4=26-50% of time
5=51-75% of time
6=>76% of time

57) Since 1995, has the frequency with which you have made such requests to applicants changed over time? Please respond to each statement below.

For each statement below:
1=Yes
2=No
3=I don't know

-I request that applicants use formal rapid wetland assessment tools more often.
-I request that applicants use formal rapid wetland assessment tools for more activities.
-I request that applicants use formal rapid wetland assessment tools less frequently .
-I request that applicants use formal rapid wetland assessment tools for fewer activities.
-My requests to applicants concerning use of formal rapid wetland assessment tools have not changed.

You might have more frequently recommended that applicants in one state use formal assessment tools than you recommended that applicants in another state use these tools. You might have recommended that applicants in one state use a particular formal assessment tool, and applicants in a different state use another. Your requests to applicants concerning their usage of formal rapid wetland assessment tools might have varied in other ways across states.

Have your requests to applicants that they use formal rapid wetland assessment tools for regulatory purposes been different in the different states in which you have worked at some point since 1995?

1=Yes
2=No

3=I don't know
4=Not applicable -- I did not work in a wetland regulatory job in more than one state.

58a2) Please briefly explain how your requests to applicants that they use formal rapid wetland assessment methods were different in the different states where you worked, and why.

You might have more frequently recommended that applicants use formal rapid assessment tools when your job mainly involved permitting than when your job mainly involved enforcement. You might have recommended that applicants with whom you interacted as a field inspector use a particular formal rapid wetland assessment tool, and applicants with whom you interacted when reviewing mitigation bank proposals use a different tool. Your requests to applicants concerning their use of formal rapid wetland assessment tools might have varied in other ways depending on your job.

Since 1995, have your requests to applicants that they use formal rapid wetland assessment tools been different depending on the state wetland regulatory job in which you were working? (Check one.)

1=Yes
2=No
3=I don't know
4=Not applicable -- I have not worked in more than one state wetland regulatory job.

58a4) Please briefly explain how your requests to applicants that they use formal rapid wetland assessment tools were different in the different state wetland regulatory jobs you have held, and why.

58) How useful, on average, do you think that applicants have found formal rapid wetland assessment tools when using them in connection with state-regulated activities?

1=Not useful
2=Somewhat useful
3=Quite useful
4=I do not know enough about applicants' use of formal rapid wetland assessment tools to answer this question.

Informal methods of wetland assessment include using best professional judgment to evaluate a wetland, using methods and assessment criteria informally developed and/or shared by individuals, or using a combination of elements from different formal wetland assessment tools in a manner that seems sensible but is not officially approved.

Applicants are regulated or potentially regulated entities that you have dealt with as a state wetland regulator. Applicants can mean "consultants employed by applicants" as applicable.

59) At some point since 1995, have you used any of the following informal methods of assessing wetlands for regulatory purposes? (Check all that apply.)

[Individual check boxes]
-Best professional judgment
-Methods and assessment criteria I developed myself
-Methods and assessment criteria informally developed and informally shared by other wetland regulators
-Elements from different formal wetland assessment tools in a combination that makes sense to me but is not formally approved
-Other (please describe):
-I have not used informal methods of assessing wetlands for regulatory purposes.

60) Which statements best describe how you have used these informal methods since 1995? Please respond to each statement below.

For each statement below:
1=Yes
2=No
3=I don't know

-I generally have used them instead of a formal rapid wetland assessment tool.
-I generally have used them to complement a formal rapid wetland assessment tool.
-I have used them in certain situations, and use a formal rapid wetland assessment tool in other situations.
-I have used informal methods of wetland assessment in one or more other ways at some point since 1995 (please describe):

You might have used different informal methods of wetland assessment in different states. You might have used best professional judgment in one state more often than in another. You might have used informal methods to complement formal tools in one state, and used informal methods instead of formal tools in another state. Your usage of informal methods might have varied in other ways depending on the state in which you were working.

61a1) Has your use of informal methods of assessing wetlands for regulatory purposes varied across the different states in which you have worked at some point since 1995?

1=Yes
2=No
3=Not applicable -- I have not worked in a wetland regulatory job in more than one state.

61a2) Please briefly explain how your use of informal methods of assessing wetlands differed across states, and why.

You might have used informal methods of assessing wetlands differently when your job mainly involved permitting versus when it mainly involved enforcement. Your use of informal methods may have been different as a field inspector than when reviewing mitigation bank proposals. Your use of informal methods might have varied in other ways depending on your job.

61a3) Has your use of informal methods of assessing wetlands been different depending on the state wetland regulatory job in which you were working at some point since 1995?

1=Yes
2=No
3=Not applicable -- I have not worked in a wetland regulatory job in more than one state.

61a4) Please briefly explain how your use of informal methods of assessing wetlands has been different depending on the state wetland regulatory job in which you were working, and why.

61) Since 1995, have applicants appeared to use any of the following informal methods of assessing wetlands for state-regulated activities? (Check all that apply.)

[Individual check boxes]
-Best professional judgment
-Methods and assessment criteria the applicant developed on its own
-Methods and assessment criteria developed and shared by members of the regulated community
-A combination of elements from different formal rapid wetland assessment tools. [Only appears if respondent had heard of these tools]
-Other (please describe):
-Applicants do not appear to use informal methods of assessing wetlands for regulatory purposes.
-I do not know enough about applicants' use of informal methods of wetland assessment to answer this question.

62) Which statements best describe how applicants typically have used these informal methods since 1995? Please respond to each statement below.

[Individual check boxes]
-They generally have used them instead of a formal rapid wetland assessment tool.
-They generally have used them to complement use of a formal rapid wetland assessment tool.
-They generally have used them in certain situations, and use a formal rapid wetland assessment tool in other situations.
-Applicants have typically used informal methods in one or more other ways since 1995 (please describe):

Applicants might have used informal wetland assessment methods differently in different states. They may have used best professional judgment more frequently in one state more often than in another. They might have frequently used informal methods to complement formal tools in one state, and frequently used informal methods instead of formal tools in another state. Applicants might have used informal methods in other ways that varied across states.

63a1) Has the way in which applicants have used informal methods of assessing wetlands for regulatory purposes appeared to have varied across the different states in which you worked at some point since 1995? (Check one.)

1=Yes
2=No
3=I don't know
4=Not applicable -- I have not worked in a wetland regulatory job in more than one state.

63a2) Please explain how applicants' use of informal methods appeared different in different states, and speculate on why.

63a3) Has the way in which applicants have used informal methods of assessing wetlands for regulatory purposes appeared to different depending on the state wetland regulatory job in which you were working at some point since 1995? (Check one.)

1=Yes
2=No
3=I don't know
4=Not applicable -- I have not worked in a wetland regulatory job in more than one state.

Applicants with whom you interacted when your job mainly involved permitting may have used informal wetland assessment methods differently than applicants with whom you interacted when your job mainly involved enforcement. Applicants with whom you dealt with as a field inspector may have used informal wetland assessment methods different than applicants with whom you dealt with when reviewing mitigation bank proposals. Applicants might have used informal methods in other ways that varied depending on your job.

63a4) Please explain how applicants' use of informal methods appeared different depending on the wetland regulatory job in which you were working, and speculate on why.

Please think about four people on whom you have relied upon the most for advice, in your professional capacity, about state wetland regulatory matters since 1995. Think about the people on whom you relied upon in the past as well as those you rely upon now. These individuals do not have to be current or former state agency employees. They can be consultants, researchers, academics, or other people. If you worked in wetland regulation in the past, consider people you regularly relied upon during the time you spent in state wetland regulation. You will next be asked to list these people and answer a few questions about them.

If you rely on fewer or more than four people, that is fine. You will be able to indicate this.

The people whose names you write down may be contacted as part of this research project and asked questions similar to those you are being asked. If you are not comfortable providing the name of an individual, you do not have to mention him or her. These individuals will not be told that you provided their names.

64) Please describe the first person:

-Name
-This person's job title when you interacted with him/her
-Year when you began relying on this person for regulatory advice (can pre-date 1995)
-Year when you stopped relying on this person for regulatory advice (if this is an ongoing relationship, write "current")

65) When we interacted, _____ was a: (Check all that apply)

[Individual check boxes]
-State bureaucrat
-Local bureaucrat
-National bureaucrat
-Member of the public
-Member of the regulated community (non-consultant)
-Consultant
-Scientist
-Policy specialist
-Other
-I do not know the position this person held when we interacted.

66) On average, I interacted with _____:

1=Less frequently than once or twice a year
2=Once or twice a year
3=Every few months
4=Every few weeks
5=Every few days
6=More frequently than every few days

67) When we interacted, I considered _____ a:

1=Professional acquaintance
2=Colleague
3=Friend

68a1) Please write the number (estimate) of additional people upon whom you have regularly relied, in a professional capacity, for advice concerning state wetland regulatory matters since 1995.

68a2) Considering these other people upon whom you have regularly relied for advice since 1995, please roughly estimate the percentage breakdown of their professional roles.

69) Please describe the first person:

-Name
-This person's job title when you interacted with him/her

-Year when you began relying on this person for regulatory advice (can pre-date 1995)
-Year when you stopped relying on this person for regulatory advice (if this is an ongoing relationship, write "current")

70) When we interacted, _____ was a: (Check all that apply)

[Individual check boxes]
-State bureaucrat
-Local bureaucrat
-National bureaucrat
-Member of the public
-Member of the regulated community (non-consultant)
-Consultant
-Scientist
-Policy specialist
-Other
-I do not know the position this person held when we interacted.

71) On average, I interacted with _____:

1=Less frequently than once or twice a year
2=Once or twice a year
3=Every few months
4=Every few weeks
5=Every few days
6=More frequently than every few days

72) When we interacted, I considered _____ a:

1=Professional acquaintance
2=Colleague
3=Friend

73) Did you talk with _____ about formal rapid wetland assessment tools?

1=Yes
2=No

74) Please list the formal rapid wetland assessment tools you discussed with _____ during the time you interacted since 1995. [Up to seven options; for each tool and contact, the subsequent panel repeats.]

If you discussed more than seven tools with _____, you will be able to indicate this later. You can leave lines blank if you discussed fewer than seven tools.

75) Consider your communication with _____ about _____. This person . . . (Respond to each statement.)

1=Agree
2=Disagree

-Recommended the use of the tool because it appeared to have been used successfully elsewhere.
-Recommended the use of the tool because research and/or preliminary pilot studies made the tool seem promising.
-Discussed the pros and cons of using the tool.
-Discouraged the use of the tool because the tool did not seem to work well when tried elsewhere.
-Discouraged the use of the tool because research and/or preliminary pilot studies were not encouraging.
-Discussed other topics related to the tool (please describe briefly).

76) Answer "yes" if, since 1995, you have regularly relied on additional people for advice about state wetland regulatory matters.
1=Yes
2=No

77) Please write the number (estimate) of additional people upon whom you have regularly relied since 1995, in a professional capacity, for advice concerning state wetland regulatory matters.

78) Considering these other people upon whom you have regularly relied for advice since 1995, please roughly estimate the percentage breakdown of their professional roles.

The next few questions ask you about your role, at some point since 1995, in getting a state agency to use one or more formal rapid wetland assessment tools used for regulatory purposes.

You might have been involved in getting a state agency to use a formal rapid wetland assessment tool by hearing about the tool at a conference and suggesting to your team leader that your agency try using the tool. You might have led a pilot project testing the tool for your agency. You might have used the tool on your own, on an informal basis, and then gotten other wetland regulators at your agency onboard. You might have done other activities that encouraged a state agency to start using one or more formal rapid wetland assessment tools.

79) Were you involved in getting a state agency to start using one or more formal rapid wetland assessment tools for regulatory purposes at some point since 1995?
1=Yes
2=No

Please describe how you facilitated a maximum of six tool adoptions by state environmental agencies. It is fine if you were involved in helping get fewer tools adopted. If you were involved in helping get more tools adopted, you will have the opportunity to note this.

If you were involved in getting the same state agency to use more than one tool, you will be given the opportunity to fill out a separate set of fields for each tool. For example, if you encouraged Tennessee's environmental agency to use one tool in 1999 and a different tool in 2003, fill out two sets of fields. Write "Tennessee" in both state lines, but write the different tool names in the different tool fields.

80) Please describe the first tool you were involved in getting a state agency to start using.

Tool:
State:
Year state began using the tool:

81) Please briefly describe what you did to get the state agency to start using _____, noting the name of the agency.

82a1) Did the approaches you used in getting states to start using one or more tools at some point since 1995 vary across the different states in which you worked?

1=Yes
2=No
3=Not applicable -- I did not work in a wetland regulatory job in more than one state.

82a2) Please explain how and why your approaches for getting states to start using one or more tools varied across states.

82a3) Did the approaches you used in getting states to start using one or more tools since 1995 vary depending on the state wetland regulatory job you were holding?

1=Yes
2=No
3=Not applicable -- I did not work in a wetland regulatory job in more than one state.

82a4) Please explain how and why your approaches for getting states to start using one or more tools varied depending on the state wetland regulatory job you were holding.

82) Which statements best explain why you did not encourage your agency to start using one or more formal rapid wetland assessment tools for regulatory purposes? Please respond to each statement.

1=Yes
2=No

[Individual check boxes]

-I did not think a formal rapid wetland assessment tool was needed in state wetland regulatory activities.
-I did not know about any effort to get my state to start using a formal rapid wetland assessment tool, so I could not get involved in such an effort.
-I was not sure how my agency could integrate a formal rapid wetland assessment tool into its regulatory activities.
-I thought it would be a bad idea for my agency to start using a formal rapid wetland assessment tool in regulatory activities.
-I did not have enough time to get involved with an effort to get my agency to start using a formal rapid wetland assessment tool.
-I did not think I had enough relevant expertise to get involved with such an effort.
-I was not asked to be involved in such an effort.
-There are other or different reasons why I did not get involved (please describe):

The next few questions ask you about your involvement, at some point since 1995, in helping implement one or more formal rapid wetland assessment tools used for regulatory purposes once your agency had already started using the tools.

You might have planned or held workshops to train staff members in the use of a tool, encouraged other regulators to use the tool, or directed other regulators to helpful resources if they had trouble when trying to use the tool. You also might have done other activities that in some way facilitated your agency's implementation of one or more formal rapid wetland assessment tools.

83) Were you involved in helping implement one or more formal rapid wetland assessment tools (at some point since 1995) once your agency had already started using the tool(s) for regulatory purposes?

1=Yes
2=No

Please describe how you helped state environmental agencies implement a maximum of six tools. It is fine if you were involved in helping implement fewer than six tools. If you were involved in facilitating the implementation of more than six, you will have the opportunity to note this.

If you helped the same state agency implement more than one tool, you will be given the opportunity to fill out a separate set of fields for each tool. For example, if you helped Tennessee implement one tool in 1999 and a different tool in 2003, fill out two sets of fields. Write "Tennessee" in both state lines, but write the different tool names in the different tool fields.

84) Please describe the first tool you helped implement.

Tool:
State:
Year state began using the tool:

85) Please briefly describe what you did to get the state agency to implement _____, noting the name of the agency.

86a1) Did the approaches you used for helping implement one or more tools at some point since 1995 vary across the different states in which you worked?

1=Yes
2=No
3=Not applicable -- I did not work in a wetland regulatory job in more than one state.

86a2) Please explain how and why the approaches you used for helping implement one or more tools varied across the different states.

86a3) Did the approaches you used in helping states implement one or more tools at some point since 1995 vary depending on the state wetland regulatory job you were holding?

1=Yes
2=No
3=Not applicable -- I did not work in more than one state wetland regulatory job.

86a4) Please explain how and why your approaches for helping states implement one or more tools varied depending on the state wetland regulatory job you were holding.

86) Why did you not help your state agency implement one or more formal rapid wetland assessment tools used for regulatory purposes? Please respond to each statement.

1=Agree
2=Disagree

[Individual check boxes]
-I thought tool implementation was going fine without any need for my involvement.
-I did not know about any effort to facilitate implementation of any formal rapid wetland assessment tools in my state, so I could not get involved in such an effort.
-I was not sure how my agency could integrate a formal rapid wetland assessment tool into its regulatory activities.
-I did not think it was a good idea for my agency to be using a formal rapid wetland assessment tool in regulatory activities.
-I did not have enough time to get involved with an effort to facilitate my agency's usage of a formal rapid wetland assessment tool.
-I did not think I had enough relevant expertise to get involved with such an effort.
-I was not asked to be involved in such an effort.
-There are other or different reasons why I did not get involved (please describe):

The next few questions concern your involvement, at some point since 1995, in revisions made to one or more formal rapid wetland assessment tools after your agency had already started using the tool(s).

You might have helped create a "version 2.0" of the tool, incorporating changes based on field testing. Or you might have worked on a project to make sure tool protocols were consistent with new guidance or new changes in regulations. You might have been involved in other activities that helped revise a tool your agency was using.

87) Were you involved in revisions made to one or more formal rapid wetland assessment tools (at some point since 1995) after your agency had already started using the tool(s) for regulatory purposes?

1=Yes
2=No

Please describe how you helped state environmental agencies revise a maximum of six tools. It is fine if you were involved in helping revise fewer than six tools. If you were involved in revising more than six, you will have the opportunity to note this.

If you helped the same state agency revise more than one tool, fill out a separate set of fields for each tool. For example, if you helped Tennessee revise one tool in 1999 and a different tool in 2003, fill out two sets of fields. Write "Tennessee" in both state lines, but write the different tool names in the different tool fields.

88) Please describe the first tool you helped revise.

Tool:
State:
Year state began using the tool:

89) Please briefly describe what you did to help the state agency to revise _____, noting the name of the agency.

90) Overall, across all revisions with which you may have been involved, how difficult was it to make these revisions?

1=Not difficult
2=Somewhat difficult
3=Quite difficult

91a1) Did the difficulty of the revision process vary across the different states in which you have worked at some point since 1995?

1=Yes
2=No
3=Not applicable -- I have not worked in a wetland regulatory job in more than one state.

91a2) Please explain how and why the difficulty of the revision process varied across different states.

91a3) Did the difficulty of the revision process vary depending on the state wetland regulatory job you were holding (at some point since 1995)?

1=Yes
2=No
3=Not applicable -- I have not worked in more than one state wetland regulatory job.

91a4) Please explain how and why the difficulty of the revision process varied depending on the state wetland regulatory job you were holding.

92) Why did you not help your state agency revise one or more formal rapid wetland assessment tools used for regulatory purposes? Please respond to each statement.

1=Agree
2=Disagree

-I thought the tool(s) were good as they were and revisions were not necessary.

-I did not know about any effort to revise any formal rapid wetland assessment tools in my state, so I could not get involved in such an effort.
-I was not sure how my agency could improve a formal rapid wetland assessment tool through revisions.
-The process of making revisions seemed too difficult or complicated.

-I thought the tool(s) were flawed, but I did not think revisions could correct the problems.
-I did not have enough time to help revise of a formal rapid wetland assessment tool.

-I did not think I had enough relevant expertise to get involved with a revision effort.

-I was not asked to be involved in such an effort.
-There are other or different reasons why I did not get involved (please describe):

You have completed the survey! Thank you for your time. Your insight is valuable.

(Please exit the survey by clicking on the right-hand arrow on the bottom right of this screen.)

If you are willing to be potentially contacted for follow-up questions, please provide your name and contact information. You do not have to provide this information if you do not want to do so.

Name:
Email address:
Phone number:

If you have questions concerning this survey or would like to learn more about the research it informs, please contact Gwen Arnold at gbarnold@indiana.edu.

**The definition of a formal rapid wetland assessment tool used in this survey is modified from the definition provided by Fennessy and co-authors (see below).*

References

Adamus, P. R. and L. T. Stockwell. 1983. A Method for Wetland Functional Assessment, v. 1: Critical Review and Evaluation Concepts (WET). Report No. FHWA-IP-82-23. Washington, DC: Federal Highway Administration.

Ammann, A. P., and A. Lindley Stone. 1991. Method for the Comparative Evaluation of Nontidal Wetlands in New Hampshire. Concord, NG: New Hampshire Department of Environmental Services, NHDES-WRD-1991-3.

Bradshaw, J. G. 1991. A Technique for the Functional Assessment of Nontidal Wetlands in the Coastal Plain of Virginia (VIMS Method). Special Report No. 315 in Applied Marine Science and Ocean Engineering. Gloucester Point, VA: Virginia Institute of Marine Science, College of William and Mary.

Fennessy, M. Siobhan, Amy D. Jacobs, and Mary E. Kentula. 2007. An evaluation of rapid methods for assessing the ecological condition of wetlands. Wetlands 27 (2): 543–560.

Appendix 2-3. Interview protocol

Pre-Interview

Thank you for agreeing to participate in this interview. The questions would focus on your experiences with wetland assessment and wetland assessment tools, what you know about wetland assessment in the states with which you are familiar or have worked in, and about how regulators in those states have approached wetland assessment. I am interested in how wetland assessment has occurred in Mid-Atlantic states since 1995.

If you do not want to answer any question that I ask, let me know and we will skip it. You can end the interview at any time.

As noted, your responses would be kept confidential unless you give permission for your name and position to be mentioned when a written product, such as the dissertation and/or an article that might be published, is produced using data from our interview.

Before we begin, there are a couple of definitions that will help you in answering the questions. If you need me to remind you of these definitions as we go along, just let me know:

-The terms "wetland regulation" or "regulatory activities" refer to state policies affecting wetlands that are implemented and enforced by state employees. If someone violates a state wetland regulation, he could be penalized under state law. Examples include state prohibitions on fill of wetlands, requirements that applicants obtain state permits before impacting wetlands, or rules states make governing the activities of wetland mitigation banks. Wetland regulation does not refer to purely incentive-based or purely voluntary wetland programs.

-A "formal rapid wetland assessment tool" is a tool for wetland evaluation developed by experts and recognized, at the state, regional, or national levels, as a more or less legitimate technique for wetland evaluation. This tool (1) measures wetland condition, (2) includes a site visit, and (3) takes two people no more than a half day in the field and another half day in the office to complete. Examples include the Wetland Evaluation Technique (WET), the VIMS Method, and the Method for the Comparative Evaluation of Nontidal Wetlands in New Hampshire. Some formal wetland assessment tools attempt to measure the functions and values of wetlands.

-"Applicants" are regulated or potentially regulated entities that you may have dealt with as a state wetland regulator. Applicants can mean "consultants employed by applicants" as applicable.

If you have questions about any other phrases or terms in the questions I ask, please let me know.

End of Interview

We're all done! Thank you for your time and insights. One final question:

Would you be comfortable with your name and professional position being mentioned when the data is analyzed and the dissertation is written? It is perfectly fine if you do not want to disclose this information.

If you have any questions about issues we talked about, or my research, please don't hesitate to email or call me. Thank you again.

General Notes About the Interview Questions
All the questions are in present tense, but if the interviewee was involved in wetland regulation in the past, they will be changed to past tense when verbally conveyed.

"Skips" and "logics" are not included in this list of questions, but will be used as appropriate. For example, if the interviewee indicates she has not used a rapid wetland assessment tool, questions about her usage of the tool will not be asked. If the interviewee indicates she doesn't know much about revisions to the tool, the questions about revision goals and substance will not be asked.

Some questions are designed for wetland regulators/experts with a high level of experience and knowledge about their state's experience with wetland assessment tools. Other questions are designed for individuals with a lower level of experience and knowledge. Which questions the interviewee is asked will depend on the responses the interviewee provides (indicating her level of experience/knowledge) and information the interviewer has about the interviewee (e.g., information concerning her position in a regulatory agency gained from an agency organizational chart). Not all interviewees will be asked all questions.

Some questions are phrased in the present tense, but regulators/experts with past experience with assessment will be asked about this past experience.

Some questions are phrased such that they ask about only one tool. However, if the interviewee has indicated knowledge of or experience with more than one tool, the question will be repeated for the additional tools with which the interviewee is familiar.

The questions may not be asked in the order they appear.

Interview Questions
-When did you first hear about formal rapid wetland assessment tools being used by states for regulatory purposes?

-Have states with which you are familiar or have worked in officially adopted a particular formal rapid wetland assessment tool for use in the state? Can you speculate on why or why not?

-Do state regulators use formal rapid wetland assessment tools in state wetland regulatory activities? Can you estimate what percentage use these tools in regulatory activities? Has that percentage changed over time? If so, why and how?

-If state regulators don't use formal rapid wetland assessment tools in state wetland regulatory activities, why don't they?

-Which formal rapid wetland assessment tools do regulators use?

-Why did they choose to use these tools?

-How complex do they find these tools? Are some parts of the tool more complicated or difficult to use than other parts? Are some elements more difficult to apply than others? Please explain.

-What do you think are the strengths of these tools? The weaknesses?

-Do you know who developed these tools? For example, was it developed by experts who work for your state government, experts at the federal level, or scientists at some type of academic institution? Can you describe the tool development process? For example, do you know how long the process took? Who was involved? The main challenges with which developers struggled (if any)? What resources the tool developers relied upon? What steps developers specifically took in crafting the tool, and why they chose to structure the process in that way? What entities (like universities or federal agencies) may have assisted in the tool development process?

-Do you know which entity in the states in question manages the implementation of formal rapid wetland assessment tools? If yes, do you know what types of challenges this entity typically faces?

-How much do you know about the history of using formal rapid wetland assessment tools in these states? Have these states tried to use other tools in the past (since 1995)? Why or why not? If so, what happened when the state tried those other tools?

-What activities did people within and outside state agencies pursue to get the agencies to start using the tools?

-If state regulators with whom you are familiar have used more than one tool, how long did they use each? Why did they use more than one?

-What factors encourage or discourage state regulators from starting to use formal rapid wetland assessment tools? Do you think other regulators are motivated by these same factors?

-What factors encourage or discourage state regulators from continuing to use these tools over time?

-If state regulators stopped using one or more formal rapid wetland assessment tools, which tools did they stop using, and why?

-What activities did people within and outside state agencies pursue to help the agencies implement the tool?

-Have there been revisions to these tools during state agencies' use of them? If yes, why were the tools revised?

-Can you describe the nature of the revisions? For example, would you say that the tool was revised by tweaks made by individual regulators during day-to-day use, through formal revisions made in an official modification process, or both? Can you provide some examples?

-Were the tweaks made by individual regulators ever given formal status as an official change to the tool? Can you speculate on why or why not?

-How difficult was it to make the revisions? Please explain.

-Do you know what sources people involved in revising the tool relied upon in the revision process? For example, did they rely on the expertise of policy experts or scientists, did they look at other tools in other regions, did they follow a national model, or did they use other approaches?

-Was defensibility of the tool (legal, scientific, or other) a consideration when making the revisions? If yes, for whom or to whom did it seem important that the tool be justified or defended?

-Did the revisions meet their goals? Why or why not?

-What do you think would have helped make the revisions more successful?

-What kinds of data do state regulators require when performing wetland regulatory responsibilities?

-How well have formal rapid wetland assessment tools met these wetland regulatory data needs?

-What types of data did you expect that a rapid wetland assessment tool useful in state wetland regulatory processes should provide?

-If the tools with which you have had experience did not provide all these types of data, can you elaborate on the types of data they did not provide?

-Why do you think these tools did not provide that data? For example, were the tools not designed to provide the data? Were the metrics intended to collect such data inadequate? What other explanations can you think of?

-Has the frequency with which state regulators have used formal rapid wetland assessment

tools changed over time? Why or why not?

- Have the activities for which state regulators have used formal rapid wetland assessment tools changed over time? Why or why not?

-Are there some state wetland regulatory activities in which regulators do not use formal rapid wetland assessment tools? If yes, why do you not use formal rapid wetland assessment tools in these activities?

-How often do applicants or consultants independently choose to use formal rapid wetland assessment tools? Has their behavior in this respect changed over time, or when different tools or regulatory activities were involved?

-Can you give some examples of ways in which applicants use formal rapid wetland assessment tools to inform their interactions with state wetland regulators?

-What factors do you think encourage or discourage applicants from independently choosing to use formal rapid wetland assessment tools?

-What factors encourage or discourage applicants from actually using wetland assessment tools over time?

-Why do you think that applicants do not independently choose to use formal rapid wetland assessment tools more often than they do?

-How useful, overall, have you found formal rapid wetland assessment tools?

-Do you think state regulators share your opinion about the usefulness of formal rapid wetland assessment tools? Why or why not?

-What would make formal rapid wetland assessment tools more useful?

-How useful do you think most applicants have found formal rapid wetland assessment tools?

-Given the overall experience agencies have had with the(se) tools, would you call the(se) tool(s) a success? Why or why not?

-Do you use any informal methods of assessing wetlands for regulatory purposes? For example, do you use best professional judgment, methods/criteria you developed yourself or which were developed informally by others, or an informal combination of assessment tools? If yes, please describe the informal methods you use to assess wetlands for regulatory purposes.

-If you use informal methods in some situations and formal tools in others, please describe the kinds of situations in which you use each, and what distinguishes those situations.

-Do applicants appear to use informal methods of assessing wetlands to inform their interactions with state wetland regulators? If yes, what types of methods do they use, and how do they typically use them? Does their behavior in this respect change when different tools or regulatory activities are involved? Has their use of informal methods changed over time?

-If applicants appear to use informal methods in some situations and formal tools in others, please describe the kinds of situations in which it appears that they use each, and what distinguishes those situations.

Appendix 2-4. Qualitrics coding tree

This is an abbreviation of the coding tree used to organize the qualitative data. Not all nodes are presented because of space constraints or redundancy. Notes to the reader are italicized and in parentheses. Each item in the coding tree is a node to which references are coded. A plus sign (+) indicates that the node is a "parent" and has "child" nodes.

+Applicants
- Challenges
- Culture
- Strategic
- Training and skill
- Why don't want to use tools
- Why want to use tools

+Biophysical
- Coverage
- Cross-sector
- EPA regions
- Equivalency
- Fit
- Function vs. value vs. condition
- Scarcity

Contention, offense, and defense
Funding (not tool specific)
Governance institutions
+Interviewees *(All 98 interviewees are coded to nodes here, but the coding is not reproduced; rather, the example below shows the coding scheme applied to each.)*
- +Federal
  - +Sub-sector as applicable (e.g., Corps, EPA)
  - +Interviewee numeric code
    - Geographic scope
    - Privacy preference
    - Professional wetland experience
- +Private
- +Scientists (academic)
- +State
- +Varied sectors

+Judgment
- BPJ
- Predictability
- Subjectivity

Mitigation
+Networks
- Adoption networks
- Implementation networks
- +National
  - *(Interviewees were coded here when data indicated that they had communicated about*

assessment in national policy circles.)

+Regional

(See above, but for regional policy circles.)

+Organizations

(Any organization discussed by any interviewee is represented as a node, and all references to it coded accordingly.)

Other states (not policy learning)
Policy learning (not state specific)
Rapanos
+Regulators
Culture
Political influence
Preferences
Training
Turnover
+Rules and regs
401 certification
404 permits
Isolated wetlands
Nationwide permits
Non-tidal laws
Science-policy divide
Tool quality (general)
+Tools
87 Manual as a tool
+Amphibian IBI *(All tools are coded similarly, but the coding is not reproduced; rather, the example below shows the coding scheme applied to each.)*
Adoption
Appropriate use
Challenges
+Cross-sector interactions
Federal-federal
Federal-other
Federal-private
State-federal
State-other
State-private
State-state
Desirable qualities
Entrepreneurs
Funding
Implementation
Mitigation
Policy learning
Quality

Revision
Stopping
Use
+Delaware tools and attempts
+Eastern Kentucky Stream Assessment
+EPA RBA
+EPW
+HEP and PAMHEP
+HGM
+Holland McGee
+Maryland community model
+Maryland mitigation tool
+Maryland tools and attempts
+Multiple tools
+New England Method
+Ohio tools and attempts
+Pennsylvania tools and attempts
+IBI
+Virginia tools and attempts
+West Virginia tools and attempts
+WET
+WETTING
+Wetland assessment theory and general practice
Why tools are good overall
Why tools are not worth it

Chapter 3: Policy learning and science policy innovation implementation by street-level bureaucrats

1.0 Introduction

Sound environmental policy relies on sound science. However, U.S. environmental policy, particularly the day-to-day implementation decisions made by government bureaucrats, sometimes fails to integrate best available science into regulatory practice (Dilling and Lemos 2011; Husbands Fealing et al. 2011; Jasanoff 1990; Latin 1988). This chapter examines when and why such failure may occur, focusing on regulatory use of rapid (non-tidal) wetland assessment tools by state bureaucrats. Use of such tools is a discrete, individual-level example of science policy implementation.

Rapid wetland assessment tools are a class of policy innovations developed in recent decades to aid wetland management; more than 100 tools exist nationwide (Kusler 2006). State environmental agencies first became aware of these tools around 1995, though few used them until the late 1990s and 2000s (C104: Oct. 31, 2010). A rapid wetland assessment tool "(1) measures wetland condition, *functions, or value*, (2) includes a site visit, and (3) takes two people no more than a half day in the field and another half day in the office to complete" (Fennessy, Jacobs, and Kentula 2004, 543; own modifications in italics).

A rapid wetland assessment tool is a combination of a questionnaire and instruction sheet. It highlights the data a bureaucrat should collect to evaluate the potential impacts of activities proposed for a wetland, and helps him interpret those data when making a regulatory decision such as issuing a permit for development. Fully accounting for the benefits of wetlands when making regulatory choices has challenged bureaucrats for decades (Kusler 2006; Mitsch and Gosselink 2007). Presumably, bureaucrats should be eager to embrace tools that could facilitate such accounting. However, while few data empirically

document the extent to which bureaucrats use these tools in regulation, anecdotal evidence suggests their use is relatively infrequent (e.g., Kusler 2006).

This apparent lack of use is puzzling. The U.S. Environmental Protection Agency strongly encourages states to adopt these tools (EPA 2006). Experts contend that well-designed and applied rapid wetland assessment tools can help states identify and address water quality impairments and intelligently execute wetland regulatory tasks (Ainslie 1994; Fennessy, Jacobs, and Kentula 2007). These tools integrate best available science into regulatory activities and thus are an excellent focus for an investigation exploring when such integration occurs in policy implementation.

Examining policy implementation requires a brief explanation of the policy context. Rapid wetland assessment tools are technically complex policy instruments with relatively low consequence or visibility to the general public. Tool use is largely a matter of discretionary choice by bureaucrats who make day-to-day wetland policy implementation decisions. In the six states this investigation examines, many bureaucrats who might use these tools have not received explicit top-down direction from their administrative agencies about which tools to use and how. Only one of the six states (Ohio) has officially adopted a tool for regulatory use, and even there, the tool is not used for all regulatory activities and was not official practice for the entire study period. In other states, environmental agencies recommend use of some type of assessment tool but do not specify which. In still others, tool use is neither officially recommended nor prohibited. Arguably, anecdotal data has been the primary source of information about bureaucrat tool use until now because even identifying potential tool users is difficult; tools could be used by a variety of state actors involved in wetland regulation (e.g., a transportation planner or a biologist charged with

monitoring threatened and endangered species and habitat) working in a variety of positions in a variety of agencies.

This fairly decentralized, opaque, and discretionary implementation context makes the question of whether and why state bureaucrats involved in wetland regulation use rapid wetland assessment tools both more difficult to investigate and more compelling. The results of this analysis can enhance understanding among scholars and policy practitioners of how implementation of science policy innovations occurs in similarly amorphous regulatory environments. This chapter shows that opportunities for learning about policy innovations are critical to implementation success.

2.0 Conceptual framework

Street-level bureaucrats are central to the adoption and subsequent implementation of science policy innovations. These bureaucrats need to learn about policy innovations before they can use them, and they are likely to learn through communication with or examples set by peers.

The state bureaucrats positioned to implement rapid wetland assessment tools are classic street-level bureaucrats. They possess technical expertise which makes their political and administrative superiors likely to allow them substantial freedom in their regulatory choices, particularly about issues such as a tool use which have low public salience (Gormley 1986). Street-level bureaucrats implementing policy generally face large workloads, tightly constrained budgets, and multiple and potentially competing demands from superiors (Evans and Harris 2004; Hupe and Hill 2007; Lipsky 1980). They tend to develop standard operating procedures that make their day-to-day work manageable (ibid.; Fineman 1998;

Honig 2006). These bureaucrats shape their implementation mandates, creating policy through their day-to-day activities (Lipsky 1980; Maynard-Moody and Musheno 2003; Weatherley and Lipsky 1977). Those activities are essentially a series of policy adoptions, where adoption is understood as the formulation of a policy measure (e.g., writing a wetland permit) that is subsequently executed (e.g., granting an applicant the permit) (Weimer and Vining 2004).

Yet the political science literature on diffusion and adoption of policy innovations has not paid substantial attention to these phenomena as they involve street-level bureaucrats. That literature tends to use states or municipalities as its units of analysis, exploring how external factors, such as policy adoption by proximate jurisdictions, and internal factors, such as available resources, independently or jointly affect diffusion and adoption (e.g., Berry 1994; Berry and Berry 1999; Walker 1969). Diffusion and adoption are often evidenced by the presence of a policy in a jurisdiction where it previously was absent. The entity receiving diffusion or achieving adoption (e.g., a legislature or a city council) often is not specified (e.g., Feiock and West 1993; Soss et al. 2001) or is discussed vaguely (e.g., Berry 1994; Berry and Berry 1990; Boehmke and Witmer 2004). Scholars who focus on these entities (e.g., Allen and Clark 1981; Hays and Glick 1997; Mintrom and Vergari 1998; Pavalko 1989) tend to analyze them as unitary actors, often using their traits, such as susceptibility to lobbying, to explain diffusion and adoption trends. The problem with this slant in the literature is that it places the processes by which individual actors positioned to entrench innovations into day-to-day policy practice, and often the actors themselves, into a black box. Yet slack resources, the proximity of other states which have adopted policies, or the traits of entities such as legislatures do not drive the actual processes of implementation.

Those processes are driven by the choices of implementing agents. Much of the literature is not asking an important question: How do those agents decide to implement a policy innovation?

A smaller literature seeks to understand the policy adoption and implementation choices of bureaucrats. However, this scholarship tends to focus on bureaucrats with political connections and managerial responsibilities, not on those who implement policy at the street level. Sapat (2004), for example, studies adoption of environmental policies by state administrative agencies by focusing on decisions of agency administrators. Teodoro (2009) investigates how the professional norms and networks of police chiefs and water utility managers affect the likelihood of these individuals deploying policy innovations. Teske and Schneider (1994) examine innovative policy activity in local governments by examining the behavior of city managers. The relatively high-level decision-makers these scholars study face different incentives, constraints, and day-to-day realities from bureaucrats who operate in the field, interacting with clients and making workaday choices that run government programs. Yet those workaday choices are important because they are the arena in which street-level bureaucrats will decide to use—or not use—rapid wetland assessment tools and similar science policy innovations. Again, how do street-level bureaucrats decide to implement such innovations?

This chapter's contention is that street-level bureaucrats must learn about policy innovations before they can use them. Wetland bureaucrats in this investigation pursue what Matland (1995) described as "experimental implementation," policy implementation that

occurs in situations of relatively low political conflict but high ambiguity.[33] In such situations, policy outcomes are apt to be shaped by the context-specific choices of local actors rather than, for example, macro-level political dynamics. Those choices are particularly likely to be influenced by bureaucrats' discussions with other policy actors about implementation options and lessons learned from implementation attempts (ibid.). "This [implementation] process is more open to environmental influences than are other forms of implementation," argued Matland (1995, 166). If wetland bureaucrats acquire assessment tool information from their immediate environments, they will be more likely to implement these tools.

The process by which policy actors in a specific field choose or revise policies based on the acquisition of new information or experience is called policy learning (Hall 1988), a topic which has its own literature in political science. The content of policy learning often focuses on policy instruments and concrete means of improving policy implementation (Rose 1991). Policy learning may involve dialog (van der Knapp 1995), or policy actors may mimic the policy practices of others rather than learn via discourse (May 1992). Either way, actors must communicate about or observe new policy practices to learn about them. Policy learning can be a precursor to policy change (Bennett and Howlett 1992).

Policy actors learn by drawing lessons from peers and experts, often located in interstate networks and epistemic knowledge communities (Rose 1991). The more general literature on innovation diffusion points out that this process relies on communication channels, such as mass media outlets, through which information about an innovation can pass between entities (Rogers 1995). In the context of discretionary bureaucratic adoption of

[33] Wetlands are highly complex ecosystems; some of their dynamics are still poorly understood (Mitsch and Gosselink 2007).

technically complex policy instruments of low public salience and visibility, interpersonal ties rather than such outlets are likely to be the primary communication vehicles (Muth and Hendee 1980). Vertical communication channels through which information could be sent from an administrative hierarchy are also less likely to influence bureaucrat choices. Brancheau and Wetherbe (1990) examined the diffusion of spreadsheet software use among end-users in 18 large businesses. Guidance from information systems departments and managers did not have a significant impact on software usage by front-line employees, but "interpersonal channels of communication were dominant in all phases of adoption decision-making" (ibid., 115).

Street-level bureaucrats, particularly those who are relatively unlikely to acquire information about policy innovations from their political or administrative superiors, learn about such innovations by communicating with and observing the behavior of their peers. This conceptual framework provides the context for three specific hypotheses, presented in subsequent sections, about the kinds of learning pathways which may influence the implementation choices of street-level bureaucrats.

2.1 Learning pathway 1: Job experience

More job experience should cause a bureaucrat to use assessment tools less frequently because experienced bureaucrats have been exposed for a longer time to models of professional practice not reliant on these relatively innovative tools. They therefore will be less open to learning about tools. Two arguments support this claim.

First, over time, bureaucrats develop standard operating procedures and heuristics that facilitate task execution (Jones 2002). These practices can be quite persistent (e.g.,

Berglund, Gange, and van Waarden 2006). The cognitive shifts necessary for a bureaucrat to revise his mental models can be difficult (Lester and Wilds 1990), particularly when the shifts would involve a bureaucrat's "secondary beliefs" (Sabatier and Weible 2007), established notions about the mechanisms best suited to advancing the bureaucrat's policy goals. A bureaucrat whose institutionalized repertoire of regulatory practices and beliefs about optimal policy tools does not include use of assessment tools may not be open to learning about these tools.

Second, more experienced bureaucrats may be less likely to use tools because these individuals may be more likely to rely on best professional judgment (BPJ) when making regulatory choices. Best professional judgment encompasses the knowledge bureaucrats gain through years of regulatory work. BPJ is idiosyncratic, unique to the individual. In the wetland policy community, BPJ is explicitly recognized as legitimate grounds for decision-making. Asked about his regulatory choice criteria, one bureaucrat responded, "Well, there's the old tried and true BPJ" (B205: March 15, 2011). Approximately 54.4% of respondents to the survey detailed in Section 3.0 reported using BPJ in wetland regulation.

The more experienced a bureaucrat becomes, the more his BPJ develops. A wetland bureaucrat is familiar with his own BPJ, but he may know less about the data informing a rapid wetland assessment tool or the assumptions built into it. Experienced bureaucrats thus may be more comfortable using their BPJ in a regulatory decisions. In fact, some interviewees described tools as most necessary for new bureaucrats who have not yet familiarized themselves with the resources they regulate. Using a tool can "give you a framework; it forces you to look at stuff . . . your best professional judgment is probably great concerning [X or Y topic] but not so much on the other things, so having a tool at least

gives you the basics . . . It can guide you, maybe make you a better professional" (C193: Oct. 30, 2010). These arguments lead to this chapter's first hypothesis:

H1: State bureaucrats with more relevant job experience will be less likely to use a rapid wetland assessment tool.

The empirical analysis explores this hypothesis by evaluating the influence of a bureaucrat's pertinent job experience on tool usage. The *job experience* variable is the sum of the years survey respondents reported working in wetland regulatory jobs multiplied by the percent of time (per job) they reported devoting to wetland activities.

2.2 Learning pathway 2: Structured knowledge acquisition

The next hypothesis postulates that bureaucrats who more regularly participate in training events such as workshops and conferences will be more likely to use rapid wetland assessment tools. The more training bureaucrats receive, the more frequently they are exposed to best management practices and thus the more likely they are to hear about assessment tools.

While intended to be accessible, these tools still can be somewhat complex. Wetland bureaucrats who gain information about them in structured learning environments may be more likely to use them than bureaucrats who have not had similar experiences. Commented one tool developer, "It [the tool] is too complicated to just say, 'Go out there and collect data.' . . . You have to have some kind of training . . ." (F042: Nov. 15, 2011). Said a bureaucrat from a state outside this investigation where tool use appears relatively common,

"The reason it gets used is because we train people in its use. We don't just stick it out there . . . through these trainings we update them [users] on the science, [and] we can sort of bring everybody up to the same level of expertise" (F078: March 14, 2011).

Bureaucrats may participate in training events voluntarily, as evidenced by the survey respondent[34] who said "Training was optional but I would take [it] . . . if there was a new version or if there was a lapse of time where it was in the best interest to take the course for a refresher." Training may also be mandated by administrative superiors, as evidenced by the survey respondent who said he attends events "as provided by the agency that I work for." Thus, this learning pathway may capture not only individual-level interest in policy learning, but also a vertical push for learning from a bureaucrat's administrative hierarchy.

H2: The more training events a state bureaucrat attends, the more likely he will be to use a rapid wetland assessment tool.

The empirical analysis evaluates this hypothesis by examining the impact of *annual training* on tool usage. This variable indicates the average number of training events a respondent attended per year during his tenure in all the wetland regulatory jobs he held in his career. Because more experienced bureaucrats are likely to have attended more training events in absolute terms, respondents were asked about their average annual attendance. These events encompass all opportunities for structured learning about wetland best management practices, not just assessment-focused training opportunities.

[34] Survey respondents were anonymous.

2.3 Learning pathway 3: Interpersonal ties

When a bureaucrat is connected via his policy network to individuals who know about rapid wetland assessment tools, the bureaucrat is more likely to learn about these tools and how to use them. A policy network is composed of linkages, nodes, and a setting variable. The nodes in this investigation are policy actors; the linkages are their relationships. Nodes form linkages to obtain resources (Benson 1982). The setting variable is the substantive issue area, such as wetland policy, that affects and is affected by activities of the network (ibid.).

Network linkages help bureaucrats gain policy-relevant information. Bureaucrats rely on other bureaucrats and experts in the private and public sectors for data to inform science-based policies (Kerwin 1994; May 1992). Bureaucrats use networks to learn what other units of government are doing to address policy problems and may model their own policies accordingly (Bennett and Howlett 1992; Heichel, Pape, and Sommerer 2005; Mintrom 1997).

This chapter uses an "ego network" approach to examine the impact of network ties (Wasserman and Faust 1994). Ego networks consist of an ego (here, a bureaucrat responding to a survey) and alters (other actors) with whom the ego has linkages. Ego network analysis yields data about the ego's relationships and how they affect the ego. However, this approach is limited by the fact that egos typically are asked to describe a relatively small number of linkages and alters (ibid.). This investigation asked respondents about their ties

with five alters upon whom respondents depend most for advice about wetland regulatory policy.[35]

One might assume that the tool-related attitudes of alters would influence a bureaucrat's tool use. For example, if a bureaucrat learned about a tool from someone who disliked it, the bureaucrat could be less likely to use the tool. The data collected from survey respondents does not allow an exploration of the valence of network communication about tools. However, this aspect of communication actually may not substantially influence tool use.

Honig (2006) examined attempts by central office administrators (bureaucrats) working for school districts in Oakland, California, to establish and maintain school-community partnerships. The partnerships were a new concept and the bureaucrats' tasks were characterized by ambiguity and uncertainty. Honig observed that bureaucrats "look for professional practice models that they associate with legitimacy or success regardless of whether following those models is actually likely to improve . . . outcomes" (ibid., 362).

Similarly, assessment tools are relatively new to many state bureaucrats (C104: Oct. 31, 2010), who may perceive a substantial level of ambiguity concerning their use. State wetland bureaucrats, like Honig's school bureaucrats, may be more concerned with models of professional practice associated with tools than with usage outcomes. The general newness of these tools in the state context also may mean that many policy actors may not yet have strong opinions about tool utility. Accordingly:

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[35] Respondents described ties with four alters in detail and then indicated whether they had ties with one or more additional alters.

H3: Bureaucrats whose wetland policy networks contain individuals who provide information about wetland assessment will be more likely to use a rapid wetland assessment tool.

The empirical analysis explores this hypothesis by evaluating the impact of *network communication* on tool usage. This is a binary variable which indicates whether a respondent discussed rapid wetland assessment tools with one or more alters in his wetland policy network.

3.0 Methods

This investigation explores rapid wetland assessment tool implementation using data from a survey of individuals employed at some point between 1995 and 2011 as state wetland bureaucrats (n=149) in Delaware, Maryland, Ohio, Pennsylvania, Virginia, and West Virginia. States were selected based on "most likely" case analysis (George and Bennett 2005, 121). Individuals were eligible for the survey if, during the study time period, they had a job where state wetland regulation was one of their main tasks or they participated in one or more projects where state wetland regulations were involved. The survey was online and respondents were invited using email and postal invitations. Table 3-1 summarizes survey

outcome rates calculated using best practices described by the American Association for Public Opinion Research (AAPOR 2011) and Smith (2009).[36]

Table 3-1. Survey outcome rate summary statistics

	Proportional allocation-estimated cooperation rate, weighted average across states	**Best-estimate cooperation rate range, weighted average across states**
Combined invitation modes	28.6%	28.6–40.4%
Email invitation	28.8%	28.8–41.8%
Postal invitation	19.6%	19.6–35.7%

The proportional allocation-estimated cooperation rate for the overall survey (combined modes) is somewhat below the average outcome rate for online surveys reported by Shih and Fan (2008), whose meta-analysis of 39 web-based studies found a mean survey response rate of 34%. Sheehan's (2001) review of 13 online surveys administered from 1998 to 1999 calculated a slightly more comparable average response rate of roughly 31%. The true cooperation rate in this investigation likely falls within the best estimate range and may be as high or higher than averages reported in the literature.

The number of survey returns as a proportion of survey contacts were fairly comparable across states: Delaware (24.5%), Maryland (31.3%), Ohio (34.6%), Pennsylvania

[36] The proportional allocation-estimated rate is the product of a procedure which assumes that the proportion of respondents who screened themselves out of the survey due to ineligibility is the same as the proportion of non-respondents who were ineligible. This rate is conservative because it is likely that ineligibility is higher among non-respondents than respondents (Smith 2009). The maximum of the rate range was calculated by dividing the number of eligible respondents by the full sample minus all sample members of unknown eligibility and assuming that all non-respondents were ineligible. This approach likely inflates the outcome rate because at least some non-respondents probably were eligible (ibid.).

(28.6%), Virginia (24.8%), and West Virginia (24.3%). These rates generally suggest that geography was not a major influence on non-response.[37] Chapter 2 discusses the sources and nature of potential survey bias in greater detail.

The survey data are complemented by quotes from elite interviews (n=98, roughly 58 interview hours) with regional policy actors. The state and sectoral affiliations of interviewees, their selection, and interview coding are also described in Chapter 2.

4.0 Data analysis

4.1 Preliminary data exploration

Until now, the argument that state bureaucrats do not use rapid wetland assessment tools for regulation has been largely anecdotal. The survey addressed this data lacunae by directly asking street-level wetland bureaucrats whether they had used a rapid wetland assessment tool at some point since 1995. Approximately 27% had never heard of these tools, a statistic which suggests a gap in policy learning. Roughly 35% of respondents reported tool usage.

Among the approximately 38% of survey respondents who had heard of rapid wetland assessment tools but had not used them, the most frequently cited reasons for non-use were that bureaucrats did not know enough about the tools (58% of this group of

[37] Ohio's slight over-representation in the data does not meaningfully affect this chapter's analysis. When the Ohio cases were removed and the regression analyses re-run, the variables significant in Model 1.0 were significant (with similarly signed coefficients) with the exception of the state-level adoption progress variable ($p < 0.137$). Chapter 1, Appendix 2-1 Section 2.0 discusses potential reasons for that variable's lack of significance. Because of its marginal significance at $p \leq 0.10$ and its substantive importance, adoption progress was included in the Ohio-free iteration of Model 1.1. In that regression, the variable was significant, along with the variables significant in the previous iteration. This chapter's analysis is based on Model 1.1, and the Ohio-free version of Model 1.1 finds statistically significant the same variables as the Ohio-inclusive version.

respondents) and that no one else in their agency used such tools for regulatory activities—that is, they lacked models of professional practice (36%).[38] These findings also suggest that lack of tool use by state bureaucrats may be a failure of learning.

4.2 Correlation analysis

Correlation was used as a pre-regression sorting mechanism (Spicer 2005) to determine which theoretically grounded variables offered the most explanatory leverage. This approach allowed for relative parsimony in subsequent logistic regressions.[39] Each independent variable was correlated with a dichotomous variable indicating whether a survey respondent used a rapid wetland assessment tool at some point between 1995 and 2011.[40] In Table 3-2, the hypothesis that the variable operationalizes is indicated in parentheses.

Several potential control variables were analyzed. *Adoption progress* is a five-level ordinal variable indicating how close state administrative agencies have come to integrating a rapid wetland assessment tool officially into state-level wetland regulation (e.g., whether the state is still in early stages of tool development or is almost finished pilot-testing a nearly complete tool). This variable is intended to capture the impact of communication and

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[38] Response options were not mutually exclusive. Eighty percent said there were one or more other reasons they did not use assessment tools. The top four other reasons identified via thematic analysis were: others in my agency used a tool so I did not need to do so, tool use was not required by the regulatory process, using such tools was not in my job description, and tool use was unnecessary.

[39] Parsimony was particularly important because the n is relatively small. Long (1997) advises against having fewer than 10 observations per independent variable in a logistic regression.

[40] Pearson's correlation ® was used when both variables were continuous, Somers'd when one variable was dichotomous and the other ordinal, phi when both variables were dichotomous, and point biserial (rpb) when one variable was dichotomous and the other continuous. The type of correlation is indicated by its abbreviation, followed by the n in parentheses.

models of professional practice transmitted to a street-level bureaucrat vertically from his administrative hierarchy. Data for classifying states into the ordinal categories came from secondary sources and interviews described in Chapter 2.

The *wetland scarcity* variable is the ratio of state non-tidal wetland land area to total land area. Relative wetland abundance may prompt bureaucrats to use assessment tools to help routinize and streamline their substantial workloads, whereas bureaucrats who manage fewer wetlands may feel less pressure to seek tools to provide such assistance.

A state's *regulatory structure* is evaluated because bureaucrats in states with more layers of wetland protection (e.g., a state wetland protection law in addition to wetland protections offered by the federal Clean Water Act and implemented, in part, by the states) may be less likely to use rapid wetland assessment tools because they have multiple other mechanisms to support and structure their wetland regulatory practice, whereas bureaucrats in states with fewer formal regulatory mechanisms may be more likely to seek instruments to help them manage wetlands. This ordinal variable's four levels characterizes the de jure authority a state has over its wetlands, where each level assumes an increasingly rigorous regulatory regime averaged over the entire study time period.

Although formal education is a kind of structured learning, it is not used to evaluate Hypothesis 2 because that hypothesis is concerned with on-the-job training. However, because interviewees sometimes said that they had learned about wetland assessment in a university course, two measures of formal education are evaluated: a ten-level ordinal variable where a respondent reported his highest degree of *education* and a three-level ordinal variable wherein a respondent indicated how well that education prepared him for wetland regulatory work (*education preparation*).

Finally, the *applicant connection* binary variable indicates whether a survey respondent answered "I don't know" when asked about applicant (regulated community member) perceptions of (a) assessment tool utility and (b) complexity. If the respondent gave a substantive answer to either question, the variable's value was 1, but otherwise it was zero. A substantive answer indicates that a bureaucrat perceives that he knows something about how members of the regulated community think, potentially implying a relationship with applicants which could be a learning pathway (e.g., if an applicant informs the bureaucrat about assessment tools). However, because it is not clear whether a respondent's sense of applicant connectedness comes from interactions with applicants or from more general impressions gained during organizational and professional socialization, the variable is used as a control.

Table 3-2. Correlation analysis

Job experience (H1)	rpb(142) = 0.2412, p < 0.0036**
Annual training (H2)	rpb(145) = 0.2650, p < 0.0012**
Network communication (H3)	phi(129) = 0.5616, p < 0.000***
Adoption progress (Control)	Somer's d(148) = 0.3870, p < 0.000***
Wetland scarcity (Control)	rpb(146) = 0.1767, p < 0.0311*
Regulatory structure (Control)	Somer's d(148) = -0.0666, p < 0.478
Education (Control)	Somer's d(146) = .0694, p < 0.464
Education preparation (Control)	Somer's d(146) = .1297, p < 0.128
Applicant connection (Control)	phi(143): 0.3271, p < 0000***
p ≤ 0.05 = * p ≤ 0.01 = ** p ≤ 0.001 = *** (two-tailed)	

A bureaucrat's job experience appears to influence tool use likelihood. However, contrary to the expectation of Hypothesis 1, the job experience coefficient is positive rather than negative. The correlation analysis supports Hypotheses 2 and 3.

Bureaucrats in states which have made more progress officially integrating tools into policy appear more likely to use tools. The positive coefficient on wetland scarcity suggests that wetland abundance is associated with higher rates of tool usage. Bureaucrats in states with less rigorous de jure wetland regulatory regimes appear more likely to use tools. Bureaucrats who perceive they know something about how applicants think also appear more likely to use assessment tools, perhaps suggesting a learning dynamic. The other control variables do not appear to influence tool usage significantly.

4.3 Logistic regression

The variables introduced above were used in two logistic regressions. The first, Model 1.0, included the variables statistically significant in Table 3-2 ($p \leq 0.05$). Model 1.0 showed statistical significance for job experience ($p < 0.013$), network communication ($p < 0.000$), and the constant ($p < 0.002$). Adoption progress was on the edge of significance ($p < 0.068$). The model used 132 observations and had a pseudo R2 of 0.3497, with a likelihood ratio (LR) chi2(6): 59.69 and prob > chi2: 0.0000.[41] The second logistic regression, Model 1.1, dropped the variables that were not significant in Model 1.0 ($p \leq 0.05$) except for the adoption progress variable, which was retained because of its substantive importance and marginal significance:

[41] A likelihood ratio test that the coefficients in Model 1.0 were simultaneously equal to zero yielded chi2(6): 36.29, $p < 0.0000$, suggesting that the null hypothesis can be rejected. The variables in Model 1.0 were not correlated with coefficients above/below +/- 0.3312.

Table 3-3. Model 1.1[42]

Variable	Coefficient	Standard error	z	P > z
Job experience	0.1185	0.0442	2.68	0.007**
Network communication	2.3397	0.4820	4.85	0.000***
Adoption progress	2.4001	0.8203	2.93	0.003**
Constant	-3.9532	0.7531	-5.25	0.000***
Obs: 132 LR chi(3): 56.48 Prob > chi2: 0.0000 Pseudo R2: 0.3309 LL: -57.0985				
$p \leq 0.05$ = * $p \leq 0.01$ = ** $p \leq 0.001$ = ***				

The robustness of these models was evaluated by running several other specifications. Model 1.1 appears generally robust and is theoretically and substantively preferable to the alternate models.

The regression analysis does not support Hypothesis 1. The positive, statistically significant coefficient on job experience suggests that more experience increases rather than decreases a bureaucrat's likelihood of using a tool.[43] While the correlation analysis supported Hypothesis 2, training is not statistically significant in Models 1.0 and 1.1. The regression analysis suggests that gaining access to assessment information from network contacts significantly explains tool usage, supporting Hypothesis 3.

[42] A likelihood ratio test that the coefficients in Model 1.1 are simultaneously equal to zero indicates the null hypothesis can be rejected, chi2(3): 36.30, $p < 0.0000$. The Bayesian information criterion suggests that Model 1.1 offers a better fit than Model 1.0 (-510.802 for Model 1.1 and -499.361 for Model 1.0). Aikaike's information criterion supports this inference (0.926 for Model 1.1 and 0.947 for Model 1.0).

[43] There also does not seem to be a threshold before or after which job experience differentially impacts usage. When the square of the job experience variable was included in a Model 1.0 iteration (along with all original variables), it was not significant ($p < 0.490$).

The predicted probability of tool usage, given different settings of the independent variables, can be computed using Model 1.1's estimates. In Table 3-4, the other variables are held at their means.

Table 3-4. Predicted probabilities using Model 1.1

Variable	**Likelihood of a bureaucrat using a rapid wetland assessment tool**
A bureaucrat communicates with a network alter about assessment	58.9%
A bureaucrat does not communicate with a network alter about assessment	12.2%
Adoption progress = 0 (Maryland)	8.2%
Adoption progress = 0.25 (Delaware)	14.0%
Adoption progress = 0.5 (West Virginia)	22.9%
Adoption progress = 0.75 (Pennsylvania, Virginia)	35.2%
Adoption progress = 1.0 (Ohio)	49.7%
Job experience, from the 1st percentile (0.02 years) to the 99th (22.5 years)	17.8–75.7%

5.0 Discussion

This chapter's main argument is that when a street-level wetland bureaucrat learns about rapid wetland assessment tools, he is more likely to use such tools. Learning or lack thereof was posited to occur via three pathways: job experience, structured knowledge acquisition, and interpersonal ties. The analysis generally supports the learning argument, even though some pathways appear more salient than others or salient in unanticipated ways.

Since there is so little empirical data about whether and why state bureaucrats use rapid wetland assessment tools for regulatory work, these findings are meaningful for policy practitioners. The findings support and nuance arguments in the policy learning literature about the importance of policy actors receiving information about new policy products so they can then decide whether or how to use such innovations. The chapter also contributes to an under-theorized area in political science's analysis of innovation diffusion and adoption by focusing on these phenomena as they involve street-level bureaucrats.

Of course, tool exposure is not enough to ensure use. The literature on utilization of policy research products recognizes that uptake is affected by a host of factors related to the product; the producers of the product; the policy actors; the social, economic, and political contexts; the congruence between the product and its arena of application; and more (Beyer and Harrison 1982; Green et al. 2009; Huberman 1994; Knott and Wildavsky 1980; Sabatier 1978). However, these are all second-order factors. For these factors to have a chance at affecting a bureaucrat's behavior, a bureaucrat must first learn about the innovation. Satisfying that first-order condition alone explains more than one-third of the variation in use of rapid wetland assessment tools by state bureaucrats.

Hypothesis 1, concerning job experience, posited that more experienced bureaucrats would be less likely to use a tool because they would resist learning, having become accustomed to second-best methods for evaluating wetlands. Also, best professional judgment, which interviews suggested was more developed and extensive among more experienced wetland bureaucrats, seemed likely to crowd out tool use. However, the analysis did not support Hypothesis 1, and this unexpected finding warranted post-hoc exploration.

First, the hypothesized tendency of bureaucrats who have worked in wetland regulation a long time to resist learning might be less important than the likelihood that experienced bureaucrats have substantial knowledge about the state of wetland science and associated best practices and thus would be more likely to use tools. Second, the use of best professional judgement in regulatory practice by survey respondents at some point since 1995 does not significantly correlate with their level of job experience: $r_{pb}(144) = 0.0428$, $p < 0.6078$. The argument that experienced bureaucrats' reliance on BPJ crowds out tool use thus appears flawed.

The job experience variable may be significant in the regression analysis because it captures the more frequent participation by experienced bureaucrats in training events: $r(144) = 0.1986$, $p < 0.0170$). Similarly, correlating job experience with the applicant connection variable suggests that more experienced bureaucrats have a stronger connection with applicants from whom they might gain assessment information: $r_{pb}(140) = 0.2797$, $p < 0.0007$.

Finally, the data allow some exploration of whether more experienced bureaucrats appear more likely to use tools merely because they have had more time over which to do so. If more usage opportunities are a primary driver of tool use, experienced bureaucrats should be more likely to have discarded tools relative to newer bureaucrats. Bureaucrats who use tools but do not find them helpful will probably stop. Bureaucrats with more opportunities to use tools over time also presumably have had more opportunities to discard them. Thus, newer bureaucrats with fewer discard opportunities should exhibit more tool use without discard, whereas more experienced bureaucrats should exhibit more tool use with discard. However, if usage opportunity is not a primary driver of tool use, there should

be no significant difference in the rates at which bureaucrats of different levels of experience discard tools.

Fisher's exact test was used to evaluate whether there is a statistically significant relationship between bureaucrats possessing varying levels of experience (values of the job experience variable sorted into quartiles: low, medium-low, medium-high, and high) and bureaucrats discarding tools after using them versus not discarding them, or discarding one tool but then using another. (The latter two behaviors are grouped in one category because bureaucrats who used one tool and then another did not discard the entire assessment enterprise.) The resulting p value, $p < 0.165$, suggests that the relationship is not significant. Bureaucrats with more experience may use tools at higher rates not merely because of more opportunities, but rather for other reasons, perhaps including a recognition of tool utility.

The lack of support in Model 1.1 for Hypothesis 2, wherein training was posited to be a learning pathway, makes sense given the positive impact that job experience appears to have on tool usage. Job experience accrues daily over time. In contrast, training events occur relatively infrequently (the median number of training events a respondent attended annually was two; the maximum was five) and are usually short in duration. If repetitive experiential exposure to tools facilitates learning and subsequent use, it may be sensible that discrete, non-repetitive information-dissemination events have less influence. Scholars in the experiential learning camp of the long-standing pedagogical debate about the efficacy of direct instruction versus experiential learning would anticipate this result (e.g., Clark, Kirschner, and Sweller 2012).

Given that many of the bureaucrat survey respondents are unlikely to have received explicit direction from their administrative hierarchies concerning assessment tool use, it is

sensible that the analysis supports Hypothesis 3. Tool use appears more likely when the individuals upon whom bureaucrats rely most frequently for wetland regulatory advice—members of their policy networks—convey assessment information to bureaucrats. Bureaucrats appear to learn about tools via lateral communication with peers. This finding is affirmed by data from a survey question wherein bureaucrats were specifically asked how they first learned about rapid wetland assessment tools. Roughly 86.5% of respondents who knew the tools existed heard about them from someone at a conference, a member of the regulated community, a scientist, or another state environmental employee. Communication with another state employee was the most frequent response, at 35%. Only 13.5% of respondents first learned of tools by reading about them. For street-level bureaucrats, interpersonal communication appears to be an important pathway for tool-related learning and for learning about science policy innovations more generally.

Finally, the influence of a state's progress toward official tool adoption on tool use is reasonable given this chapter's core argument concerning learning. This control variable represents a vertical learning pathway. The more steps relevant state agencies have made toward adoption, the more likely are bureaucrats to have heard about rapid wetland assessment tools from the administrative hierarchy. State-level progress toward adoption also may send signals to bureaucrats about the desirability of using tools. Recall that some bureaucrats who had not used rapid wetland assessment tools said they did not do so because tool use had not been formally sanctioned. Bureaucrats seeking logics of appropriateness will look to their peers, but they also will look to their superiors (March and Olsen 1984).

6.0 Conclusion

This investigation examined factors affecting whether state wetland bureaucrats implement rapid wetland assessment tools in regulatory practice. Its findings support the argument that when bureaucrats have more opportunities to learn tool-related information and practice norms, they are more likely to implement tools. Although a wealth of other factors affect uptake by policy actors of policy-relevant research products, this inquiry's findings are significant because they show that learning alone—achieved job experience, lateral communication through network ties, and vertical communication of organizational cues—has a meaningful impact on tool use likelihood.

These findings have more general implications for the integration of best available science into on-the-ground environmental policy when such integration is largely a matter of individual choice by street-level bureaucrats rather than the result of a centralized mandate. Rogers (1995, 365) noted that "our understanding of decentralized diffusion systems is still limited owing to the general lack of investigation of such user-dominated diffusion." This analysis shows that attending to the interpersonal ties and job experience of street-level bureaucrats is critical to understanding whether and how science policy innovations diffuse among those actors and whether and how they incorporate these innovations into their implementation practices. Street-level bureaucrats are also influenced by the signals they receive from administrative superiors about the appropriate mechanisms by which they should integrate science into regulatory choices. Policymakers interested in facilitating better science-policy integration in decentralized policy environments should focus on making street-level bureaucrats aware of science policy innovations. They also should encourage

more day-to-day, on-the-job interactions among bureaucrats and sources of innovation expertise.

Chapter 4: The struggle for state-level adoption of rapid wetland assessment tools

1.0 Introduction

Only one of the six states this investigation examines has adopted a rapid wetland assessment tool into official regulatory policy. This is not for lack of effort. The Delaware Department of Natural Resources and Environmental Control began pursuing this goal in 2009 (A280: Feb. 16, 2011). The West Virginia Department of Natural Resources began developing a tool for regulatory application in 2004 (MAWWG 2004).[44] The Virginia Department of Environmental Quality began its effort in 2003 (A323: Nov. 29, 2010). The push at the Pennsylvania Department of Environmental Protection began in 1996 (A397: Dec. 13, 2010), though the most recent phase of the effort began in roughly 2005 (B312: Feb. 22, 2011). Maryland's Department of Natural Resources and Department of the Environment also began their assessment efforts in 2005 (Ghigiarelli and Conn 2007; A266: Nov. 4, 2010), though those efforts have been minimal. The Ohio Environmental Protection Agency started its assessment initiative in 1998 and successfully achieved regulatory adoption in 2002 (A009: Oct. 21, 2010). However, the reasons the Ohio EPA succeeded highlight some of the reasons other state agencies are struggling. This chapter investigates the roots of those struggles.

Chapter 3 showed that some wetland bureaucrats in these states use assessment tools and others might if given more information. These findings suggests that these tools are

[44] The specific start date was difficult to pin down for West Virginia. Two actors with primary responsibility for tool development said 2005 (F042: Nov. 15, 2010) and 2001–2002 (E663: Nov. 23, 2010), while state bureaucrats gave a rough estimate of 2006 (A778, 931: Dec. 14, 2010). West Virginia makes its first appearance in the meeting minutes of the Mid-Atlantic Wetland Workgroup when, in 2004, a brief note describes the WVDNR's very early steps toward tool adoption. Thus, 2004 is used here.

perceived as useful by some bureaucrats, and accordingly, that states are not avoiding adoption because tools are considered undesirable. State bureaucrat interviewees, while sometimes wary about certain tool aspects (e.g., weights assigned to certain types of plant communities), overall often appeared to view tools' regulatory application favorably. A Pennsylvania bureaucrat said, "It [regulatory tool use] provides standardization and consistency, which is good, because we always get accused of being inconsistent, capricious . . . [and] for the industry it gives them something to expect. . . . That's comforting" (A369: Dec. 13, 2010). Echoed a Delaware bureaucrat, "When it comes right down to it, it [regulatory assessment] is the best thing . . . for the resource. . . . There's better tracking of what's really happening. . . . We'll be able to analyze and to some degree monitor and account for all the different services and functions [wetlands provide]" (A280: Feb. 16, 2011).

If wetland bureaucrats are generally positive about assessment tools, and tool use is considered a best management practice, the question is—as an EPA expert put it—"Why can't we take something that is already working [in Ohio] and move it around [to other states]?" (C796: March 23, 2011). This chapter uses synergistic institutional analysis to illuminate how the macro-level structures of environmental federalism and the Clean Water Act, and the power inequities, path dependencies, unexpected outcomes, and incentives these structures have generated, collectively make regulatory tool adoption difficult—though not impossible—for state environmental regulatory agencies.

2.0 Understanding policy phenomena through synergistic institutional analysis

Institutions are the "human-constructed constraints or opportunities within which individual choices take place and which shape the consequences of their [individuals'] choices" (McGinnis 2011, 170). Institutions encompass formal written rules prescribing sanctions for rule violators and informal practices which may be unwritten and may not involve sanctions. Institutional analysis is the detailed study of universal components of human behavior which, when arranged in different configurations at multiple levels of action, create diverse patterns of regularized social behaviors (Ostrom 2005). This chapter's institutional analysis draws on elements from the three theoretical perspectives on institutions that dominate political science: rational choice, sociological, and historical institutionalism (Hall and Taylor 1996). While there are differences between these traditions, they also have substantial complementarities which allow for a synergistic institutional analysis that provides more leverage over the puzzle of tool adoption failure than insights from only one theoretical vantage.

Of the three traditions, rational choice institutionalism focuses most closely on human agency and individual choices. This approach holds that individuals have explicit preferences which they pursue strategically (Shepsle 2006). Early forms of rational choice institutionalism argued that individuals acted based on fully formed preferences, with full information about their choice options and consequences (Miller 1997). Later interpretations allowed for bounded rationality, the notion that individuals pursue their self-interest given cognitive limitations (Jones 2002). Early scholars also assumed that individuals made choices that maximized narrow economic utility, but later scholars acknowledged that individuals

can define their self-interest in other ways, such as making a positive contribution to society (Miller 1997; Ostrom 2005).

In this tradition, institutions solve collective action problems by minimizing transaction costs (Elster 1986; North 1990; Ostrom 2005; Weingast and Marshall 1988). People often need the cooperation of others to secure their goals, but in a rule-free society, they cannot confidently gain that cooperation. People thus create mutually beneficial rules for behavior; these institutions persist as long as they are mutually useful (Miller 1997; Moe 1990). The institutions envisioned by rational choice scholars may be social conventions which emerge via strategic interactions and are propagated through learning, adaptation, and other self-reinforcing mechanisms (Fudenberg and Levine 1998; Knight 1992). They also may be explicitly crafted (Coase 1960; Ostrom 2005; Posner 1980; Williamson 1991). Finally, institutions may be compromises negotiated or new status quos created when actors engage in conflict while pursuing their goals (Knight 1992; Miller 1992). This last perspective assumes institutions persist as long as they serve the interests of the powerful actors who structured them and less powerful actors cannot find ways to upend them (Moe 1990, 2005).

Sociological institutionalism does not consider human behavior to be so purely instrumental. While rational choice institutionalism is quite concerned with how humans form institutions, sociological institutionalism focuses more on the power institutions have in human life and less on their origins (Coleman 1990). Institutions are often viewed as latent, scripts and narratives that condition behavior without people being aware of their influence (Beckert 1999). This perspective often leads sociologists to puzzle over how humans might change institutions of which they are not even conscious (e.g., Garud, Hardy, and Maguire 2007).

In this tradition, people do not necessarily make choices explicitly intending to maximize personal utility, but instead seek to behave in ways consistent with their roles in society, cultural standards, and norms, narratives, and identities to which they adhere (Boudon 1981; March and Olsen 1996). Institutions may evolve not because they solve a particular problem, but because they enhance social legitimacy or provide frames for the interpretation of social and political phenomena (March and Olsen 1984; Meyer and Rowan 1977). Sociological institutionalism is particularly concerned with the formation, behavior, and nature of organizations (ibid.), and how they shape the choices of their members (Bowles 1998). Organizations are a key building block of society because they create cultures and systems of meaning which members apply in their day-to-day interactions within and outside the organization (van Maanen 1977; van Maanen and Schein 1979).

Historical institutionalism is more concerned with the determinants, outputs, and contexts of organizational structures (Gamm and Shepsle 1989). Of the three traditions, it is least concerned with individual behavior (ibid.). While the other two conceptualize institutions as rules or scripts, historical institutionalists are most likely to study the behavior of Congress or a political party, or even an entire regime structure (e.g., the welfare state) rather than a single branch of government, and understand these entities as institutions (e.g., Krehbiel 1993; Pierson 1996).

While rational choice institutionalism has been criticized for inadequately explaining institutional change, historical institutionalism heavily focuses on such change over time (Greif and Laitin 2004). Scholars in this tradition often examine the historical record, tracing the key junctures, ideas, and sometimes unexpected events that appear to have shaped present structural arrangements (March and Olsen 1996). If rational choice is overly

functionalist (Green and Shapiro 1996), historical institutionalism may run in the other direction: Institutions look or behave as they do because of happenstance or "synchronic causality" (Ma 2007, 66). A different ordering of events in history could have resulted in entirely different arrangements, and the apparent consequence of an event when it occurred may have no relationship with its ultimate impact (ibid.).

This perspective is particularly concerned with how the distribution and exercise of power shape organizational forms. Political struggles lead to power imbalances enshrined in institutions (Thelen and Steinmo 1992). Historical institutionalism also focuses on path dependence, the disproportionate influence of initial conditions on subsequent institutional forms and the options allowed and disallowed by the trajectories those choices establish (Ma 2007; Pierson 2000; Pierson and Skocpol 2002). Society and its organizations adapt to institutions such that, over time, institutions become increasingly "sticky" and change resistant (Pierson 1996).

Ostrom (2005) argues that, to understand policy phenomena, a researcher often must analyze activity at different levels of governance and in different arenas (e.g., the biophysical and social arenas). When focusing on one dimension, the researcher holds variables in the others constant. The same logic applies to using different theoretical perspectives on institutions to understand different parts of a policy puzzle. A researcher trying to understand a complex series of events is not necessarily well served by focusing, as might a scholar of historical institutionalism, only on how past events constrain the behavior of organizations understood as unitary actors. The researcher might need to examine the incentives driving the individuals who, though members of the organization, make choices that maximize their personal payoffs—an account a rational choice institutional scholar

would find reasonable. Yet such a scholar might not be able to comprehend why firms, which presumably are formed to reduce transaction costs, sometimes do not craft contracts or set wages in ways that maximize efficiency (Baker, Jensen, and Murphy 1988). Understanding these outcomes might require the researcher to investigate the normative concerns of top firm decision-makers and the firm's organizational culture, an inquiry which would be aided by a sociological perspective on institutions. Diermeier and Krehbiel (2003) contend that institutional change can be explained if the analyst recognizes that institutions operate at multiple levels, examines one level while holding the others constant, and allows behavioral assumptions to vary across levels. This chapter's argument is similar. Different institutional understandings, rooted in different assumptions about human behavior, can be warranted in different parts of an analysis of a policy puzzle.

The three institutionalisms not only complement one another, but they also sometimes use different languages to describe related or similar concepts (Dowding 1994). The social learning and adaptation that entrench social conventions in rational choice accounts (Knight 1992) may be the same forces that create scripts that become so ingrained in the fabric of daily life that they are no longer recognized by humans whom they affect (Beckert 1999). Institutions that began as optimal solutions to problems may become the sticky, path-dependent institutions described by Pierson (1996) and other historical institutionalists. The organizational cultures studied by sociological institutionalists may over time make organizations sufficiently autonomous that organizations find ways to persist, re-shaping their own mandates in ways not originally intended by their rational designers (Carpenter 2001). This chapter highlights just these kinds of relationships. It shows, as other

scholars have argued (e.g., Dowding 1994; Hall and Taylor 1996), that elements from all three approaches can be used to help analyze policy phenomena thoroughly.

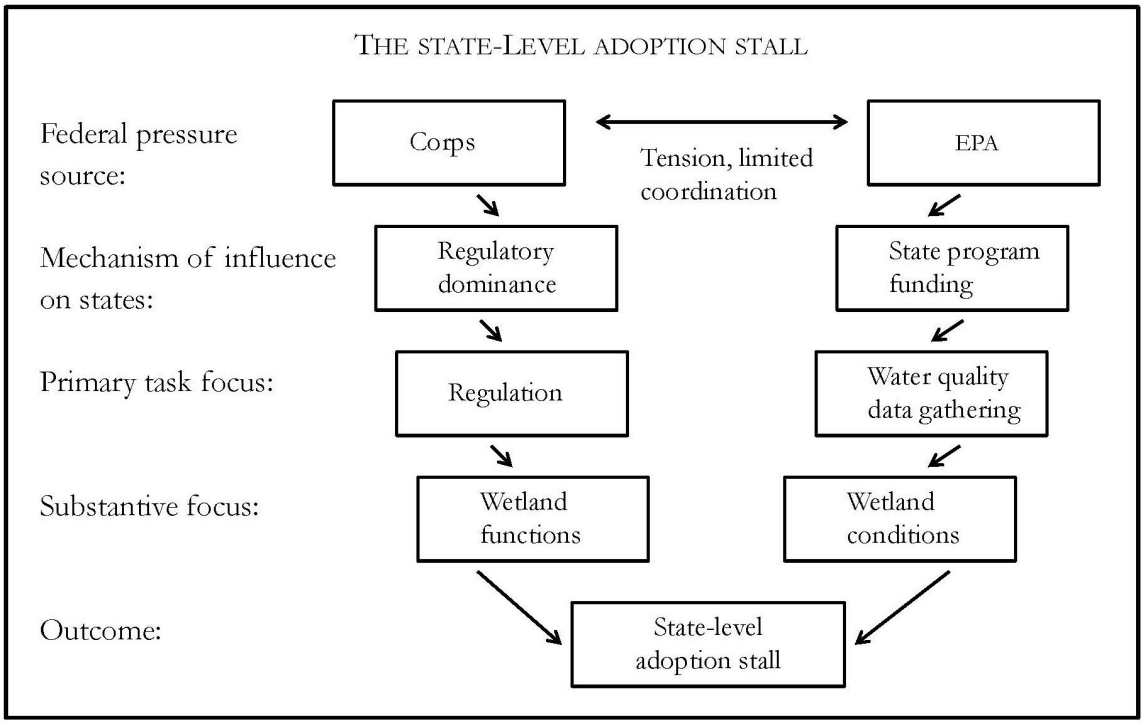
3.0 Institutional analysis of the state-level tool adoption problem

This chapter next uses synergistic institutional analysis to examine how each element in a complex configuration of institutions—legal statutes and regulatory authorities; jurisdictions, attributes, and behaviors of bureaucratic organizations at different levels of governance; and substantive attributes of the policy problem—interacts with the others to generate an unintended outcome: hindering state-level regulatory adoption of rapid wetland assessment tools. Synergistic institutional analysis uses the complementarities and connections among rational choice, sociological, and historical institutionalism to explain policy phenomena more satisfactorily than could any one of those theoretical traditions alone. Because of the many working parts in this account, this chapter's Appendix 4-1 offers the reader a glossary of key regulations, organizations, and initiatives discussed here.

Figure 4-1 is a simplified conceptual schema of factors and actors which help explain why tool adoption efforts involving states often peter out before adoption is achieved. Its elements are described in subsequent sections, the first of which explains how the American system of cooperative environmental federalism provides an overarching structure for wetland regulatory interactions between the Corps, the EPA, and the states. Next are two sections which detail the substantive and task foci of the Corps and the EPA vis-a-vis wetlands. States and their regulatory practices are the focus of the following section. That discussion is followed by a series of sections specifically focusing on each set of interactions between the Corps, the EPA, and the states, and the exercise of federal regulatory pressure

therein. The final portion of the institutional analysis summarizes how those interactions, themselves affected by the essential characteristics of each involved entity, generate the adoption stall identified at the bottom of Figure 4-1.

Figure 4-1. Explaining the state-level tool adoption stall



3.1 The institutions of cooperative environmental federalism

The purviews and behaviors of U.S. administrative agencies in this account are broadly shaped by environmental federalism, or the manner in which power to manage environmental phenomena is distributed among the federal government and states or tribes (Fischman 2005). North (1990), a scholar in the rational choice tradition, would conceptualize the parameters of environmental federalism as the "rules of the game" for administrative agencies.

Since the 1970s, the dominant legal regime for pollution control in the United States has been cooperative federalism, where the federal government uses incentives and punitive action to induce state governments to coordinate with it and accept its direction (Fischman 2005). States are generally subordinate to the federal government under this system (Kincaid 1990; Welborn 1988), which has four main elements. First, the federal government generally provides funding to states to help them pursue activities the federal government desires. Second, the federal government requires states to pursue certain policies they might have pursued if not for state-level political resistance or lack of expertise. Third, states are given a central role in meeting federal-level statutory mandates. They can determine the extent to which they will execute these mandates, though if they choose not to execute them or do so only partially, the federal government may take punitive action or execute a mandate itself. Fourth, state pollution control laws are generally not pre-empted by the federal government unless they do not meet minimum federal standards (Fischman 2005; Glicksman 2006; Greve 2000; Percival 1995).

3.2 The U.S. Army Corps of Engineers

As implied by the "task focus" component of Figure 4-1, the U.S. Army Corps of Engineers has primary responsibility for national-level wetland regulation under Section 404 of the Clean Water Act, which authorizes the Corps to issue permits for the insertion of dredge or fill material into jurisdictional wetlands. The Clean Water Act is the kind of institution typically analyzed by rational choice scholars: a rule intentionally crafted for a specific end. The Clean Water Act seeks to "restore and maintain the chemical, physical and

biological integrity of the Nation's waters"[45] and variously charges federal agencies and the states with implementing this mandate.

The Corps' regulatory responsibilities are handled by districts with territorial jurisdictions.[46] To varying degrees, many district staff with jurisdiction in the states investigated in this dissertation tended to be skeptical, in interviews, of rapid wetland assessment tools. A regulator in the Philadelphia District commented, "I've never seen any great strengths [of these tools] . . . if you're just evaluating a specific project, then what information are you getting out of it [a tool]? Nothing" (B783: March 15, 2011). Delaware bureaucrats have had little success convincing Philadelphia District staff to support the state's regulatory use of a tool (A941: Nov. 15, 2010). A regulator with nearly 30 years of experience in the Norfolk District said that during her tenure the district has done relatively little with such tools (B907: Feb. 14, 2011). Some regulators with the Pittsburgh District said they have little experience using assessment tools (B804, B077: Feb. 22, 2011). One regulator from the Baltimore District noted that bureaucrats in Pennsylvania championing a tool ". . . invited me to one of their field workshops. Whatever. I wasn't too high on it [the tool] and so they never invited me again" (B312: Feb. 22, 2011). With the exception of regulators in the Buffalo and Huntington Districts (for reasons explained in Section 4.0), few district regulators interviewed for this project recalled using any rapid wetland assessment methods other than two, discussed below, that were once officially sanctioned by the Corps (e.g.,

[45] 33 *U.S. Code* sec. 1251(a) (1972).

[46] The districts and their jurisdictions are identified in Section 3.10.

B077, B804: Feb. 22, 2011; B783: March 15, 2011).[47] The Corps' organizational culture helps explain regulators' attitudes and limited tool knowledge. Path dependencies rooted in historical experience further explain the Corps' reticence regarding rapid wetland assessment tools.

The U.S. Army Corps of Engineers is a notably hierarchical government organization with a distinctive set of norms and standard operating procedures that demand disciplined fidelity to mandates issued from its power center. These institutions are rooted in the Corps' identity as a military organization. When it was founded in 1802, the Corps' dual purpose was fort construction and training soldiers (Shallat 1994). Today, the agency's range of responsibilities is broader and encompasses environmental management. However, each of the Corps' 38 domestic district offices is headed by a ranked military official. The agency has an ongoing "West Point tradition" substantially responsible for a culture which socializes regulators into norms of rigidity and resistance to change. The hallmarks of that culture are "standardized forms, written guidelines, precise accounting, field offices, [and] clear lines of command" (Shallat 1994, 9). Said a consultant:

> One thing I see at the Corps is change is just not a good thing there. They avoid it like the plague. [They are] very institutionalized and the chain of command stays roughly the same for a very long time. So as long as it works and you don't get into trouble, people are going to not rock any kind of boat. And typically, the people who do try to rock the boat, even a little bit, they are not looked on favorably by anyone else in the Corps. And so, it seems like the whole institution has that resistance to doing anything [innovative]. (D556: Dec. 22, 2010)

[47] An exception is that some district regulators had used the New England Method (USACE 1995). However, this exception proves the rule discussed in subsequent paragraphs. The New England Method was also produced by the Corps.

This culture partly explains district regulators' attitudes towards rapid wetland assessment tools. Corps districts prosecute wetland regulatory tasks but generally do not pursue research that could inform regulatory activities (B088: March 17, 2011). Some Corps staff indicated that district offices have neither the time nor capacity for the latter task (ibid.; B312: Feb. 22, 2011; B783: March 15, 2011), while others said that such research is simply not in their job descriptions (e.g., B289: March 15, 2011). Said one district regulator, "We've never been the lead with respect to doing anything like that. That's not what our funding is for" (B783: March 15, 2011). From the sociological institutionalist's perspective, such behavior would not be considered appropriate by the dominant norms of the agency. The limited research role of Corps districts means that staff there are unlikely to develop assessment tools for use in their jurisdictions and that it is reasonable for district regulators to have limited knowledge of available tools, especially to the extent that these tools are described in scientific publications generally written by and for researchers.

Corps district regulators get research products from the Engineer Research and Development Center (ERDC) (B804: February 22, 2011), a command center which, in the Corps' organizational hierarchy, is more closely tied to headquarters-level decision-makers than to the districts (USACE n.d.). District regulators wait for ERDC to disseminate research products and for headquarters staff to tell district officials how and when to use them. One Baltimore District regulator noted that her counterparts have been asking Corps headquarters for help understanding wetland assessment approaches being developed by states, but that "nothing seems to be on the horizon" (B088: March 17, 2011). Other Corps staff members referenced the research primacy of ERDC (B077: Feb. 22, 2011; B205, B921: March 15, 2011; B333: March 7, 2011). In the Philadelphia District, a Corps regulator

commented on an assessment tool Pennsylvania hopes to adopt: "They've worked on it, they've run it by us, and we basically said we use ratios[48] and we're going to continue to use ratios until our ERDC figures something else out" (B289: March 15, 2011).

Organizational culture is not the only reason district regulators resist regulatory assessment tools championed by state environmental agencies. Historical events created path dependencies which make the Corps as an agency resistant to regulatory assessment.

The Corps previously championed regulatory application of two different assessment tools. The first, the Wetland Evaluation Technique (WET) (Adamus and Stockwell 1983; Adamus et al. 1987), was embraced by the Corps in 1987 (Novitzki, Smith, and Fretwell 1997). WET was initially hailed as a breakthrough in wetland regulatory practice; "everyone jumped on WET and it became the gospel" (D336: Feb. 3, 2011). Corps headquarters staff told district officials to use WET and to ask applicants to do the same. But by 1990, the Corps had abandoned WET (Novitzki, Smith, and Fretwell 1997).[49] A major element of WET's downfall was that district regulators thought its implementation was too difficult and its results were not worth the trouble (A397: Dec. 13, 2010; B783: March 15, 2010; C193: Oct. 30, 2010; C306: March 24, 2011; D229: Feb. 8, 2011; F439: March 15, 2011; F446: March 12, 2011). However, district regulators did not make the decision to abandon WET. Just as the leaders at the top of the agency's administrative hierarchy decided districts should use WET, those leaders decided its use should stop. Said a veteran state bureaucrat, "WET had acceptance for awhile . . . it was the newest, hottest, and latest and greatest. And then it

[48] This is a standard Corps approach to wetland regulation described in Chapter 1.

[49] Many interviewees described the reasons why WET and its successor fell out of favor, but those critiques are not central to this account.

was decided that it's not so good" (A927: Feb. 23, 2011). Asked how the decision occurred, he said, "It's what was the latest breeze out of Washington. If Washington can get onboard something, they can get off board" (ibid.).

A key lesson from the WET experience is that district regulators had been told to use the tool. They had tried to heed this mandate from their superiors, as was appropriate given the Corps' hierarchical norms and regulators' professional roles. However, the cognitive dissonance between the expectations of Corps superiors and the struggles district regulators experienced in trying to implement WET began to sour district regulators on regulatory rapid wetland assessment.

The Corps' next regulatory tool attempt was the Hydrogeomorphic Approach (HGM) (Brinson 1993; Smith et al. 1995). HGM was "supposed to be this silver bullet that could be applied nationwide" (F078: March 14, 2011). It was intended to be a simpler and more strongly rooted in on-the-ground conditions than WET (Novitzki, Smith, and Fretwell 1997). Again, the Corps invested heavily in HGM. District staff were told to use HGM to assess wetlands and were trained in its use (B205: March 15, 2011; F693: Dec. 27, 2010; F303: Nov. 18, 2010). Yet like WET, HGM was a notable failure. "It was the best thing going for about two years. Then it just sort of disappeared" (A397: Dec. 13, 2011). "It never went anywhere" (B783: March 15, 2011). Commented a veteran consultant: "There was a lot of excitement [over HGM], but . . . it became real apparent that this stuff was not going to see the light of day. There was no way" (D336: Feb. 3, 2011).

One of HGM's major downfalls, noted a senior Corps official, was that its implementation hinged on the development of region-specific models that were often prohibitively expensive (B333: March 7, 2011). But why did high-level Corps decision-

makers embrace HGM in the first place? Did they not understand HGM's costs? Did officials at Corps headquarters believe they would have the funds to support its implementation? Such myopic behavior would be partly explicable from a historical institutionalist perspective, which expects that decisions meant to solve present problems often have unexpected and potentially undesirable consequences (Ma 2007; Pierson 1996). Historical institutionalism, however, often cannot adequately explain how or why certain choices produce unexpected outcomes (Hall and Taylor 1996). The Corps' behavior is inconsistent with a rational choice perspective that would expect institutions such as HGM to function as intended by their designers, at least initially (Hall and Taylor 1996; Roland 2004), rather than go awry nearly from the start. Here, the third institutional perspective appears most useful. Multiple interviewees suggested that this behavior is typical of the Corps' organizational culture. Sociological institutionalism would not expect the Corps to choose the most rational or efficient mechanism for wetland assessment (Bartley 2007), but rather to behave as agency staff perceive it should, per shared internal logics and standards (March and Olsen 1984).

Within the Corps, instructions typically come from the top of the administrative hierarchy and subordinates plow ahead relatively unblinkingly. Said one expert who advised the Corps concerning HGM, "[We told] the other Corps people in the field [the reasons HGM wouldn't work], any number of times, dozens of times, [talked] a lot of them blue in the face . . . [But] it was going to be what it was going to be. We all railed against it and said, 'This ain't going to work. It's totally impractical. It cannot work.' [But] he [one of HGM's authors] said, 'Well, decision's already been made [by Corps superiors]'" (F111: March 15, 2011). Said another, "HGM didn't work for a lot of reasons. One of them [was that] . . . the

Corps said 'This is what you will use. . . . we are going to roll it out, and we are going to make it happen, because we are the Army"' (C796: March 23, 2011). Echoed a third, "The Corps, God love 'em, they just go off on this path and then . . . HGM" (E763: Nov. 5, 2011). The agency's command-and-control culture pushed HGM to districts, but that culture was not powerful enough to overcome the tool's issues. By the late 1990s and early 2000s, the agency's HGM effort had largely failed.

HGM's failure further soured district regulators, who had struggled to implement the tool and had often found it onerous or unusable without relevant models (B205: March 15, 2011; B333: March 7, 2011; C306: March 24, 2011; D019: Feb. 8, 2011; D324: March 24, 2011; D336: Feb. 3, 2011; F078: March 14, 2011; F111: March 15, 2011), on the concept of regulatory wetland assessment. It is thus unsurprising that today, district regulators appear uninterested in state-championed tools. Moreover, the fact that the Corps as an agency has not resumed its pursuit of the assessment silver bullet suggests that the WET and HGM debacles convinced high-level staff that such an effort is not worthwhile. Powerful path dependencies appear to be discouraging the Corps from supporting state-level adoption of rapid wetland assessment tools for regulatory use.

If Corps regulators could be convinced to shake off these legacies, the tools to which they most likely would gravitate would be function focused. This priority, highlighted in the "substantive focus" component of Figure 4-1, aligns with the Corps' specific institutional mandate under the Clean Water Act. The act allows Corps regulators to deny permits for development in wetlands only when "discharge of such [dredge and fill] materials into such [wetland] areas will have an unacceptable adverse effect on municipal water supplies,

shellfish beds and fishery areas (including spawning and breeding areas), wildlife, or recreational areas."[50]

The act incentivizes regulators to seek assessment tools that will help them evaluate the extent to which proposed impacts will affect wetland functions. The rational appeal of such tools is that they are likely to help regulators meet their goals; the sociological appeal is that tools focused on function align with the agency's mission and associated norms. A regulator from the Philadelphia District, which—among the Corps districts examined in this investigation—has perhaps the most adversarial stance towards assessment tools, even allowed, "But, you know, if you had a methodology that really gave you good information on what were specifically the functions that were most likely to be affected by an activity, I think you could help design better mitigation" (B205: March 15, 2011).[51]

However, a major problem for state-level regulatory adoption of rapid wetland assessment tools, discussed more extensively in Sections 3.3 and 3.4, is that many tools state agencies are considering are not function focused, at least not exclusively. Yet, said a regulator, "We are required to protect functions. And that's where the big disconnect is between the tools and the regulatory area" (F078: March 14, 2011). Many of the tools instead prioritize ecological condition. The friction between condition-focused tools being pursued by state environmental agencies and the function-focused tools Corps regulators perceive as potentially helpful is plain in comments from some Philadelphia District staff:

> B289 (March 15, 2011): Pennsylvania is . . . trying to figure out how to apply their rapid bioassessments [a set of condition-focused rapid assessment protocols] to compensatory mitigation.

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[50] *Code of Federal Regulations* 40 Part 231.1 (1979).

[51] Compensatory wetland mitigation is an activity the Corps pursues under Section 404.

> B783 (March 15, 2011, sarcastically): . . . They've said we'll eventually be able to accept it . . .
>
> B289: [But] they currently don't have anything in line with the [Section 404 function-focused] rules . . .

The reason why state agencies are pursuing condition-focused tools despite the Corps' interest in function-focused ones is discussed next.

3.3 The U.S. Environmental Protection Agency

The U.S. Environmental Protection Agency has ten regional, territorially defined offices. The states in this investigation are all in Region 3 except Ohio, which is in neighboring Region 5. The Clean Water Act allows the EPA to review the Corps' regulatory decisions made under Section 404 and veto them if they stand to have unacceptable environmental impacts (EPA 2011b), though vetoes are rare. However, more critical for this account is the EPA's mandate under Section 305(b) of the Clean Water Act, highlighted in the "task focus" component of Figure 4-1. Section 305(b) requires that the EPA biennially obtain from states data on state water quality. These data must characterize the extent and nature of water pollution, its impacts, and how the pollution will be mitigated. As the "substantive focus" component of Figure 4-1 suggests, Section 305(b) is specifically concerned with the condition of the nation's waters (EPA 2009a).

The EPA summarizes these data in a biennial report to Congress (EPA 2009a). This arrangement is cooperative environmental federalism in action; the EPA "depend[s] upon state implementation to achieve federal statutory objectives" (Glicksman 2006, 724). Problematically, states have a long history of not reporting wetland data. In the EPA's 2004 report to Congress, "only 10 states provided information on the support of designated uses

for 1.8 million acres of wetlands . . . a tiny portion of the nation's 108 million acres" (EPA 2009a, 25). The National Wetland Condition Assessment Initiative (NWCA) evidences the EPA's concern with this lack of reporting.[52]

State agency and EPA staff members have long maintained that the reason states minimally report wetland quality data is that they lack necessary resources and tools (EPA 2012e; EPA 2002). Consequently, NWCA seeks to provide state agencies with model tool elements they can use in subsequent independent wetland water quality monitoring initiatives. This classic example of cooperative environmental federalism reveals the complex power dynamics affecting attempts by state agencies and the EPA to create mutually beneficial institutions. State agencies have institutionally conferred power over the EPA but lack resources to effectuate this power, and the EPA is both subordinate to state agency staff (in its need for them to gather water quality data) and dominant over them (in holding expertise they require to gather data and, as described later, funding). Via NWCA and other initiatives, the EPA is encouraging state agencies to adopt tools that can help the EPA meet its reporting mandate by yielding wetland condition data.

Experts point out that the tools best for condition assessment and those that effectively inform regulatory practice share some elements but in other ways do not overlap. Measuring the intactness of biological communities, as do condition-focused tools, is not necessarily the same as measuring the extent to which a wetland performs functions (Cohen, Carstenn, and Lane 2004; Hruby 1999; Kusler 2006; Mitsch and Wilson 1996; Sutula et al. 2006; Turner, Redmond, and Zeller 2001; A041: Nov. 18, 2010; A266: Nov. 4, 2010; C104: Oct. 30, 2010; C114: March 23, 2011; F078: March 14, 2011). In fact, condition- and

[52] NWCA is described in Chapter 1.

function-focused tools could yield opposite indications about the value of a wetland. A wetland might be highly polluted and thus have poor floristic quality and little species diversity. However, the wetland might be functionally valuable because it traps polluted runoff rather than letting it flow to a river used for recreation or commerce.

While EPA regulators who execute the agency's obligations under Section 404 of the Clean Water Act are interested in regulatory wetland assessment, that focus has developed only in the last few years (C104: Oct. 30, 2010). In contrast, the EPA has been trying for the last two decades to get state environmental agencies to adopt condition-focused tools which would allow state reporting of wetland quality data (C858: Dec. 8, 2010). This historical push has created path dependencies that now are stumbling blocks for regulatory wetland assessment. Said a national assessment expert and regulator, "[Condition assessment is] fine if that's the information you need, but . . . we [in regulatory work] are not required to protect conditions. We are required to protect functions. . . . practitioners are talking to me, [and] they're saying, 'I don't need conditions. I don't want to degrade and downplay all my valuable wetlands in an urban area because the have a low condition'" (F078: March 14, 2011).

The condition vs. function and the EPA vs. the Corps debates beg a perhaps obvious question: Why, in a discussion of *state-level* adoption of wetland assessment tools, do these national-level controversies matter? The following sections explain why.

3.4 The states

Although the states in this investigation have different characteristics, their environmental agencies and associated staff are all bound by certain institutions which affect

how they approach wetland regulation and assessment. The first such institution is Section 401 of the Clean Water Act. This section empowers state officials to ensure that discharges to waters within their jurisdictions meet state water quality standards. This delegation is meant to be a backstop to Clean Water Act effluent limits established by the EPA and implemented via national-level permitting (Glicksman 2006). Section 401 allows state officials to deny or condition pollution-allowing actions by the federal government, such as issuance of Section 404 wetland permits (Johnson 1999). Section 401 gives state agencies the rare upper hand over federal agencies and decision-makers.

State officials, however, rarely press this advantage. Johnson (1999, 417) describes Section 401 certification as "the mythical giant." Donahue (1996, 201) notes the "untapped power of Clean Water Act Section 401." State environmental agencies generally give minimal attention to their "enormous discretionary power concerning federal grants, licenses, and permits" (Leonard 1998, 291). A rational choice, power-focused approach to institutional analysis might, at first blush, find this outcome puzzling: Why would state officials not jump at an opportunity to leverage relatively rare power over the federal government into pollution control arrangements more tailored to state priorities?

Johnson (1999) argues that state officials often hold back because they assume federal agencies are the best judge of whether a proposed action is consistent with the Clean Water Act. Federal agencies implement or guide the implementation of many parts of that act, while state staff members have a lesser role. Moreover, the EPA was recently criticized by congressional legislators for superseding state officials' determinations under Section 401, though EPA officials protested that they had taken no actions that formally overruled state-level decisions (Copeland 2011). This tiff nonetheless suggests that state officials perceive

that federal regulators are closely looking over the state officials' shoulders with respect to Section 401, and may perceive that it is easier and/or more sensible simply to cede to federal authority.

From a rational choice perspective, transaction costs have generally appeared lowest for state officials who do not rigorously implement Section 401 and thus do not have to acquire substantial Section 401 expertise or staff. There are some signs that this cost-benefit calculus may be changing. A series of Supreme Court decisions in roughly the past two decades (the most recent in 2006) affirmed and clarified that state agencies have broad authority under Section 401 to condition or disallow federally sanctioned projects with environmental impacts (Copeland 2011). Environmental groups have seized this opportunity to encourage state officials to use Section 401 certification more actively—though their enthusiasm has been met by greater resistive pressures from development interests (ibid.; Meltz and Copeland 2006). State bureaucrats do appear increasingly aware of the advantages Section 401 can offer as another tool for environmental protection (Copeland 2011). Whether this awareness and the cross-pressures from environmental and development interests increase or decrease the transaction costs state officials face vis-a-vis embracing Section 401 certification will likely depend on local political, economic, and environmental conditions.

State agencies also may shy away from Section 401 action because the EPA's implementing regulations for the section are primarily procedural, lacking substantive guidance regarding which national government activities can be subject to Section 401 review and the conditions state officials can impose (Copeland 2011; Ransel and Meyers 1987–1988). Though the Supreme Court's decisions have provided greater clarity in recent

years, other court rulings have generated more ambiguity. A 1998 federal court of appeals ruling, for example, held that state bureaucrats could not use Section 401 to regulate nonpoint source pollution (Copeland 2011). Per sociological institutionalism, state officials remain unclear about the logics of appropriateness associated with implementing Section 401 and so remain hesitant. Per historical institutionalism, the fact that so few state agencies have rigorously leveraged Section 401 since the writing of the Clean Water Act has established a pattern of non-use which state environmental managers now may not even recognize. They might not realize why capitalizing on Section 401 to a greater degree would be desirable or understand how they might do this.

The institutional mandate that Section 303 of the Clean Water Act places on state officials is tied to Section 401. Section 303 requires that states establish water quality standards by which they can evaluate proposed impacts per Section 401. States must submit their standards to the EPA for approval (Ransel and Meyers 1987–1988). Per cooperative federalism, the Clean Water Act establishes minimum requirements for state standards; if they are not met, the EPA can impose its own (Johnson 1999; Glicksman 2006).

The Clean Water Act does not explicitly charge states with establishing wetland-specific water quality standards. Only 14 states have established them, and the only state in this investigation to do so is Ohio (Kusler 2011). Instead, most state environmental agencies simply apply the same standards to wetlands as they do to rivers, lakes, or streams (ibid.). However, the EPA has been encouraging state agencies to create wetland-specific standards since at least 1990 and has interpreted the Clean Water Act as requiring them (EPA 1990, 1994). The agency again emphasized this priority in a 2006 guidance to states (EPA 2006). The EPA wants state officials to create these standards because, once they exist, the EPA

can hold states accountable to them via water quality data reporting requirements under Section 305(b). The EPA is trying to execute its institutional mandate to report to Congress on national water quality.

Wetland-specific standards could improve environmental protection because wetlands frequently behave differently from other waterbodies with which they are often lumped. For example, high levels of tannic acid are typical for some forested wetlands and bogs, but are a sign of poor resource quality under most conventional water quality standards (A030: Dec. 17, 2010). A state that lacks wetland-specific standards, and whose regulatory policies are more permissive of proposed development projects that stand to affect an already polluted waterbody, risks losing healthy wetlands by miscategorization.

There are a variety of reasons why state officials have been reticent to adopt wetland standards. One is that once such standards exist, state staff are committed to evaluating wetlands for Section 401 certification and Section 305(b) reporting. This likely would mean more work for state environmental agencies which are generally overburdened and understaffed. (A285, A937: Nov. 3, 2010; C114: March 23, 2011; D019: Feb. 3, 2011; D222: Feb. 16, 2011; D324: March 24, 2011; D336: Feb. 3, 2011; D687: Dec. 29, 2010; D725: Feb. 7, 2011; F590: Nov. 8, 2010) Moreover, if this more expansive evaluation finds that a state's wetlands are substantially polluted, state officials might have to list wetlands as "impaired" in reports submitted to the EPA and potentially develop total maximum daily loads—pollution management strategies—for wetlands.[53] Kusler (2011) notes that states agencies avoid setting

[53] The EPA does not require states to consider wetlands when developing lists of impaired waterbodies nor to create TMDLs to address wetland impairments (Kusler 2011). However, as editor of the *National Wetlands Newsletter* (2003–2006), I more than once heard state bureaucrats worry that developing wetland standards could be the start of a slippery slope towards these difficult tasks.

wetland standards because of insufficient funding to implement them, concerns about regulatory burden, the complexity of wetland ecosystems, and the perceived difficulty of integrating standards into the state's existing water regulatory regime, among other challenges. The rational choice institutional analyst might conclude that, for many state environmental agencies, adopting wetland standards makes little sense: the EPA might want them to do so but apparently has no strong regulatory hook to compel this action, and state agencies have few incentives to move away from the present institutional equilibrium.

The behaviors of state agencies are more varied vis-a-vis explicit regulation of wetlands. In Delaware and West Virginia, the Corps and the EPA directly implement the Section 404 permitting program. Applicants go to Corps district offices for a wetland permit and enforcement is handled by the EPA and the Corps (ELI 2008). Environmental agencies in Maryland, Pennsylvania, and Virginia have arrangements wherein the Corps delegates them Section 404 permitting authority for proposed activities that fall into specific impact categories, stand to have minimal individual and cumulative impacts on the environment, and do not affect sensitive areas, among other provisions (Houck and Rolland 1995; USACE 2011).

This delegation appears designed to reduce transaction costs for Corps districts, freeing federal regulators to focus on more substantial impacts while the state agencies handle day-to-day permitting minutiae. Because state agencies opt into this arrangement, the rational choice perspective assumes that they must reap benefits from doing so. Maryland, Pennsylvania, and Virginia all have state non-tidal wetland laws which address issues not covered by national law (ELI 2008). The payoff officials in these states gain for shouldering some of the Corps' permitting burden is being able to bundle state and federal wetland

permitting requirements together for applicants proposing minor impacts, thereby maintaining a relatively more favorable reputation among citizens and developers whose political influence could affect the state environmental agency's budget. Delaware and West Virginia, in contrast, do not have state non-tidal wetland laws, and thus state agencies do not have the same incentive to opt in.

Environmental agencies in Maryland, Pennsylvania, and Virginia also have joint permitting arrangements with the Corps (ELI 2008). These institutions streamline regulatory activities such that an applicant needs to submit only one permit application and the state and federal agencies sort out whether and which of their strictures apply. Because agencies at both levels of government make regulatory decisions based on the same application, they coordinate on the content and structure of the application. This institutional arrangement also appears designed to reduce transaction costs: the applicant does not have to submit multiple applications subject to different requirements, the reviewing agencies do not have to deal with applicants providing them data that are irrelevant or in wrong formats because the data were prepared for other agencies, and the agencies regularize and speed the permitting process by sharing standard operating procedures concerning permit reviews.

The wetland regulatory regime in Ohio is a hybrid of those described above. The Ohio Environmental Protection Agency does not implement delegated portions of Section 404 or pursue joint permitting with the Corps. As in Delaware and West Virginia, the federal agencies directly implement the Section 404 program in Ohio. Like Maryland, Pennsylvania, and Virginia, Ohio has a separate state wetland law. However, unlike in those states, Ohio's law only protects wetlands not considered federally jurisdictional (ELI 2008). The unique advantages of Ohio's regulatory regime are described more comprehensively in Section 4.0.

State agencies struggle to adopt rapid wetland assessment tools for regulatory work not only because of the Corps' resistance and the condition vs. function dilemma, but because of institutionally enshrined funding constraints. As described in Section 3.6 below, EPA Wetland Program Development Grants (WPDGs), provided to state agencies pursuant to Clean Water Act Section 104(b)(3) (ELI 2008; EPA n.d.; C858: Dec. 8, 2010), substantially support state-level wetland monitoring and assessment efforts. However, these grants pose two major problems for tool implementation. First, the grants cannot last longer than four years and often have even tighter time frames; some last only a year (EPA 2011d; D858: Dec. 8, 2010).[54] As a West Virginia representative argued to the EPA, "We can't build a large program on a series of three-year grants" (MAWWG 2005, online). The grants coordinator for EPA Region 3 noted that this is a common complaint among state bureaucrats (D858: Dec. 8, 2010), who say that by the time the grant agreement is hammered out and funds actually are disbursed, they sometimes have as little as half to one year to use the monies before they must start reporting tangible results to their EPA grants officer (E670: Oct. 17, 2011; E733: Oct. 17, 2011).

Such short grant periods push state agencies to pursue small, discrete projects that can quickly yield successful results, proving to EPA officials that ongoing funding is warranted. State regulators want to continue receiving WPDGs, not least because they can sometimes leverage these project-specific monies to support core wetland program tasks indirectly. Said an EPA expert:

[54] The EPA Region 3 grants coordinator noted that in the future, the time frames should be lengthening somewhat, with ceilings at five or seven years and floors at two (C858: Dec. 8, 2010). If it materializes, this will be a positive development.

> One of the things that I've seen with states going in for the [wetland program development] grants is that they basically go in to get grants to keep staff that they have on soft money. . . . Then there's other states who basically do what my [EPA] branch calls "culminating on the stump." Money that comes in basically supports their program. They need those funds to have staff to get basic things done. . . . the most they can do [is] run their program. (C114: March 23, 2010)

Problematically, adopting a tool into a regulatory program is not a short project with a good chance of success. It is a long slog of activities that include surveying the literature for relevant tools and tool elements; meeting to discuss tool development, revision, and regulatory integration; field testing and calibrating the tool; educating stakeholders and users about the tool; and potentially even engaging in political negotiations to codify the tool in formal rulemaking (Sutula et al. 2006). Many things can and often do go wrong, and the fact that five of six states in this investigation do not have tools integrated into official policy shows that quick success is unlikely. Thus, state agencies are incentivized to pursue projects that will not necessarily substantially advance the regulatory adoption of assessment tools.

The second, even more fundamental problem with WPDGs is that state officials cannot use them to integrate tools into regulatory practice. This institutional mandate comes from Congress' authorizing language, the articulation of which seems clearly a key juncture of the type analyzed by historical institutional scholars. The EPA must specify that "**Implementation of wetland protection programs is not an eligible [funding] effort**" (EPA 2011d, 1, bolded in source). State agencies can only use grant funds for "research, investigations, experiments, training, demonstrations, surveys, and studies" (ibid.). This constraint is a substantial barrier to state-level regulatory tool adoption (C858: Dec. 8, 2010). Said a Virginia bureaucrat, "the EPA only funds program development. . . . It's a huge problem, but it's the reality. We are going to reach a point where when we roll the first

version out, [and] that's when the grant money for that first version ends because now we are implementing it" (A528: Nov. 29, 2010).

State officials try to find ways to pursue projects that are both eligible for grant funding and at least indirectly help advance the regulatory tool adoption effort. The Virginia bureaucrat continued:

> A528 (Nov. 29, 2010): But, when we add on [to the tool], for instance, the linear project [a new wetland research initiative], that's program development.
>
> Interviewer: So if you can keep these side projects going . . . you can say, "Oh, well I still have money for that [research] so I can go work on this [tool implementation, using the funds indirectly]."
>
> A528: Well, we have our [state] general funds, too. . . [but] the state match for grants . . . . frees up dollars that I can use somewhere else. But if the EPA money dried up tomorrow, God forbid . . .

Problematically, time and effort devoted to short-term, side research projects is time and effort not specifically spent on tool adoption and implementation:

> I think that implementation is hard [for states]. . . . . For example, in Pennsylvania they rolled it [their draft tool] out in two watersheds. And that's kind of the last we heard . . . They had this grand plan where you rotate around the state in a five-year cycle, and they did the first year, and then . . . they got stopped dead in their tracks in implementation. . . . I think a lot of times you're having trouble going to implementation, so while you're waiting, you might as well revise it [the tool]. (E763, Nov. 5, 2010)

The EPA Region 3 grants coordinator noted that there have been multiple failed attempts to get Congress to authorize WPDGs to support implementation (C858: Dec. 8, 2010). This institutional arrangement plainly does not meet the assessment needs of the EPA or state wetland bureaucrats, so explaining it from the rational choice perspective is difficult unless the arrangement meets other needs of congressional actors or EPA political principals, such as a desire to keep a short leash on implementing agents. The historical

perspective might speculate that the funding conditions met certain needs in the past but, because of institutional stickiness, have neither fallen away nor changed to accommodate today's policy reality. The sociological angle might suggest that the short-term nature of EPA funding reflects a suspicion within the agency or among its principals that state bureaucrats can too easily be co-opted by local political interests, with an attendant norm of keeping close tabs on state activities. Said a long-time state bureaucrat:

> But there was this mistrust, and there is this continued, I believe, mistrust in some areas . . . Where [the EPA thought we] played state politics, where [the EPA thought we] influence[d] permit decisions [in ways] detrimental to the environment, and if not for the federal government watching over our shoulders, the politicians are going to make permit decisions. Which doesn't happen in Pennsylvania, and doesn't happen in most states. . . . I'm not saying that things don't happen, but on a day-to-day basis, no . . . [but] I think that there is this misconception out there at the federal level that if not but for them the states would run amuck. (A397: Dec. 13, 2010)

These explanations are not mutually exclusive, and they lead to the same outcome: The short-term, research-focused nature of EPA funding prevents states from integrating rapid wetland assessment tools into regulatory practice.

3.5 Corps-EPA interactions

This is the first in a series of sections that explains how the EPA, Corps, and state environmental agencies interact to create outcomes that stymie state-level efforts to integrate rapid wetland assessment tools in regulatory practice.

Figure 4-1 noted that the Corps and the EPA are often divided by tensions and engage in limited coordination over wetland activities. A large literature documents fights between the agencies, generally occurring at the headquarters level, over their shared mandate for wetland management. A rational choice institutional analyst would find these

struggles quite explicable, since that mandate is a "social institution[s] [produced] in the process of seeking distributional advantages" (Knight 1992, 107). Houck (1989) explains that, when the Clean Water Act was drafted, the agencies were given joint wetland management authority as a compromise. The Corps had traditionally regulated activities in navigable U.S. waters, but environmental interests feared the Corps would prioritize commerce over environmental protection. Industrial and military interests were concerned that giving the newly created U.S. Environmental Protection Agency authority over navigable waters would harm the economy and compromise the nation's ability to protect itself from harm via its waterways. Congress settled on making the agencies jointly responsible for national-level wetland regulation, with frequently frustrating results (ibid.). This outcome is just what a historical institutionalist—concerned with the over-time implications of institutionally enshrined power struggles—might have expected.

For example, the Corps has been criticized for not requiring wetland permit applicants to address concerns raised by EPA reviewers, while EPA regulators have been criticized for not holding up more Corps permit decisions (GAO 1988; Griswold 1990). The Corps and the EPA have regularly failed to agree on standards for interpreting wetland guidance and regulations (Griswold 1990). The agencies have often disagreed over the extent to which a proposed project actually is water dependent, when compensatory wetland mitigation is necessary, division of responsibility for enforcement, and more (Griswold 1990; Houck 1989; Mortimer 1998). Until as recently as 2002, the Corps and the EPA did not even employ the same definition for "fill material" (Martin 2010), even though agreement on that point seems critical for agencies that regulate the insertion of such material into wetlands.

The discord between the EPA and the Corps over wetland regulation makes the tool adoption dilemma even more difficult. "The EPA has the resources to fund development of these sorts of tools, but in many cases there's not that much communication between the EPA and the Corps on the need for the tool or the likelihood of the district using it. In other words, they're developed almost in a vacuum . . . it would be truly useful if there was more communication," commented one Corps regulator (B333: March 7, 2011). An EPA official whose job is to promote assessment nationwide said, frustrated, "You would think that, after all these years, Region 3 would be sending comments to Corps districts saying their [the regional office's] favorite method. . . . [But they don't], so I said, 'Screw it.' . . . It's not going to play out on the [inter-agency] regional level" (C796: March 23, 2010).

3.6 EPA-state interactions

Because of the Clean Water Act water quality reporting mandate, the EPA wants state environmental agencies to set wetland water quality standards and provide data on standard attainment. The EPA has, perhaps aspirationally, argued that "state monitoring programs can be upgraded to include all of the elements [necessary to yield such data] . . . by 2014" (EPA 2006, 3). To this end, EPA Region 3 facilitated the 2001 creation of the Mid-Atlantic Wetland Workgroup, a collaboration of Mid-Atlantic state wetland bureaucrats (including Ohioans) with assessment responsibilities, and substantially funds the group (C858: Dec. 8, 2010). "The primary objective of the Mid-Atlantic Wetland Workgroup is to . . . facilitate the development and implementation of wetland monitoring strategies . . ." (MAWWG n.d., online).

The EPA's actions are explicitly functionalist: the agency forged institutional relationships between Mid-Atlantic state environmental agencies so that agency staff would share assessment strategies and hopefully overcome their long-standing failure to collect wetland condition data. And indeed, state bureaucrats involved in assessment and regional experts cite the workgroup as influential in state tool adoption efforts (e.g., A009: Oct. 21, 2010; A266: Nov. 4, 2011; A397: Dec. 13, 2011; A778: Dec. 14, 2010; C104, C193: Oct. 30, 2010; C114: March 23, 2011; E663: Nov. 23, 2010; F042: Nov. 15, 2010).

The EPA leverages funding for the same end, prioritizing WPDG proposals intended to help state officials develop comprehensive wetland monitoring and assessment programs (EPA 2011c). As noted in Figure 4-1, funding is the agency's primary mechanism of influence over states in this policy arena. A knowledgeable official estimated that 95% of the funds the state agencies in this investigation (besides the Ohio EPA) devote to monitoring and assessment come from the EPA (C104: Oct. 30, 2010). The Ohio EPA has similarly received substantial EPA support (C114: March 23, 2010, C306: March 24, 2011). This funding is critical for state-level assessment efforts. Asked whether her state's assessment effort would go forward without EPA money, a Virginia bureaucrat said, "Probably not . . . we would not be at the point we are today without it. . . . We wouldn't still be continuing with it [the adoption attempt]. To have EPA funding has been very, very important for us . . . a lot of states wouldn't be where they are without it" (A323: Nov. 29, 2010).

The behavior of the EPA and state environmental agencies is explicable from the sociological angle, which both expects organizations to adapt to their environments (Carroll 1984) and for organizations to seek to shape those environments through explicit

manipulation and/or via the creation of cultures, narratives, and cognitive frames (Meyer and Rowan 1977; Pfeffer and Salanick 1978). State agencies are adapting to the policy environment created by the EPA, and the EPA is seeking to manipulate that environment by using political tools (e.g., programmatic funding) and by establishing a sense of shared purposed and identity among Mid-Atlantic wetland bureaucrats involved in assessment work.

Cooperative environmental federalism involves carrots such as funding and sticks such as withdrawal of funding (Fischman 2005). The mechanisms noted above are carrots, but the EPA may be ready to use more stick-like measures to secure wetland data from states. Starting in fiscal year 2011, state agencies applying for WPDGs were strongly encouraged either to have roughly five-year plans outlining how proposed activities would fit into the state's wetland program or to seek funding to draft such plans; the plans are supposed to contain provisions for wetland assessment (EPA 2006; EPA 2010; C858: Dec. 8, 2010). While the plans are billed as voluntary, the EPA has indicated that it will give extra points in the grant competition process to plan-associated projects (EPA 2010). A state wetland program's potential receipt of Clean Water Act Section 106 Performance Partnership Grants also will be positively influenced by the state having a wetland program the EPA considers appropriate and complete (EPA 2006, 12).

The rational choice perspective which understands institutions as bargains suggests that the actor with more power generally receives the greatest benefits from an interaction (Osborne and Rubenstein 1990). The historical approach points out that the powerful actor enshrines those benefits in an institution which is then entrenched over time (Peters 2005). If "a player who has less to lose from a breakdown is more likely to risk one" (Maynard-

Smith 1982, 153), and the EPA knows that state wetland programs depend on the agency's funding, then the EPA's pressure on state officials to comply with its tool development priorities is entirely expected, as should be state acquiescence. More puzzling is why has the EPA spent nearly twenty years persistently, patiently, and—in terms of the end goal, relatively unsuccessfully—funding state-level assessment efforts rather than using a hard stick.

One possible answer lies in the power state agencies hold over the EPA. The EPA needs state officials to collect data for the agency to submit to Congress. If state actors do not execute this task, the EPA is obligated to try—but the agency lacks the requisite resources. Those resource limitations are why NWCA is a single probabilistic survey effort rather than a comprehensive one with multiple, similarly comprehensive planned iterations. State agencies may have been stringing the EPA along for years, supporting their core wetland programs with federal monies, because they knew that the EPA was unlikely to risk a breakdown in its relationships with its state collaborators. Said the EPA official charged with encouraging assessment tool adoption, "I've tried with the EPA regions [to get them to say to states], 'Well, you apply your [assessment] method, whatever method you want, and send a letter to the Corps saying . . . this is what we are going to do.' [But they] can't get it done" (C796: March 23, 2010).

Sociological and historical institutionalism offer other explanations which do not exclude this rational choice account. The EPA might be unwilling to play the heavy in this arena because its organizational logics of appropriateness make this identity uncomfortable, perhaps even implausible:

> It's hard for the EPA, I think, to require the states [to do things], like [say], "We are going to hold other money hostage if you don't add this to your

> standards within four years or something." . . . They just can't do that. It totally destroys the relationship they have with the states, and so they don't want to do that. They—[for them] it's all cheerleading and giving people good incentives, funding, training, [and] models they can use so that they can more easily adopt what the EPA considers to be a more appropriate approach. (F693: Dec. 27, 2010)

Although the EPA now officially prefers that grant-receiving states have wetland program plans which include provisions for assessment, the sociological perspective might suspect that the agency will interpret this mandate loosely. After all, a 1992 publication by an EPA wetland official maintained that "states in the United States are required to develop water quality standards for their wetlands by the end of Fiscal Year 1993" (Robb 1992, 143). Yet two decades later, only about a quarter of states have such standards, including just one of six in this investigation—and yet all six states have consistently received EPA wetland grants. This intuition is further supported by the fact that the EPA announced in 2009 that grant applications consistent with approved program plans would receive extra points during selection, but just a year later softened the mandate, announcing that even applications proposing to develop plans could receive the extra points (EPA 2009b, 2010).

From the historical perspective, decades ago the EPA established a dynamic wherein state agencies became dependent on EPA funds to run their wetland programs. Even though the EPA now wants state agencies to accomplish certain goals that many are not attaining, such as setting wetland water quality standards and deploying tools to measure their attainment, the EPA also wants state agencies to continue protecting wetlands and knows they need funds to do so. Moreover, when the EPA decided that it would report state-collected water quality data to Congress, it forestalled its own development of capacity to gather such data independently. The EPA locked itself into a pattern of mutual dependence with state agencies from which both sides find deviation difficult (see North

1990). Unfortunately, that lock-in is steering EPA and state officials towards condition-focused tools that Corps regulators reject. And, as Section 3.7 explains, it is tough for a state wetland program to contradict Corps preferences.

3.7 Corps-state interactions

As indicated in Figure 4-1, the Corps' primary mechanism of influence over state agencies is regulatory dominance. The power asymmetry in these regulatory arrangements seems to imply that if a rapid wetland assessment tool were to be used in wetland regulation, it would be by the Corps' explicit choice (in Delaware, Ohio, and West Virginia) or by a choice made in Corps-dominated negotiations with state officials (in Maryland, Pennsylvania, and Virginia).

Because the latter three states are delegated some components of the Section 404 permitting program and have joint permitting processes with the Corps, state environmental staff and regulators at the Corps districts with relevant jurisdiction coordinate on the kinds of data permit applications will request and the protocols, such as assessment tools, that will be used to evaluate sites. Said one state bureaucrat, "Since the Corps is still the main regulatory entity in a lot of places, they have a lot of force. They're the ones that are still making the minimum requirements of any program. So even if a state has a regulatory program, it's just that they have an agreement with the Corps and they are working with them to issue permits. The Corps still has jurisdiction over all wetlands in all the Mid-Atlantic" (A941: Nov. 15, 2010). Observed another expert, "Virginia has its own state wetland regulatory program [but] the bottom line still falls to the Corps to make a determination whether a water or a wetland is jurisdictional" (D019: Feb. 8, 2011). Multiple

EPA regulators said that when state agencies and Corps districts partner on wetland regulation, Corps officials have to be onboard with the state permit process (C104, C193: Oct. 30, 2010; C858: Dec. 8, 2010; C796: March 23, 2010).

This account is consistent with the strains of rational choice and historical institutionalism which focus on how institutions are shaped by the relative power of the actors involved. The Corps has leverage over state wetland bureaucrats and so Corps officials and policies substantially influence state permitting protocols. It is also often rational for state bureaucrats to follow the lead of Corps officials in regulatory affairs because many state environmental laws mirror federal ones (LII 2010). Corps wetland bureaucrats can provide state officials with relevant models of practice without state actors having to do extensive independent research. Overall, state bureaucrats' transaction costs are often lowest when they accept rather than try to buck the preferences of Corps regulators.

The historical approach would point out that because the Corps as an institution won out over the EPA in the agencies' past conflict over primary control of federal wetland regulation, the Corps continues to play a more central role in the work of state wetland bureaucrats. Moreover, state wetland bureaucrats often interact more frequently with Corps staff than with EPA regulators. Corps regulators process wetland permits in concert with or at least alongside state officials, whereas EPA officials receive permits from the Corps for review and may not interact with state bureaucrats in this process. There are some general permits which the EPA does not review individually; the EPA also is not always involved in enforcement. The sociological perspective would argue that it is thus reasonable for state bureaucrats to align themselves with the preferences of the Corps because those preferences

are rooted in norms and standard operating procedures into which those bureaucrats are socialized through their day-to-day work with Corps officials.

In theory, state bureaucrats could flip the power dynamic with the Corps and make application of a rapid wetland assessment tool a condition of Clean Water Act Section 401 water quality certification. However, state officials rarely take such a stand. They know that applicants resist having different standards imposed on them (B088: March 17, 2011). Corps regulators affirm that "It makes no sense to have two different ways of doing things [state and federal] because then we're putting applicants through two different . . . scenarios" (B205: March 15, 2011). And yet Corps officials would do just that, or at least threaten to do so; a Corps district regulator said that if a state agency and the Corps had different preferred assessment protocols, the Corps likely would not coordinate with the state agency and the applicant probably would just have to evaluate its site using the Corps' protocol and then the state's (B088: March 17, 2011). Corps districts appear unwilling to bend and so state agencies do instead: ". . . [S]tates like West Virginia have been unwilling to buck the Corps' permit proceedings" (Doremus 2009, online). A state bureaucrat there said of the Corps, "We're at their complete mercy, and basically [all] the federal agencies. And that's what drives our program. If they change their direction, then we have to change our direction. And it's because we get crossways, and the state regulators do not like to have something different from the federal government that requires business to do something twice as much or different" (A931: Dec. 14, 2010). The norms of acquiescence to federal authority into which state bureaucrats are socialized, the fact that the wetlands' regulatory buck ultimately stops with the Corps, the frequent alignment of state and federal environmental laws, and the fear that applicants burdened with different and confusing mandates could raise a political ruckus

that might imperil perpetually resource-strapped state wetland programs (F840: Oct. 13, 2010) all mean that the Corps significantly influences state regulatory processes and state regulatory programs have significant incentives to accept that influence. That influence steers state agencies away from using assessment tools in wetland regulation.

3.8 Preliminary inferences about the state-level tool adoption problem

This section briefly summarizes how the incentives, constraints, and dynamics just described lead to the state-level adoption stall identified at the bottom of Figure 4-1. First, the Corps' organizational norms, standard operating procedures, rules, and past experience with regulatory application of assessment tools make the agency wary about state agencies embracing such tools. To the extent that Corps regulators might be amenable to tool use, they have incentive to embrace function-focused tools.

Second, the EPA provides nearly all the funding state agencies have been using for decades to develop wetland monitoring and assessment programs. State officials often indirectly use these monies to fund their core state wetland programs. State environmental staff are thus highly responsive to EPA funding. The Clean Water Act's water quality reporting requirements causes the EPA to encourage state staff to embrace condition- rather than function-focused assessment tools. The EPA's attempts to get state agencies to deploy such tools, however, are hampered by time-limited grants that cannot support implementation.

Third, the EPA and the Corps have a history of conflict over wetland management that makes the agencies unlikely to harmonize the assessment pressures they exert on state actors. Although in their research, development, and wetland program planning activities,

state agencies are influenced and funded by the EPA, state-level wetland regulatory activities are influenced by the Corps. Even though state officials could flip this second power dynamic via Section 401, they rarely use this leverage.

In sum: The EPA is pushing state officials to develop condition-focused rapid wetland assessment tools that the Corps rejects. Neither federal agency offers state agencies sufficient support for tool adoption and subsequent deployment, so state-level assessment efforts generally stall before reaching those outcomes. However, this outcome is not inevitable. This chapter now turns to ways to avoid it.

3.9 The Corps may accept tools if state officials wield independent leverage

Despite these obstacles, state wetland bureaucrats sometimes perceive that tool adoption might be possible if they could educate Corps district regulators about the utility of the tools state officials are championing. The perception may also stem from knowledge that in a few cases—Ohio being the classic example—the Corps has accepted state-level tool adoption after being pushed to do so by state bureaucrats. State-led education efforts involve direct information dissemination, education by example, or both. An individual involved in developing West Virginia's tool provides an example of the first strategy:

> This year we're meeting with the Army Corps in Pittsburgh . . . and I'm just going to go through a walk-through of the tool and say, "Look how useful it is. Look at the output you can see from it. Look how this is going to help your permitting decisions." You have to be humble and play the game. [You have to say], "Yes, most merciful Army Corps of Engineers people. I developed this sweet thing. Will you check it out for me?" And you make it look like you want their stamp of approval instead of, "Hey, I'm showing you what's up. This is something way better than what you guys have got. You should use it." . . . That's just how you approach it, how you sell it. (F042: Nov. 15, 2010)

Similarly, in 2010, Virginia environmental staff sent the Norfolk District information about the tool that state's environmental regulatory agency has been developing. Though the district did not provide much feedback, state bureaucrats say they are optimistic that continued efforts at communication will eventually convince the Corps to accept the state-championed approach (A323: Nov. 29, 2010). Pennsylvania officials have invited Corps regulators to field days at which the state environmental staff demonstrated use of its draft tool (A369: Dec. 13, 2010; B312: Feb. 22, 2011; A868: Nov. 15, 2010). Delaware bureaucrats have similarly tried to reach out to Corps regulators (C104: Oct. 30, 2010). The leaders of the Mid-Atlantic Wetland Workgroup have been trying for years to get Corps representatives to attend workgroup meetings and learn about state assessment tools, and in 2010 some district regulators finally showed up (ibid.).

Environmental agency staff in Virginia and Pennsylvania are considering using the second strategy, which is made possible by their state-level wetland laws and regulatory partnerships with the Corps. Although the Corps' historical dominance in wetland regulation has established strong path dependencies which make it difficult for state officials to bring their independent regulatory activities out of step with the Corps, interviewees say these states are nonetheless considering doing just that (A369: Dec. 13, 2011; C104: Oct. 30, 2010). State officials could use assessment tools in the regulatory activities they pursue in wetlands not considered federally jurisdictional. For the minor impacts whose Section 404 permitting the states have been delegated, state bureaucrats could make decisions informed by tools without having to coordinate with the Corps (B088: March 17, 2011). Referring to Pennsylvania, a Corps district regulator said that "applicants doing those activities [in the minimal impact categories] would automatically have to use this new state wetland

assessment protocol. So the Corps would have to accept the tool" (ibid.). Once the Corps grows accustomed to the state agencies using assessment tools for a limited set of small impacts, state officials hope the federal agency will accept broader tool use:

> It's not going to be meaningful to them [the Corps] until they see it actually being used and it somehow impacts what they are doing. . . . What I would predict for Virginia is that once the state is using it [the tool] on a routine basis and it makes sense, the Corps is not going to have a problem with it. And so much of what they do in terms of permitting in Virginia is done at state programmatic general permit level,[55] so the Corps really doesn't have a lot of say. If they [the Corps] start seeing that it's being used for . . . decisions that they might not agree with, then it might become a problem, but at that point you'd hope that they'd want to work it out instead of say, "Hey, we're going to do our thing that's completely different from your thing." (C104: Oct. 30, 2010)

Pennsylvania officials appear willing to use an even more confrontational version of this second strategy. State environmental bureaucrats have explicitly threatened to use their (until now mainly theoretical) power over the Corps—the state's usefulness to the Corps in reducing that agency's day-to-day permitting burdens—to get the Corps to consider the state's assessment tool:

> Yeah, we [state wetland bureaucrats] were meeting regularly [with the Corps about assessment] and then we kind of broke it off, and then it got a little nasty. At one point they told us they weren't allowed to comment or make any recommendations on our tool development. Then we politely told them, "Well, then I guess . . . you can have your [Section] 404 program back." And that pretty much got them to say, "Okay, we'll provide comments next week" . . . They came back to the table quickly. (A369: Dec. 13, 2010)

The notion that Corps districts could endorse a rapid wetland assessment tool, or at least—gradually and over time—accept its adoption by at the state level, is not totally implausible. The Corps' dominant agency-wide norms of hierarchy and centralized control

[55] This is the level at which the state is delegated some Section 404 implementation responsibilities.

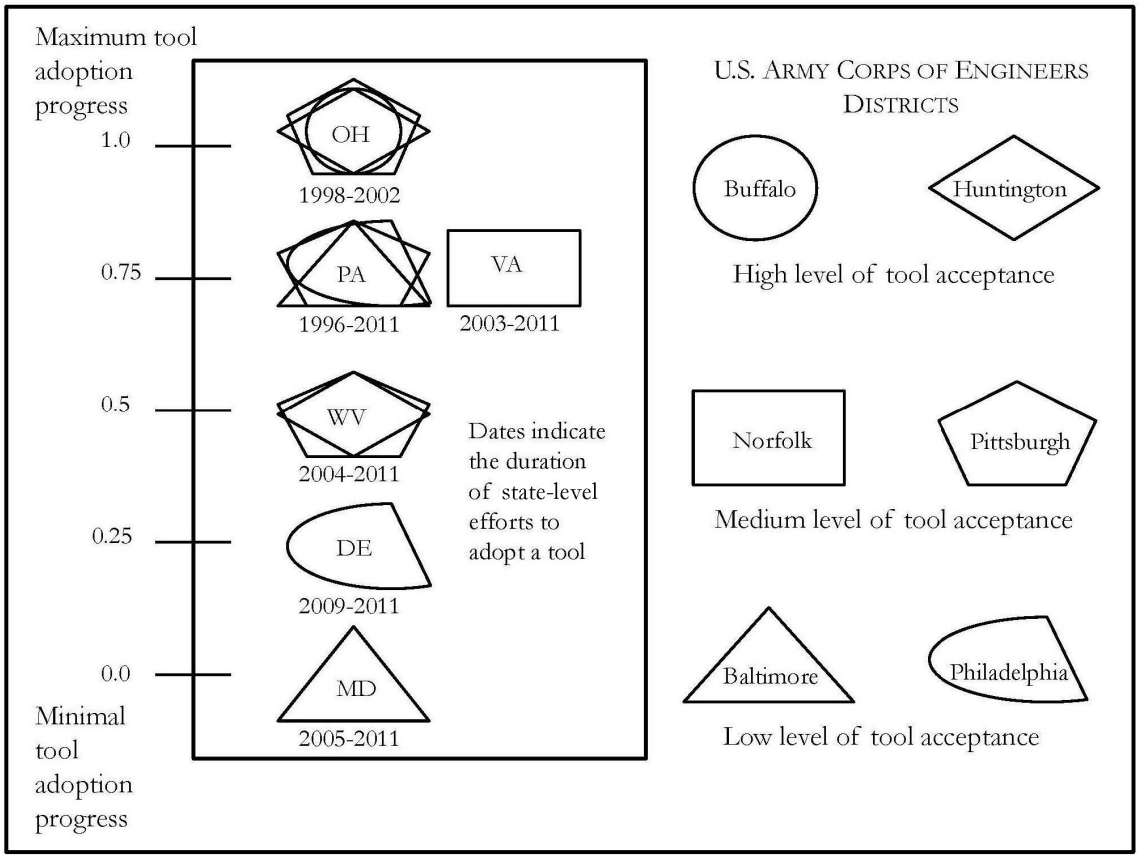
sometimes appear at odds with divergent Section 404 implementing activities of Corps districts. In 2004, the U.S. General Accounting Office reported that districts vary substantially in their understanding of "waters of the United States," a phrase whose interpretation directly affects the scope of federal jurisdiction over wetlands (GAO 2004). Interviewees depicted Corps districts as having different norms, shared value systems, and practices (e.g., A941: Nov. 15, 2010; C104, C193: Oct. 30, 2010; C114: March 23, 2011; C858: Dec. 8, 2010; D557: Dec. 27, 2010; D971: Dec. 22, 2010; D725: Feb. 7, 2011). One noted that "The [regulatory] calls can really vary . . . among the Corps districts . . . Pittsburgh [District] always used to be accused of—well, you could take Pittsburgh out, show them anything, and they would permit [it], no questions asked. And then you had the other end of the spectrum, where Philadelphia [District] was extremely [tough], very painful. Their requirements were just at a much higher level" (A868: November 15, 2010).

This divergence, and its association with state-level tool adoption progress, can be depicted visually in Figure 4-2 below. On the right side of the figure, each Corps district with jurisdiction in the region is assigned a shape.[56] The districts are roughly sorted into three categories indicating the extent to which interviewees suggested district regulators are accepting of regulatory assessment. The boxed area contains the abbreviation for each state and, below, the years over which state officials have been pursuing a regulatory assessment effort. The shapes corresponding to the Corps districts with jurisdictions in each state are

[56] No Huntington District regulators were interviewed. During data collection, the district was being sued over a stream assessment tool it had used and would not allow comment on any type of assessment. Inferences about that district were made based on insights offered by other interviewees.

superimposed over each state abbreviation.[57] The states are arrayed in the box according to an ordinal variable on the left vertical. That variable is described in Section 1.5 of Chapter 2's Appendix 2-1; it denotes the progress of a state toward tool adoption.

Figure 4-2. State-level tool adoption progress and current attitudes of Corps districts towards regulatory assessment[58]



[57] The Baltimore District manages wetland regulation in Maryland; in Delaware; the Philadelphia District; in West Virginia the Huntington and Pittsburgh Districts, in Pennsylvania, the Philadelphia, Baltimore, and Pittsburgh Districts; in Virginia the Norfolk District; and in Ohio, the Buffalo, Huntington, and Pittsburgh Districts (though the latter has less coverage in the state than the other two) (EPA 2012a, 2011a).

[58] Figure 4-2 offers a snapshot of the attitudes of Corps districts and the tool adoption progress of state environmental agencies as of this writing, and therefore at the end of the time period this dissertation examines. An earlier picture would have been different. For example, roughly a decade ago, the Corps districts with jurisdiction in Ohio were unenthused about that state's assessment tool. Figure 4-2 also does not indicate how long a state has been at its present adoption status. West Virginia's environmental staff members, for example, have made relatively rapid and

The recognition that Corps districts exhibit distinct attitudes and behaviors could suggest to state bureaucrats that districts might embrace a state-championed tool rather than feel bound by whole-organization logics of appropriateness. Comments from some interviewees appear to offer hope. One Baltimore District regulator said that her district might accept Pennsylvania's tool if district regulators could learn more about it (B088: March 17, 2011). A Norfolk District regulator noted that the district recently collaborated with Virginia environmental staff members to develop a rapid stream assessment methodology, and that the district could eventually accept a state-proposed rapid wetland assessment tool (B907: Feb. 14, 2011). A West Virginia bureaucrat said that Huntington District is "fully backing" state officials' tool adoption efforts (A030: Dec. 17, 2010).

However, there are at least two reasons, linked to the Corps' organizational culture, why districts may be slow to accept state-championed tools. First, although Corps districts sometimes vary in their interpretation of implementation mandates, they rarely vary in their acceptance of policy guidance and research products from administrative superiors. Every Corps district uses the *Corps of Engineers Wetland Delineation Manual* (USACE 1987). Corps districts all complete the same jurisdictional determination forms, follow the same public notice procedures, and follow the same prioritization scheme for compensatory mitigation. Historical precedent has taught district regulators that rapid wetland assessment tools are not a discretionary choice, but rather a policy product handed down—or not—from the agency's research command, ERDC.

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steady progress (C104: Oct. 30, 2010), whereas the effort in Pennsylvania appears to have been treading water in recent years (A868: Nov. 15, 2010; A992: Dec. 13, 2010; C796: March 23, 2010).

Second, the fact that Corps districts are generally ill-equipped to pursue their own research may be a problem. District regulators, like the Baltimore District official cited above, likely will want evidence that a state-championed tool works. They are unlikely to gather or analyze such evidence themselves. Yet even if state officials present such evidence, district regulators may still have reservations simply because the data and the tools were not produced or vetted by ERDC. However, seeking ERDC approval would be tantamount to seeking headquarters-level approval of an assessment tool, returning to the norms of centralized control, deference to superiors, and resistance to change that inhibit districts from embracing tools in the first place.

Corps districts may accept a state-championed assessment tool if they are convinced by information disseminated by state officials or by the state's example of tool deployment in its independent wetland regulatory activities. However, both strategies appear to face obstacles, not least of which is states agencies' reluctance to challenge the Corps' regulatory preferences. This section did not discuss the biggest potential source of leverage state officials have over the Corps—Section 401 certification—because most state actors seem unwilling to use this authority. The next section will show, however, that rigorous use of Clean Water Act Section 401 water quality certification can help state agencies adopt rapid wetland assessment tools.

4.0 State-level adoption of a rapid wetland assessment tool for regulatory use despite the odds

Ohio has had a notably active Section 401 certification program since the early- to mid-1990s (B077: Feb. 22, 2011; F693: Dec. 27, 2010). In states such as Pennsylvania and Virginia, Section 401 certification is folded into other permitting processes which state

agencies often pursue jointly with the Corps; certification is automatically granted once other permit conditions are met. In others, like West Virginia, only a bare-bones staff runs the Section 401 program (A030: Dec. 17, 2010). However, Ohio has nine staff in nine regional offices who work on Section 401 certification, and at least two additional staff who handle mining-related Section 401 permitting (OEPA n.d., F303: Nov. 18, 2011). In Ohio, Section 401 certification requires that a wetland slated for impacts be evaluated using a rapid assessment tool; permits are conditioned on the results of that evaluation. If an entity damages a wetland without first securing certification, the Ohio EPA (OEPA) assumes that the wetland was of the highest quality and requires a commensurately large and potentially costly amount of mitigation (B191: Feb. 17, 2011). State officials used their Section 401 leverage over the Corps to secure state-level adoption of the Ohio Rapid Assessment Methodology (ORAM).

Interviewees said that Ohio has a strong Section 401 program because the OEPA has historically been a strong, progressive agency, despite the state's history of political conservatism stereotypically at odds with rigorous environmental protection (F303: Nov. 18, 2011). OEPA has a history of "wanting to do things at a certain [high] level" and of gaining political support for its activities (C306: March 24, 2011). A Section 401 certification coordinator for the state in the early 1990s explained that, until that time, the Corps regularly issued blanket Section 404 permits for multiple acres of wetland impacts with Section 401 certification built-in through a priori state-federal agreements that prevented state officials from policing many wetland impacts. When the Corps phased out this practice, OEPA built up its skeleton Section 401 program to create today's more rigorous one (F693: Dec. 27, 2010). "Ohio, from the get go, has been very strong in using their 401 certification. . . . I'm

not sure, [maybe] it's just an agency thing, and for whatever reason, you know, it worked politically, and so they've just built this huge program and essentially the state's calling the shots through their [Section] 401 certification and the Corps is happy to work with them on most of it" (C306: March 24, 2011).

These accounts are consistent with a sociological institutionalist's analysis of OEPA, which would focus less on the origins of the organization's culture and more on that culture's day-to-day influence (Hall and Taylor 1996). A historical perspective would argue that the agency has built up a reputation for environmental protectiveness which is powerful in part because it has persisted over time, becoming a taken-for-granted dimension of the state's political landscape (e.g., Peters 2005). Historical institutionalism also uses key past junctures to explain present structural arrangements (Ma 2007), and OEPA's decision to use the Corps' regulatory shift to build the state's Section 401 program appears to be an important explanation for the agency's current clout.

Ohio officials also gained leverage over the Corps and positioned the state for tool adoption by establishing in 1998 the wetland water quality standards that the EPA had long been advocating. This decision came about in part because, since 1992, state officials had been in litigation and debate with environmental groups which were arguing that the state's provisions for public hearings associated with its generally applicable water quality standards and associated anti-degradation provision were less extensive than demanded by the Clean Water Act (Rivers Unlimited 1997). This fight continued until 1997, when the environmental groups' stance was affirmed in court. This was a critical juncture of the type highlighted by historical institutionalists. That decision pushed the involved parties into a negotiated rulemaking which led to adoption of wetland-specific water quality standards and, in 2003,

to a revised anti-degradation provision[59] applicable to other state waters (EPA 2000; OEPA 2003; A009: Oct. 21, 2010).

Ohio's wetland standards were not required by the court, however. Their adoption was motivated by at least three factors. First, there was interest among diverse stakeholders in improving Ohio's wetland protection policies (A041, A343: Nov 18, 2010). The Ohio Wetlands Taskforce, which included representatives from environmental, business, and agricultural groups (ELI 2008), was established in 1992 to develop better strategies for managing Ohio's wetlands (ASWM n.d., A041: Nov. 18, 2010). In their 1994 *State Wetland Conservation Plan*, the group's members called for the state to adopt wetland water quality standards so that Ohio officials could better protect wetlands via Section 401 certification (A041: Nov. 18, 2010). The group remained active through the late 1990s (ELI 2008) and may have viewed the negotiated rulemaking as an opportunity to advance the wetland cause. One interviewee attributed the wetland standards at least in part to ". . . so many people complaining about the wetlands program. You know, sometimes the squeaky wheel . . ." (A119: Nov. 19, 2011).

Second, at the time of the larger rulemaking, OEPA had a staff biologist whose only charge was wetland policy-relevant research (F303: Nov. 18, 2010). Dr. Siobhan Fennessy recognized the importance of wetland water quality standards and of developing a tool that could help state bureaucrats easily evaluate whether projects met those standards. Many interviewees attribute Ohio's tool adoption success to the expertise and commitment of Fennessy and her successor, John Mack (e.g., D336: Feb. 3, 2011; A009: Oct. 21, 2010, A141: April 21, 2011; F593: Feb. 10, 2011; F693: Dec. 27, 2010; C306: March 24, 2011).

[59] Anti-degradation provisions are explained below.

Third, by the late 1990s, Ohio environmental staff had a relatively long history of employing scientifically rigorous stream assessment (C306: March 24, 2011; D336: Feb. 3, 2011; A476: Nov. 19, 2010; A041: Nov. 18, 2010; A380: Nov. 18, 2010; F303: Nov. 18, 2010). State officials evaluate streams using the Qualitative Habitat Evaluation Index (QHEI), a condition-focused tool developed by OEPA in 1987 and rooted in principles of biotic integrity analysis pioneered roughly 10 years earlier (Gorman and Karr 1978; Karr et al. 1984; OEPA 1987; Rankin 1989).

> By the time . . . [state officials began developing wetland water quality standards], we had a rapid stream assessment procedure that was remarkably well developed and thoroughly documented. Ohio was one of the first states to get involved in [using] indices of biotic integrity. And they really did it right. . . . guys went all over the state collecting a ton of data on streams and really figured it out. (D336: Feb. 3, 2011)

This historical precedent helped convince Ohio bureaucrats that it was plausible to evaluate complex aquatic ecosystems such as wetlands using biological (that is, condition-focused) indicators (A030: Dec. 17, 2010). The well-established and fairly pervasive use of QHEI showed Ohio bureaucrats that a condition-focused assessment tool could be implemented rapidly and widely across the state.

The above account appears to mix explanations for state-level adoption of ORAM and wetland standards because those outcomes were intertwined. When state decision-makers adopt water quality standards, wetland specific or otherwise, they also must adopt an anti-degradation provision that sorts waters into three tiers. First-tier waters are of the lowest quality; water quality standards must ensure that these waters can continue to serve their existing uses. Second- and third-tier waters have greater quality (in ascending degree) and the protections states afford these waters, as codified in water quality standards, must be commensurately more stringent (EPA 1994). By adopting wetland standards and an

associated anti-degradation provision, Ohio officials were committing state environmental staff to sorting wetlands into three tiers with associated standards and using Section 401 certification to regulate wetlands accordingly (A009: Oct. 21, 2010).

A Section 401 permit reviewer in the late 1990s said ORAM was developed because

> . . . the regulated community that said they wanted it. What we were coming up with was a tiered set of protections for wetlands. . . . And the regulatory community said, "That's all fine and good, but we're not going to agree to that until you come up with a way to quickly put a wetland into one of those categories." They didn't want it to be a best professional judgment argument between their consultants and the regulators. They wanted an objective tool that would do that [the categorization]. And so the agency [OEPA] said, "OK, we'll commit to developing that tool." At the same time, we were going forward with the [larger negotiated] rulemaking. (A141: April 21, 2011)

Other interviewees echo this point (e.g., A230: Nov. 19, 2010; A380, A949: Nov. 18, 2010). It is one a rational choice scholar would understand: ORAM as an institution was created as a political compromise between the regulated community and regulators. Wetland water quality standards were adopted in 1998 and ORAM was being developed and revised at the same time (A009: Oct. 21, 2010; F593: Feb. 10, 2011).

ORAM is a condition-focused tool. It gives users some latitude to consider functions, but fundamentally the tool asks users to make regulatory choices based on the biotic integrity of the wetland. Sections 3.2 and 3.3 described why a condition-focused orientation often derails tool adoption efforts. There are at least three reasons why this did not occur in Ohio.

First, path dependencies and existing institutional knowledge steered OEPA staff members, many of whom had used the state's condition-focused stream protocols, towards developing a condition-focused rapid wetland assessment tool. Staff members were aware of the pitfalls associated with aiming to preserve condition potentially at the expense of

function (F593: Feb. 10, 2011; F693: Dec. 27, 2010), but "Ohio just decided that was the best way for them to go forward with their regulatory program, and that they would take the chance [that some wetlands with high functionality and poor condition would be lost] and then have the opportunity to protect the best of the best through [ORAM]" (C104: Oct. 30, 2010). Moreover, Siobhan Fennessy was critical in shaping ORAM and her training as a biologist encouraged her to embrace a condition-focused, whole-ecosystem perspective on wetland evaluation. She has, in scholarly publications and national science and policy forums, defended as legitimate this approach to wetland protection (F303: Nov. 18, 2010; E763: Nov. 5, 2010). This explanation is consistent with historical institutionalism's emphasis on present structural arrangements being shaped and constrained by past choices and investments.

Second, the function versus condition debate is substantially driven by the language of Clean Water Act Section 404 and associated obligations of Corps regulators. However, by regulating wetlands via Section 401 certification and not working with the Corps on Section 404 permitting, Ohio insulated itself to a degree from the Corps' regulatory priorities. Some rational choice scholars emphasize the importance of venue-shifting in institution creation (e.g., Ostrom 2005): actors seeking to maximize their benefits from institutional arrangements push choices about institutional structures into arenas where they have the most influence. For Ohio wetland stakeholders, this meant making OEPA offices in Columbus, not Corps district offices in Buffalo or Huntington (and to a lesser degree Pittsburgh), the main locus for wetland regulatory choices. While the Corps had some representation in the working groups that helped develop Ohio's wetland water quality standards and ORAM (A009: Oct. 21, 2010), interviewees recalled that the agency generally

provided minimal input (e.g., A141: April 21, 2011; B616: February 14, 2011). Overall, Ohio's wetland efforts in the late 1990s drew in many stakeholders from inside the state but did not similarly engage external sources except to the extent that OEPA staff researched tools developed elsewhere. Said one state bureaucrat closely involved in ORAM's development, "We did it all in-house [and] . . . that's served us really well . . . [That focus] allowed us to understand what needs to be in it [ORAM] to make it workable . . . we can work closely with [our] staff to make sure that they have a very strong understanding of how the tool works and how it can be incorporated into the regulatory program" (A230: November 19, 2010).

Third, the regulatory language that most significantly influenced the efforts of Ohio officials is not Section 404's language of function, but rather the language of conditions in Part 131 of Title 40 of the *Code of Federal Regulations*,[60] the regulations promulgated by the EPA concerning water quality standards. Part 131 describes the anti-degradation provisions with whose thresholds state water quality standards must align. Part 131 repeatedly references "water quality," a quantity which can be measured by evaluating condition (EPA 1994). The institutional mandate of Part 131 led to Ohio's wetland anti-degradation provision, to wetland standards developed pursuant to Clean Water Act Section 303, and to state-level adoption of a condition-focused rapid wetland assessment tool.

Section 3.4 explained how constraints on EPA wetland funding hinder states from integrating rapid wetland assessment tools into their regulatory programs. Although OEPA faced the same constraints, there seem to be two reason why they did not prevent ORAM's

[60] *Code of Federal Regulations* 40 Part 131 (1983).

adoption: the skillful leveraging of funds by Siobhan Fennessy's successor, John Mack, and commitment by OEPA to ORAM.

Mack had a unique background, including a law degree and a master's of environmental science, that well equipped him to shepherd the tool developed by Fennessy and others into a regulatory product used statewide. One of Mack's particular skills was managing EPA funds:

> John went in, and you can look at his state grants and [see] how he built, brick by brick, his program. He had a strategy. . . . [he] used that money both to build his staff and to put down the basis for an administrative rule so that it supported his program. He knew he had to get it [ORAM] into the [state's] regulations. . . . All the goods [e.g., policy products] that supported that [wetland program's] structure are paid for through the [wetland program development] grants. (C114: March 23, 2011)

Mack knew that once use of a rapid wetland assessment tool was mandated by the Ohio administrative code, state-level funding for tool implementation would be more secure. Consequently, he pushed for the 1998 formal rulemaking which ultimately stated that "In assigning a wetland category, the [OEPA] director will consider the results of an appropriate wetland evaluation method(s) . . ."[61] That method invariably is ORAM (A041: Nov. 18, 2011; A230: Nov. 19, 2010; F303: Nov. 18, 2010). This activity is consistent with Moe's (2005) rational choice account of policy actors choosing institutional structures that will best secure the actors' goals in an uncertain future. Historical institutionalism emphasizes that entrenched institutions are difficult to change because of the sunk costs of societal adaptations (Pierson 1996), complementing accounts like Moe's which emphasize the activity of particular actors, like Mack, to ensure those costs are sunk.

[61] *Ohio Administrative Code* 3745-1-54-B-2-a-ii (2002).

As Mack was pursuing this entrenchment, he also was securing a series of WPDGs from the EPA which underwrote research needs that he anticipated would occur during implementation (C114: March 23, 2011). "John Mack was a prolific grant writer. . . they [the EPA] would say, 'You need more funding?' And he'd say, 'Yeah, pretty much'" (A949: Nov. 19, 2010). OEPA has continued to obtain EPA WPDGs even after implementing ORAM, using them to support tasks connected to but not directly part of the implementation process (A141: April 21, 2011; A230: Nov. 19, 2010; A949: Nov. 19, 2010; F593: Feb. 10, 2011; D731: Feb. 8, 2011). Because OEPA uses grants for the research necessary to undergird ORAM, the agency only requires staff time to implement the tool (F303: Nov. 18, 2010).

This last observation leads to the second reason why federal EPA funding constraints did not stall adoption efforts in Ohio. As influential as those funds were, OEPA also invested in the tool, particularly during implementation. The EPA Region 5 wetland program coordinator noted that "We funded OEPA for a number of years. . . . and they continue to get grant money from us . . . [but] their agency was [also] willing to fund . . . the program" (C306: March 24, 2011). Federal EPA funding set in motion path-dependent processes which then garnered support at the state level: "I don't know that they would have gotten it [ORAM implementation] done without the fact that U.S. EPA funded a couple of [staff] positions which allowed [OEPA] to spend the time to . . . refine ORAM. . . . But the calibration of ORAM, the actual testing of reference sites, that was all done by OEPA's staff" (D731: Feb. 8, 2011).

The absence of the Corps from the Ohio case arguably facilitated ORAM's adoption, since the pressure the Corps exerts on environmental agencies in Pennsylvania and Virginia

appears to inhibit them from adopting tools for regulatory use. A fascinating dimension of the Ohio case is that, in exploiting its Section 401 leverage, the state's wetland program created a dynamic wherein the Corps, not the primary state environmental regulatory agency, has acquiesced to pressure for alignment exerted by the other level of government.

Because the Corps directly implements the Section 404 permitting program in Ohio and does not have a joint permitting arrangement with the state, applicants submit to the Corps a Section 404 permit application separate from the Section 401 certification documents they submit to OEPA. This two-stage process presumably is burdensome to applicants who probably would prefer greater streamlining. Over time, the Corps has facilitated this streamlining by accepting the categories into which ORAM sorts wetlands as a guide for the regulatory decisions the Corps makes pursuant to Section 404. Initially, however, the agency resisted this convergence. Recalled a former Ohio senior biologist:

> Back then there was a very strong adversarial relationship between Ohio EPA and the Corps. There were people at the upper levels . . . of the U.S. Army Corps Huntington and Buffalo Districts who were extremely resistant to their own authority. They were like, "Hey, you know, whatever. These are [just] wetlands. Yes, we have this authority [over them] and we are required to do this and this," but they [Corps staff] were not very protection oriented. They were more like, "Hey, we are the Corps of Engineers, not the Corps of Biologists. " . . . And so when they were dealing with a state like Ohio, which had such an aggressive protection program at the time . . . they were very resistant to Ohio taking too big a role in the Clean Water Act decisions . . . They were resistant to accepting Section 401 authority as anything more than a rubber stamp. (F693: Dec. 27, 2010)

Despite the Corps' unease, institutional attributes of the agency, including hierarchical deference and centralization of research capacity at the headquarters level, prevented Corps districts with jurisdiction in the state from developing alternatives to ORAM that they could give their regulators and applicants in Ohio. Most fundamentally, the Corps had no legal authority—no institutional mandate—or leverage over the state's Section

401 certification processes. In contrast, the state's condition-focused standards and protocols were being supported by the EPA, whose interest was only strengthened by the fact that these policy products could help deliver the data the EPA needs to provide to Congress. Virginia and Pennsylvania officials may have bent their programs to the Corps' will to reduce applicant burdens, but OEPA's relative strength and clout may have helped it resist pressures to bend first. Thus, the Corps was forced into passivity, waiting to see whether Ohio's new wetland protocols would make the Corps' Section 404 permitting responsibilities more difficult. "I think they were just waiting to see what kind of tool [OEPA] came up with, and then they'd evaluate it once [OEPA] had something" (A949: Nov. 19, 2010).

Over time, Corps districts with Ohio jurisdiction realized that ORAM actually could benefit them, reducing the transaction costs associated with their permitting operations. "The Corps doesn't necessarily use our tool," said the current Section 401 coordinator in Ohio, "but they understand our use of it. I also think that it helps them . . . [and] informs their decisions. Because if we say that something is a category 3 wetland, using our assessment tool, they're OK with that" (A041: Nov. 18, 2011). Staff at the Ohio Department of Transportation echoed this evaluation. "They [the Corps] have seemed pretty accepting of it [ORAM] . . . They kind of defer to OEPA and then say, 'OK, this looks good to us'" (A476: Nov. 19, 2010). Said another, "I don't remember them ever arguing over a category the OEPA had agreed with" (A280: Nov. 19, 2010).

Corps regulators say that using ORAM to inform their Section 404 decisions is now standard operating procedure in Ohio (e.g., B077, B804: Feb. 22, 2011; B616: Feb. 14, 2011; F593: Feb. 10, 2011). The relationship between Corps and state officials vis-a-vis wetland regulation has improved since ORAM has made the Corps' regulatory processes simpler. ". .

. The Corps and the state work together really well and very closely. And the Corps has no problem with using the ORAM stuff in Ohio. I think it makes their life easier. . . . [for them] it's kind of like, 'No muss, no fuss"' (C306: March 24, 2011).

For the Corps, accepting ORAM's wetland categorization scheme in Section 404 permitting made sense given the norms of implementation efficiency held by district regulators (March and Olsen 1984; Shallat 1994; Tarlock 2004). Ohio's Corps districts took advantage of a tool that helped their regulators process permit applications in a more timely and efficient manner (A141: April 21, 2011; B616: Feb. 14, 2011; B191: Feb. 17, 2011). The Corps districts likely were pleased that they could gain this advantage without having to endorse ORAM officially, since such action might have been difficult given the agency's organizational culture. State Section 401 certification simplifies Section 404 regulation without district regulators having to wait for ERDC to hand down an officially sanctioned assessment tool or having to seek explicit approval of ORAM from their administrative superiors. The district regulators' hands are tied in a way that largely suits their needs.

5.0 Discussion and conclusions

At first blush, the pervasive failure of state actors to adopt rapid wetland assessment tools into their environmental regulatory programs appears puzzling. Many tools exist and their application in wetland regulation is generally considered a management best practice. The EPA has been encouraging state agencies to use these tools, employing funding—one of cooperative federalism's mainstays—to propel state officials toward this goal. Despite these efforts, rapid wetland assessment tool use is official policy in only one of the six states in this investigation, and state-level adoption in the rest of the country is similarly rare

(A009: Oct. 21, 2010). Synergistic institutional analysis helps explicate this otherwise anomalous policy outcome.

This approach to examining the multi-layered, configural, and interrelated impacts of formal and informal rules, norms, and strategies on the behavior of individuals and organizations reveals that state-level regulatory adoption of rapid wetland assessment tools actually should be unlikely. Rational choice scholars explain institutions as the byproducts of strategic actors pursuing their self-interest or as the products of bargains whose outcomes are power dependent. Here, fairly pervasive non-adoption of tools by states is a consequence of the U.S. Army Corps of Engineers' rejection of rapid wetland assessment tools generally and condition-focused tools specifically. Cooperative federalism arrangements generally give the Corps a dominant role in state-level wetland regulatory efforts. It is usually smart for state wetland program officials to avoid making applicants who wish to impact wetlands shoulder heavy regulatory burdens. Consequently, program staff align their regulatory requirements with the Corps' so that the Corps will allow state environmental agencies to administer some parts of the federal Section 404 permitting program and will enter into joint permitting arrangements with state agencies. Although the EPA wants state-level adoption of rapid wetland assessment tools, the agency is encouraging state officials to develop condition-focused tools that the Corps has minimal incentive to support. Moreover, the EPA's primary tool for fostering state-level adoption, funding, is constrained so that it cannot support the implementation that is the natural corollary to tool adoption. State officials generally are not adequately incentivized to adopt and deploy assessment tools.

Sociological institutionalism draws attention to the norms, narratives, and symbolic practices that motivate and shape behaviors of individuals and organizations, sometimes

without explicit awareness of the parties involved. This theoretical stream helps explain the behavior of the U.S. Army Corps of Engineers as an organizational whole and the behavior of its district regulators. The agency's culture emphasizes deference to authority up the chain of the administrative hierarchy. Its military underpinnings help explain why district regulators execute their mandates as implementing "soldiers," leaving for their superiors the tasks of pursuing policy-relevant research and producing policy products such as rapid wetland assessment tools. This orientation also helps explain why district regulators are hesitant to adopt state-endorsed tools that have not been vetted by their administrative superiors. Sociological institutionalism usefully explains other aspects of state-level adoption struggles, including state officials' unwillingness to use Section 401 because of uncertainty concerning its appropriate deployment and the EPA's organizational identity and self-narratives as an explanation for its unwillingness to exert stronger adoption pressure on state agencies.

Historical institutionalism emphasizes the role of path dependencies in shaping the choices of organizations, and how the distribution of power among organizations and over time can help explain organizational structures and institutions. This perspective illuminates why the Corps resists regulatory rapid wetland assessment: the agency twice failed, rather spectactularly and at the national scale, to foster the development and implementation of two such tools. These experiences put the Corps squarely on a path leading away from rapid wetland assessment tool use or endorsement. The choice of legislators who crafted and revised the Clean Water Act to prohibit WPDGs from funding implementation explains why, today, the EPA can spur state officials to develop, revise, and research tools but not actually to adopt them. Similarly, the language those legislators used in drafting different

components of that act lead to other present-day outcomes: Section 404's language of functions steers Corps regulators away from tools that focus on condition, but the emphasis in Clean Water Act Sections 303 and 305(b) and federal regulations concerning water quality standards and anti-degradation leads EPA staff to try to compel state actors to adopt condition-oriented tools. The power the EPA holds over state wetland programs explains why the agency can get state officials to consider rapid wetland assessment tools, while the sway the Corps holds over state wetland programs explains why most state officials have little incentive to struggle to integrate tools into regulatory applications. The uneasy relationship between the EPA and the Corps vis-a-vis wetland management stems from the agencies being yoked together as part of a political compromise in the writing of the Clean Water Act, a choice that has led to repeated inter-agency confrontations and now makes the agencies unlikely to harmonize the incentives they offer state environmental agencies.

Institutional analysis also helps explain the apparent anomaly of OEPA integrating a rapid wetland assessment tool into regulatory use. Most state environmental agencies do not actively wield Section 401 certification, a passivity that has existed since the Clean Water Act was enacted and which has gained path-dependent inertia in subsequent decades. However, the organizational culture at OEPA has long been characterized by activism, progressiveness, and relative political strength. This logic of what constitutes appropriate agency behavior encouraged OEPA to build a vigorous Section 401 certification program when a change in the Corps' practices—a change no evidence suggests the Corps intended to spur more active wetland regulation by state officials, consistent with historical institutionalism's emphasis on the importance of unintended consequences and unexpectedly key historical junctures—allowed Ohio officials more latitude to exercise

regulatory leverage over wetlands. Choices made by the policy actors who crafted Ohio's original anti-degradation provision put the state on a path toward the litigation and negotiation with stakeholders which yielded the Ohio's wetland-specific water quality standards and anti-degradation provision in 1998. These outcomes were produced as a result of individuals and groups pursuing self-interested ends: stakeholders wanted greater environmental protection, members of the regulated community wanted greater regulatory transparency, and state bureaucrats wanted to incorporate best available science into regulatory practice.

The institutional mandate of Part 131 of the federal regulations governing water quality standards, along with the professional socialization and training of Ohio's water bureaucrats and the relative insulation of OEPA's wetland regulatory processes from the Corps' influence, steered Ohio staff toward a condition-focused assessment tool. OEPA's active pursuit of Section 401 certification altered the distribution of power conventionally associated with cooperative environmental federalism, giving the state agency the upper hand in its relationship with the Corps and helping explain why the Corps' regulatory practices aligned with state practices and not the other way around. This alignment can also be explained by the rational choices of Corps bureaucrats who perceived that ORAM would make their jobs easier, allowing them the advantages of using an assessment tool without the undesirable consequences of having actually to adopt or officially endorse one.

Table 4-1 highlights how each institutional tradition helps explain the complex incentives and constraints described in this chapter. Each theoretical perspective offers insight into certain dimensions of the tool adoption policy puzzle. In some cases the

perspectives offer complementary insights that better explain the policy phenomena than would insights from just one tradition:

Table 4-1. Synergistic institutional analysis of the tool adoption puzzle[62]

	Policy phenomenon explained by		
	RCI	**SI**	**HI**
U.S. Army Corps of Engineers			
Corps heeding the function-focused mandate of CWA Section 404	X		
Limited interest in or knowledge about assessment tools (generally) by Corps districts		X	
Specific Corps rejection of WET, HGM, and the regulatory assessment enterprise		X	X
Corps' attempt at implementing HGM despite warning signs		X	
Corps' power over state agencies in wetland regulation	X	X	X
Sour Corps-EPA relationship in wetland regulation	X		X
Why Corps districts might accept tools in state-level wetland regulation, but would struggle to do so	X	X	X
Why the Corps was unable to gainsay OEPA regarding ORAM	X	X	
Why the Corps ultimately embraced ORAM	X	X	
U.S. Environmental Protection Agency			
EPA heeding the condition-focused mandate of CWA Section 305(b)	X		
Complicated relationship between the EPA and state agencies concerning 305(b) water quality reporting	X	X	X
Nature and extent of the EPA's assessment pressure on state agencies	X	X	X

[62] RCI = rational choice institutionalism, SI = sociological institutionalism, and HI = historical institutionalism; CWA = Clean Water Act.

	Policy phenomenon explained by		
	RCI	**SI**	**HI**
U.S. states			
Officials in states with comprehensive state wetland laws opting into regulatory partnerships with the Corps, and those without refraining	X		
State agencies often not vigorously using CWA Section 401	X	X	X
State agencies' reluctance to adopt wetland water quality standards	X		
Why funding constraints hinder state agencies trying to deploy tools	X	X	
OEPA's strong organizational culture		X	X
OEPA embracing CWA Section 401		X	X
Ohio decision-makers adopting wetland water quality standards and an anti-degradation provision	X	X	X
OEPA developing a condition-focused assessment tool			X
ORAM as a political compromise	X		
Ohio officials and stakeholders venue-shifting to gain advantage over the Corps	X		
How John Mack helped assure future fund and support for ORAM	X		X

Beyond showing the usefulness of institutional analysis for explaining apparently anomalous policy outcomes, this chapter offers an interesting perspective on cooperative environmental federalism. Adopting a science policy innovation that incorporates wetland management best practices was easier for state officials who maximized their independent wetland regulatory authority and were less enmeshed in state-federal interplays, and has been more difficult for state agencies that can less easily decouple their wetland regulatory processes from federal influences. One of the goals of cooperative environmental federalism is for the federal government to enable state decision-makers to pursue environmentally

beneficial policies they might prefer but cannot pursue because of state-level political resistance or lack of expertise. This analysis shows that the opposite outcome may result: The federal government may prevent state officials from pursuing policies that the state officials believe are environmentally and programmatically beneficial and would pursue if not for federal resistance.

The fundamental problem here may not be the linkage or lack thereof between state and federal actors, but rather how conflict at the federal level both incentivizes and constrains states. Though some cynics might argue otherwise, it is probably safe to say that neither the Corps nor the EPA actively want to prevent environmentally beneficial outcomes. The federal resistence state officials experience is largely the products of the Corps and the EPA working at cross-purposes. The fact that the two agencies have overlapping jurisdictions in the wetland policy area arena brings front and central their often competing and conflicting priorities, cultures, and standard operating procedures. The state-level adoption stall thus appears substantially related to the fact that state officials are striving to satisfy two very different federal "masters."

The Corps-EPA conflict over wetland management has roots going back roughly forty years and has prompted some experts to argue that policy change, at least with respect to assessment, is unlikely to come from the federal agencies; rather, it must be led by state officials willing to use available leverage to push federal officials to accept their priorities (e.g., A009: Oct. 21, 2010; C104: Oct. 30, 2010; C796: March 23, 2011). In the assessment policy scenario, the Corps is generally the recalcitrant actor who must be swayed.[63] Section

[63] If state environmental agency developed an assessment tool wholly aligned with the Corps' functional focus and unlikely to yield the wetland condition data sought by the EPA, the EPA might instead be the target of state pressure. However, EPA's decades of funding for state wetland

3.9 described how some state agencies are trying to do just that, via direct education efforts and education by example. The latter term is, of course, a neutral way of describing state power plays: State officials can use the Corps' reliance on state-level permitting support to pressure the agency into acquiescing to state assessment preferences. As the Ohio case study shows, they also can use the substantial power offered by Section 401 of the Clean Water Act.

The Ohio case, along with evidence from the other states, points to a perhaps more subtle, complementary way in which state officials can work to shift the power balance: they can make an active choice about the federal master whose service they prioritize. OEPA substantially aligned itself with the federal EPA's goals when it adopted the wetland water quality standards the EPA had long been advocating, thereby yoking Ohio officials into evaluating wetlands pursuant to condition-focused standards and associated anti-degradation tiers as a precursor to Section 401 certification. The Corps was displeased by this end-around but could do little to gainsay it. Moreover, by developing a condition-focused assessment tool, OEPA officials positioned their wetland program to take maximum advantage of the EPA's wetland funding despite its implementation limitations. OEPA's separation from Corps wetland regulatory activities obviously facilitated OEPA's alignment with the federal EPA, but even state agencies bound to the Corps through joint and delegated permitting can—in theory, given enough political will and policy acumen—align themselves more closely with EPA and thereby strengthen their position against the Corps. The Pennsylvania Department of Environmental Protection, for example, has been discussing and debating

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programs appears to have prevented this dynamic.

adopting wetland water quality standards for roughly the past ten years (A369, A397: Dec. 13, 2010).

Although the EPA seems to be the natural primary ally for state officials in this policy arena, West Virginia is showing that it need not be. Not that the EPA is displeased with the assessment work being done by West Virginia officials; in fact, just the opposite. One of EPA Region 3's assessment experts said of the state's assessment staffers, "I'm just amazed . . . They're really a success story . . . they've grown from those first meetings to now actually be developing tools, having them out in the field and testing [them], and actively thinking about, "'Okay, now what do we want to do? And how do we get that in place?"' (C114: Oct. 30, 2010). However, West Virginia's wetland bureaucrats are consciously designing a tool that focuses on functions so that their Corps districts will support it. Said a university contractor working closely with West Virginia state officials on tool development, "The impression they [state bureaucrats] have given me [about the motivation and applications of the West Virginia draft tool] is that 'We need a wetland assessment program; this is for the Army Corps of Engineers"' (F042: Nov. 15, 2010). A state bureaucrat noted that "the Corps [Huntington and Pittsburgh districts] has agreed, if these [assessment protocols] are acceptable, to put them in the regulatory program" (A931: Dec. 14).

This intentional alliance with the Corps is perhaps unsurprising given that West Virginia's environmental staff began developing a tool later than wetland bureaucrats some of the other Mid-Atlantic states, such as Pennsylvania, and appear to have learned from the struggles of other state officials trying reconcile competing demands from the Corps and the EPA. "Our system is . . . based on other people's assessment methods," said one of the tool's central developers, ". . . [But] one of the things, right off the bat . . . [is that] we

wanted to make this an almost inclusive document [in terms of functions and condition data]. So also on our front page, we have check boxes for wetland aesthetics, recreation, or educational value" (F042: Nov. 15, 2010). All the latter items he mentioned are functions that the Corps is mandated by the Clean Water Act to prioritize. While the West Virginia draft tool apparently will deliver sufficient condition data to be useful to the EPA, state officials explicitly chose to try to smooth their path to tool adoption by aligning themselves with the Corps.

Finally, a brief comment on Maryland's situation highlights the problem of not courting either master and leads to a more general discussion of power and its exercise in this policy arena and situations like it. While state environmental officials in Delaware, Pennsylvania, and Virginia are trying to appeal both to the Corps and the EPA and are making halting progress toward tool adoption as a result, the efforts of Maryland staff have been described as "dead in the water" (C193: Oct. 30, 2010). One of the main problems seems to be that "There is a person in [the] Maryland [Department of the Environment] . . . who will be an obstruction until he/she retires—who just is against, for whatever reason, wetland condition assessment" (E763: Nov. 5, 2010). Maryland's environmental regulatory agency is not aligning itself with the EPA, with its focus on wetland conditions, but neither is the state agency making meaningful overtures toward the Corps: "They [Maryland environmental staff] don't push functional assessment very hard, or very far up the ladder [of agency hierarchy or interagency linkage]" (D556: Dec. 22, 2010). Two EPA wetland experts put it more bluntly: "They can't decide what they're doing" (C104: Oct. 30, 2010) and in consequence, "They've been pretty much asleep at the wheel [with respect to assessment]" (C193: Oct. 30, 2010). Choosing a federal master and then actively pursuing

alignment, as well as trying to educate—directly or indirectly—federal actors about state assessment priorities, appears to be the path toward state-level tool adoption. State officials who don't start down the path have little chance of reaching its end.

This point leads to a more general one: If state-level assessment tool adoption depends largely on efforts by state officials, adoption success depends on their willingness to engage. The extent to which they are willing likely depends on a constellation of individual factors (e.g., personality, political and policy acumen, perhaps political ideology) and contextual ones (e.g., the culture of the environmental agency, the overall clout of that agency in the state political arena, the state's political culture). These factors, however, are not static; they can be manipulated by entities wishing to steer state officials toward tool adoption (or away from it). As noted in Section 3.4, environmental groups are pressuring state environmental agencies to use Section 401 more vigorously, an activity that generally would push state officials to align themselves more closely with the EPA (by creating more concrete standards by which to judge certification acceptability) and reduce the Corps' influence over state-level wetland and water policy choices. By essentially bankrolling state-level tool development efforts for many years, the EPA has been trying, with some success, to encourage states to appreciate the importance of rapid wetland assessment and thus be more willing to argue that importance to the Corps (C104: Oct. 30, 2010; C796: March 23, 2011). Development interests encouraged OEPA to develop ORAM, and OEPA listened (A230: Nov. 19). The generalizable lesson appears to be that conflict between federal agencies with overlapping jurisdictions can leave state agencies and their staffs, typically subordinated by the structures of federalism, as the most likely agents for policy change.

State-level actors also can become instruments in the power plays of other entities that desire policy change at the federal and state levels.

Appendix 4-1. Glossary of regulations, organizations, and initiatives discussed in Chapter 4

Anti-degradation provision An anti-degradation provision (or policy) is a component of water quality standards a state is required to adopt under Section 303 of the Clean Water Act. This provision requires that state officials classify waters within their jurisdictions into three tiers corresponding to water quality. The level of protection a state officials must establish for a waterbody via water quality standards hinges on the tier into which the waterbody is classified. Higher-tier waters are better quality and require more protection, and vice-versa (EPA 1994).

Engineer Research and Development Center (ERDC) ERDC is a U.S. Army Corps of Engineers distributed research and development command. ERDC provides research and development in the service of military installations, the armed forces, and the Corps' civil works initiatives (USACE 2010b). Corps districts with research needs generally rely on ERDC rather than trying to address those needs themselves.

Clean Water Act (Federal Water Pollution Control Act) This federal law, initially passed in 1948 but substantially amended in 1972, establishes the framework for regulation of pollutant discharges to U.S. waters and regulation of surface water quality. Some but not all wetlands qualify for protection under the Clean Water Act.

Hydrogeomorphic Approach (HGM) HGM is a rapid wetland assessment approach which, in the 1990s, the Corps aimed to integrate into nationwide wetland regulatory practice. This approach sorts a wetland into a category defined by its hydrologic, morphologic, and geologic characteristics and then uses logic models developed by experts to estimate the wetland's condition and associated functionality. HGM compares conditions in the wetland to a set of optimal reference conditions (Cole 2006; Hruby 1999). By 1998–1999, the Corps sought to "develop . . . sufficient assessment models to address 80 percent of the Section 404 permit workload requiring wetland function assessments" (Burkhardt 1996, online). This goal was never realized and HGM implementation largely failed.

Joint permitting In the joint permitting systems discussed in this chapter, an entity wishing to pursue an activity which would impact a wetland in a state where both state and federal laws might apply to such an action submits just one permit application rather than having to submit multiple permits to different agencies. The relevant state and federal agencies determine which of their strictures apply and then process the permit.

Mid-Atlantic Wetland Workgroup (MAWWG) MAWWG is a regional workgroup established in 2001 to support the science and policy of wetland assessment in Mid-Atlantic states. "The primary objective of the Mid-Atlantic Wetland Workgroup is to . . . facilitate the development and implementation of wetland monitoring strategies . . ." (MAWWG n.d.,

online). The group has been substantially funded throughout its existence by Region 3 of the U.S. Environmental Protection Agency (C104: Oct. 30, 2010). Its members are Region 3 state bureaucrats involved in wetland assessment initiatives as well as wetland science and policy experts. Wetland staff from other Mid-Atlantic states not in Region 3, such as Ohio and New Jersey, often attend the group's biannual meetings.[64]

National Wetland Condition Assessment (NWCA) NWCA is a research initiative established in 2007 by the EPA. Using probabilistic sampling, it seeks to estimate a condition baseline for most of the nation's wetland types by 2013. Another central NWCA goal is helping state agencies develop capacity to pursue wetland monitoring and assessment independently in the future, using assessment tools based on protocols NWCA develops (EPA 2008; C104: Oct. 30, 2010).

Ohio EPA (OEPA) OEPA is the primary environmental regulatory agency in the state of Ohio.

Ohio Rapid Assessment Method (ORAM) ORAM is a rapid wetland assessment tool developed in Ohio in 1998 and officially adopted by that state's decision-makers for regulatory work in 2002. ORAM is used in Section 401 certification reviews (the process by which the state regulates wetlands) and associated enforcement activities. It is not used to evaluate wetland compensatory mitigation (A009: Oct. 21, 2010).

Part 131 Part 131 is the component of the EPA's water quality regulations which describes the anti-degradation provisions with whose thresholds state water quality standards must align.

Performance Partnership Grants Clean Water Act Section 106 authorizes the award of Performance Partnership Grants to state or interstate agencies. These are water pollution control grants intended to "assist in administering programs for the prevention, reduction, and elimination of water pollution, including programs for the development and implementation of ground-water protection strategies."[65] State officials can use these grants to fund wetland program activities.

Qualitative Habitat Evaluation Index (QHEI) QHEI is a condition-focused rapid stream assessment tool developed by Ohio EPA in 1987 (OEPA 1987).

Section 104(b)(3) This section of the Clean Water Act authorizes the award of Wetland Program Development Grants described below.

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[64] New Jersey was not included in this research because it is one of only two states that has been entirely delegated the national Section 404 permitting program. Thus, any inferences based on tool use and adoption in New Jersey would only be generalizable to the second state, Michigan.

[65] *Code of Federal Regulations* 40 Part 35.160 (2001).

Section 106 This section of the Clean Water Act authorizes the award of Performance Partnership Grants described above.

Section 303 This section of the Clean Water Act requires that states establish water quality standards described below.

Section 305(b) This section of the Clean Water Act requires that the EPA biennially obtain from states data on state water quality. These data must characterize the extent and nature of water pollution, its impacts, and how the pollution will be mitigated. Section 305(b) is specifically concerned with the condition of the nation's waters (EPA 2009a).

Section 401 This section of the Clean Water Act authorizes states to ensure that discharges to waters within their boundaries meet state water quality standards. This state-level check is meant to be a backstop to Clean Water Act effluent limits established by the EPA and implemented via national-level permitting (Glicksman 2006). Section 401 allows state officials to deny or condition pollution-allowing actions by the federal government, such as issuance of Section 404 wetland permits (Johnson 1999). In theory, applicants for such a federal permit must first obtain state-level certification, a process which would involve state officials reviewing the proposed action. In practice, however, state staff members often do not pursue Section 401 certification rigorously. Certification is sometimes built into state-federal permitting agreements such that state certification is automatically granted when federal requirements are satisfied.

Section 404 This section of the Clean Water Act is the federal government's primary regulatory "hook" over wetlands. It authorizes the Corps and the EPA to govern the insertion of dredge and fill material ("dredge" material is excavated from waters and "fill" material is used to replace an aquatic area with land or alter the bottom elevation of a water body) into federally jurisdictional wetlands. (The jurisdictional status of a wetland is a complicated issue which depends in part on the navigability of the wetland/waterbody and potentially also on the nature and extent of its proximity to a navigable waterbody.). Section 404 undergirds the wetland permitting program that the Corps administers on a day-to-day basis and over which the EPA has review and ultimate veto authority. An applicant's Section 404 permit application may be denied if it stands to cause adverse environmental impacts, and/or the applicant may be required to compensate for those impacts. Some or all parts of the Section 404 permitting program may be delegated to state agencies.

State programmatic general permit This is the technical term for the partial delegation by the Corps to state agencies, referenced in the chapter, of some of the Corps' Section 404 permitting responsibilities. A state programmatic general permit is "a type of regulatory permit issued by the U.S. Army Corps of Engineers (Corps) which authorizes states, local governments, tribes, or other federal agencies with regulatory programs comparable to the Corps' Section 10 or 404 Program to issue permits for specified activities in lieu of direct Corps' issuance of such permits. . . . [State programmatic general permits are] administered by a state agency and designed to eliminate duplication of effort between Corps districts and states, as well as to make the permitting process more efficient with flexibility as to the geographic region covered . . ." (ASWM 2011, online).

Total maximum daily load (TMDL) A TMDL is "a calculation of the maximum amount of a pollutant that a waterbody can receive and still safely meet water quality standards" (EPA 2012b, online). Section 303(d) of the Clean Water Act requires that states develop TMDLs for priority-ranked impaired waters, where "impaired" is defined as not meeting state water quality standards. Currently, states are not required to develop TMDLs for wetlands (Kusler 2011).

Water quality certification Pursuant to Section 401 of the Clean Water Act, state officials must certify that an action proposed for federal approval, and which would cause discharges to waters in the state, meets state water quality standards. See Section 401 above.

Water quality standards Section 303 of the Clean Water Act requires that state decision-makers establish water quality standards by which state environmental staff can evaluate proposed impacts per Section 401. These standards must "define the goals for a water body by designating its uses [e.g., fishable or swimmable], setting criteria to measure attainment of those uses, and establishing policies to protect water quality from pollutants" (EPA 2012d). State officials must submit their standards to the EPA for approval (Ransel and Meyers 1987–1988). The Clean Water Act establishes minimum requirements for state standards; if they are not met, the EPA can impose its own (Johnson 1999). The standards must ensure that the state's anti-degradation provision is satisfied.

Wetland Evaluation Technique (WET) WET is a rapid wetland assessment approach which the Corps tried to integrate into nationwide wetland regulatory practice. WET was developed in 1983 and revised in 1987 for Corps usage (Novitzki, Smith, and Fretwell 1997). The tool asked users to examine the biological, chemical, and physical attributes of a wetland, and assigned value to these attributes based on societal values. Users found WET burdensome and flawed. The Corps abandoned the tool in the early 1990s (ibid.).

Wetland Program Development Grants (WPDGs) These grants are authorized under Section 104(b)(3) of the Clean Water Act. They can be awarded to state agencies or other entities. They are intended to "promote the coordination and acceleration of research, investigations, experiments, training, demonstrations, surveys, and studies relating to the causes, effects, extent, prevention, reduction, and elimination of water pollution. . . . [priority is] given to funding projects that address the three priority areas identified by the EPA: Developing a comprehensive monitoring and assessment program; improving the effectiveness of compensatory mitigation; and refining the protection of vulnerable wetlands and aquatic resources" (EPA 2011c). State officials often use these monies to support their wetland monitoring assessment efforts substantially and to support their core wetland program activities indirectly.

Chapter 5: Street-level policy entrepreneurship

1.0 Introduction

A policy expert, asked about the factors that encourage state environmental agencies in a six-state region of the United States to embrace innovative tools for wetland management, said, "It comes down the person in the state regulatory agency. Great activity is always associated with a particular person. . . . their leadership creates the [facilitative] environment" (E763: Nov. 5, 2010). Her statement echoes what policy and management scholars have oft-argued: Certain actors—policy entrepreneurs—frequently appear to have a disproportionate influence over policy and organizational processes and outcomes. However, certain such individuals are understudied. This conceptual chapter will show that, contrary to prevailing themes in the literature, implementing bureaucrats sometimes can be policy entrepreneurs.

2.0 Literature and theory

2.1 The street-level blind spot in scholarship on policy entrepreneurs

A policy entrepreneur is an individual, group, or organization which leverages resources to generate a favored policy outcome (King and Roberts 1992; Kingdon 1984). Policy entrepreneurs creatively "recombine intellectual, political, and organizational resources into new products and courses of action for government" (Oliver and Paul-Shaheen 1997, 744), then entrench new institutions in place of old ones (Beckert 1999; Maguire, Hardy, and Lawrence 2004; Sheingate 2003). Their innovations often disrupt existing social, political, or economic arrangements (Etzioni 1987; King and Roberts 1992; Kingdon 1984; Mintrom 1997; Schumpeter 1942).

The policy entrepreneurship literature generally does not characterize the government employees who deliver policy—street-level bureaucrats—as entrepreneurs. Lipsky (1980, 3) classically defined street-level bureaucrats as "public service workers who interact directly with citizens in the course of their jobs, and who have substantial discretion in the execution of their work." These workers leverage resources to secure favored policy outcomes at the micro level, making and shaping policy through their daily choices (Lipsky 1980; McLaughlin 1987; Maynard-Moody and Musheno 2003; Riccucci 2005; Weatherley and Lipsky 1977). In this sense, their activities appear entrepreneurial. However, three lines of evidence suggest that the policy entrepreneurship literature has a street-level blind spot.

First, the policy entrepreneurship literature often explicitly or implicitly characterizes the policy process as initiated and directed by elected officials or high-level administrators rather than by street-level actors. This literature often relies on the policy stages heuristic of problem identification, agenda-setting, adoption, implementation, and evaluation (Anderson 1979). Scholars tend to focus on how elite or elite-focused entrepreneurs identify problems (stage one) and then frame them to advance a policy agenda persuasively (stages two and three) (e.g., Baker and Steuernagel 2009; Garud, Hardy, and Maguire 2007; Hwang and Powell 2005; Maguire, Hardy, and Lawrence 2004; Mintrom 1997; Pralle 2006; Ugur and Yankara 2008). Some scholars maintain that these actors continue their advocacy through subsequent stages (Bardach 1977; Mintrom 1997; Mintrom and Norman 2009). However, the empirical research largely focuses on the early stages.

Second, the literature often tacitly suggests that agenda-setting or adoption leads to successful implementation of policy innovations. Balla (2001) inferred successful policy entrepreneurship when insurance commissioners encouraged their states to adopt model

HMO legislation. Mintrom's (1997) successful entrepreneurs convinced state legislatures to adopt school choice reforms. Pralle's (2006) policy entrepreneurs in Canadian pesticide regulation succeeded by re-framing issues policymakers considered. Thompson (1994) attributed entrepreneurial success to a U.S. cabinet member who convinced the Reagan administration to consider expanding Medicare. Implied is that once high-level decision-makers accept the policy entrepreneur's innovation, they will instruct bureaucrats to implement it and implementation will occur as dictated—a supposition street-level bureaucracy scholars recognize as unrealistic.

When policy entrepreneurship scholars do focus on implementation, they tend to emphasize elite "fixers" (Bardach 1977). Levin and Ferman's (1986) analysis of factors contributing to successful implementation of youth employment programs discovered that "executives . . . often acted as 'fixers,' repairing the implementation process and protecting and correcting their programs" (311). Kling and Iacono (1984) attributed successful implementation of a new information system in a large firm to a fixer role played by a senior vice-president. This orientation implies that policies should be executed as elites created them, and elite entrepreneurs—not street-level actors—may have to correct deviations from the plan.

Third, the literature often argues that entrepreneurs levy influence from outside the policy process, securing support from key decision-makers and bureaucratic allies (e.g., Baker and Steuernagel 2009; Johnson, Hirt, and Hoba 2011; King and Roberts 1992; Oliver and Paul-Shaheen 1997; Van Der Steen and Groenewegen 2009). This contention implies that those insider supporters are necessary for policy execution but are not themselves entrepreneurs.

Some scholars do examine how bureaucrats try to secure policy changes via conventional channels such as participating in union lobbying or via less conventional ones such as whistle-blowing. Although these pursuits have entrepreneurial dimensions, to varying degrees they still give elites ultimate responsibility for crafting policy innovations; policies change once high-level decision-makers who are the targets of bureaucratic pressure determine they should, and change in ways the elites specify. This chapter's concept of street-level policy entrepreneurship is more radical and focuses squarely on implementation.

2.2 Street-level policy entrepreneurship

Implementing bureaucrats can, in fact, be policy entrepreneurs. Street-level policy entrepreneurs seek to develop or adopt policy innovations that will improve the implementation processes they prosecute, and to entrench these innovations in the day-to-day activities of their bureaucratic peers. Successful street-level policy entrepreneurs have resources, expertise, and professional networks necessary to find, craft, or adapt policy innovations tailored to the needs of implementing bureaucrats. They convince those bureaucrats to change their standard operating procedures and deploy the policy innovation. Successful street-level policy entrepreneurs build institutional capacity, securing resources for and mitigating threats to ongoing innovation implementation. However, the policy entrepreneurship literature may overlook implementing bureaucrats because their entrepreneurship is theoretically unexpected.

Street-level bureaucrats are often characterized as both powerful and helpless. They are powerful in that they have latitude to make case-specific implementation decisions based on their personal and organizational norms, identities, and preferences (Fineman 1998;

Maynard-Moody and Musheno 2003; Riccucci 2005; Walker and Gilson 2004; Winter 2002). Yet they are helpless in that they must manage competing and sometimes contradictory mandates while constrained by overwhelming client needs and limited time and resources (Hupe and Hill 2007; Keiser 2010; Lipsky 1980; Weatherley and Lipsky 1977). On one hand, bureaucrats have the power to develop standard operating procedures to make their day-to-day work manageable (ibid.; Fineman 1998; Honig 2006). On the other, their helplessness prevents their coping strategies from being sufficiently substantial, in scale or scope, to qualify as true innovations developed via creative recombination and advanced in an entrepreneurial manner.

In many conventional narratives, street-level bureaucrats work with available resources to develop heuristics rather than invent or adopt genuinely novel policies (e.g., Weatherley and Lipsky 1977). Winter (2002) discusses street-level bureaucrats' perceptions of available policy instruments, implying that bureaucrats themselves do not generally create these instruments. Similarly, Sandfort (2000) analyzes how street-level bureaucrats develop schema to interpret professional burdens, implying that bureaucrats themselves generally do not change official policies to lessen these burdens. Moreover, policy entrepreneurship involves changing the practices of policy actors, but accounts of street-level bureaucrats' time and resource constraints do not usually suggest they are able to shape the practices of their peers. Those practices tend to be individualistic and "idiosyncratic," co-produced in case- and situation-specific negotiations with clients (Fineman 1998, 953). Finally, street-level bureaucrats create standard operating procedures to avoid disruptions to the status quo, while a policy entrepreneur's innovation is inherently disruptive. For example, Weatherley and Lipsky's (1977, 194) school personnel rationed services, prioritized clients, and

developed paperwork shortcuts all to "secure their work environment." In sum, street-level bureaucrats are not expected to have much entrepreneurial capacity. They are "reluctant or helpless when confronted with the requirement to transform or at least significantly modify their everyday practices" (Hubíková and Havlíková 2011, 219).

The above arguments appear applicable to low- or middle-level as well as to street-level bureaucrats. Low- and middle-level bureaucrats are public servants who do not have major managerial responsibilities but do not necessarily spend all their time interacting directly with clients as do Lipsky's "teachers, social workers, and . . . police officers" (Lipsky 1980, xii). In a given day, a low- or middle-level bureaucrat may process paperwork, inspect regulatory targets, input data into a performance management system, attend a staff meeting, and meet clients. They may sometimes supervise a few other staff members on various projects, but do not make decisions for entire bureaus or other large units of a public bureaucracy. These bureaucrats, like those at the street level, are often described as "consumers of decisions made by top-level managers" (Westley 1990, 388). Like street-level bureaucrats, low- or middle-level bureaucrats are "de-energized and emotionally stricken in the face of the overwhelming power . . . [of] executives" (Huy 2002, 32), and "tasks of deploying human and material resources . . . rather than decision-making about aims and objectives and planning, seem[ed] to occupy the bulk of their time" (Horne and Lupton 1965, 23). Walker and Gilson (2004, 1258) effectively lump together street- and low- or middle-level bureaucrats, quoting a front-line implementer who said of an immediate supervisor: "She's as powerless as we are." Similarly, when analyzing the sources of innovation in public bureaucracies, Borins (2002, 2001a, 2001b) uses "middle manager or front-line staff" as an analytical category.

Because of these similarities, this chapter uses the term "street-level bureaucrat" in a more encompassing manner than Lipsky, broadening it to include low- and middle-level bureaucrats. In the cases presented below, street-level bureaucrats are staff biologists or ecologists, and, in one instance, the head of one of multiple offices situated inside a bureau which itself is situated inside a larger administrative agency. All these bureaucrats were charged with policy implementation and worked in the field to some extent during their stints as policy entrepreneurs.

Perhaps because of the literature's generally low entrepreneurial expectations for street-level actors, scholarship on adoption of policy innovations by bureaucrats tends to focus on high-level officials with political connections or substantial managerial responsibilities. Sapat's (2004) investigation of the adoption of environmental policies by state administrative agencies examines decisions of agency administrators. Teodoro's (2009, 2010) research on bureaucratic adoption of policy innovations focuses on choices of police chiefs and water utility managers. Schneider and Teske (1992) study policy innovation in local governments by examining the behavior of city managers. Per Feller (1980, 1021), this focus is justified because "senior-level bureaucrats have primary responsibility for decisions concerning the adoption of innovations." Similarly, Lee (2008) argues that public bureaucrats with more power in the administrative hierarchy will adopt innovations before bureaucrats conventionally considered to have less (e.g., front-line implementers).

Street-level bureaucracy scholars do empower their subjects to some degree, maintaining that implementers make policy through everyday choices which may be innovative. However, there is a substantial difference between a policy that emerges from the aggregation of piecemeal, discretionary, and potentially idiosyncratic implementation

decisions of bureaucrats, and the kinds of policy innovations on which this chapter focuses—those an entrepreneurial bureaucrat finds or creates because he perceives they will improve the implementation processes in which he is enmeshed and which he then seeks to institutionalize in the practices of his peers. Street-level bureaucracy scholars do not focus enough on the latter. Borins (2002, 2001a) analyzed applications to competitions held in the 1990s in developed countries that were designed to showcase innovations in public management. Administrative agencies competed by submitting examples of new policy products and processes their staff had created. Innovations developed by front-line staff and low- to middle-managers actually accounted for 48–57% of the highest-ranked applications (Borins 2001b). These bureaucrats most frequently developed innovations to address intra-agency or intra-governmental problems, such as difficulties bringing services to clients (Borins 2002, 2001b). This chapter explores how street-level bureaucrats entrepreneurially foster and institutionalize such innovations.

3.0 Methods

This inquiry examines street-level policy entrepreneurship to adopt and entrench a science policy innovation into state-level regulatory practice. The class of innovations on which it focuses are rapid non-tidal wetland assessment tools. These tools combine elements of questionnaires and instruction sheets. They highlight and help interpret data a bureaucrat should evaluate when making a regulatory decision such as whether to issue a permit for development in a wetland. They are technically complex policy instruments of relatively low salience or visibility to the general public. More than 100 tools have been developed in recent decades (Kusler 2006). For roughly the past two decades, the U.S. Environmental

Protection Agency has encouraged states to adopt these tools as a management best practice (EPA 2006). However, because of a variety of challenges, including difficulties adapting tools to state-specific regulatory needs and securing support from stakeholders, few states have adopted a tool for regulatory use (Kusler 2006).

This investigation is a portion of a larger project which examines the determinants of assessment tool use by state bureaucrats and official tool adoption by state-level public environmental agencies. These phenomena were examined from 1995 through 2011 in six states selected via a "most likely" case analysis (George and Bennett 2005, 121). The wetland policy community considers many of the states to have some of the most advanced wetland assessment initiatives nationwide (C104; C193). Several of the states are home to public research institutions nationally known for wetland research, including work on assessment, and whose scientists work with state policy actors. Regulatory tool adoption should be more likely in these states than elsewhere, and if adoption does not occur, the reasons why should be particularly informative.

The larger project relies on data from semi-structured elite interviews conducted between October 2010 and May 2011 with 98 policy actors (roughly 58 interview hours), experience gained during roughly 18 months spent working with federal wetland bureaucrats in a regional office of the U.S. Environmental Protection Agency, and analysis of secondary sources. Interviewees were initially selected because they were members of a regional assessment workgroup, their name was listed in secondary sources, or they were recommended by EPA regulators. Subsequent interviewees were identified via snowball sampling.

The topic of this chapter, policy entrepreneurship, was not part of the original research design; rather, it emerged as a research focus as data strongly suggested that street-level bureaucrats played a key role in state-level tool adoption efforts. Those efforts in the six states became "heuristic cases" used to "inductively identify new variables, hypotheses, causal mechanisms, and causal paths" (George and Bennett 2005, 75). Data from those cases helped build the theoretical account offered above concerning street-level policy entrepreneurship. This chapter focuses only on States H and I[66] for three reasons. First, all the arguments about street-level entrepreneurship articulated above are evidenced in the two cases. Second, States H and I have many commonalities; the value of a "most similar" research design is noted below. Third, developing two case studies thoroughly rather than providing six superficial accounts allows for the presentation of convincing details that reveal the nature of street-level policy entrepreneurship.

Table 5-1 shows the number of interviewees from relevant job sectors who commented on tool adoption efforts in each state or who provided insight from a national perspective. Interviewees were selected so that the sample included at least two individuals with expertise in each state and in each of the first four job sectors in Table 5-1. Bureaucrats from the U.S. Army Corps of Engineers and the U.S. Environmental Protection agency were interviewed because those agencies implement the federal wetland protection program established by Section 404 of the Clean Water Act and, in the process, often work with state bureaucrats. Regulated community members are actors who apply for permits to impact wetlands, are targets for enforcement action because they illegally damage wetlands, or are

[66] All names of states, individuals, tools, and public bureaucracies and their components have been anonymized.

environmental consultants who represent clients in such matters. Members of academia or from other or mixed sectors (including nonprofit employees, policy experts, and individuals with cross-sector experience) were interviewed if secondary or primary sources indicated they had relevant insight.

Table 5-1. Interviewee expertise by sector and state[67]

Interview sector	State H	State I	Nationwide	Total
Corps bureaucracy	4	11	0	15
EPA bureaucracy	4	3	2	9
Regulated sector	7	9	1	17
State bureaucracy	9	10	0	19
Academia	0	1	0	1
Other/mixed sectors	4	1	4	9
Total	28	35	7	70

For this chapter's analysis, a "most similar" research design (George and Bennett 2005, 50) led to the showcasing of States H and I, geographic neighbors which began their tool adoption efforts at approximately the same time. Their comparison is intended to show that street-level policy entrepreneurship critically affected state-level regulatory adoption and entrenchment of a rapid wetland assessment tool. States H and I are similar vis-a-vis many potentially relevant independent variables, differ in the quality and extent of the entrepreneurship by street-level bureaucrats, and differ on the dependent variable: State H

[67] The column values in Table 5-1 are not mutually exclusive; some individuals had expertise in more than one state.

adopted and entrenched an assessment tool, while State I did not. Table 5-2 highlights the states' similarities and differences:

Table 5-2. Comparison of States H and I[68]

	State H	State I
Similarities		
Population per square mile	282.3	283.9
Non-tidal wetlands as percent of land area	1.5	1.4
State explicitly regulates non-tidal federally non-jurisdictional wetlands	Yes	Yes
Number of offices of the state's primary environmental regulatory agency, including headquarters	6	7
Number of Corps districts with effective jurisdiction over wetland regulatory issues in the state*	3	3
State joined (and remain part of) the same regional wetland assessment workgroup in the same year	Yes	Yes
Average state per capita GDP, 2007–2010, chained 2005 dollars	$37,427	$37,809
Number of governors, 1995–2011	5	5
Differences		
Same EPA region*	No	No
State coordinates permitting with the Corps for some Clean Water Act Section 404 actions	No	Yes

[68] Data come from the U.S. Army Corps of Engineers (2009), Bureau of Economic Analysis (2011), Census Bureau (2010), and Environmental Protection Agency (Wetland Grants Database n.d.); the Association of State Wetland Managers (2011); the Environmental Council of States (2010); the Environmental Law Institute (2008); and the National Governor's Association (2011). The per capita GDP figures are totals across all North American Industry Classification System codes.

2009 budget of primary state environmental regulatory agency (millions)	$188.2	$217.51
Political party of presidential candidate winning the majority of votes in 1996, 2000, 2004, and 2008 (D = Democrat, R = Republican)	D, R, R, D	D, D, D, D
Political party control of the governorship, 1995–2011	80% Republican, 20% Democrat	60% Republican, 40% Democrat
State officially adopted a rapid wetland assessment tool for state-level regulation	Yes	No

* The EPA and the Corps have field offices with geographically defined jurisdictions. A Corps district's jurisdiction is determined by watershed boundaries and an EPA regional office's jurisdiction is determined by state boundaries. One of the three Corps jurisdictions is the same in both states.

While the process-tracing in the cases below will show that street-level policy entrepreneurship critically determined why State H adopted a tool and State I did not, at least two important differences between the states likely also shaped these outcomes.

First, State H appears to have a more politically conservative culture than State I. The former state voted for Republican presidential candidates more frequently during the study period. Political conservatism is generally associated with government policies that support business. State H embraced assessment in part because "the regulated community [that is, businesses] that said they wanted it" (A141: April 21, 2011). Business interests played an influential role in stakeholder processes associated with tool adoption in State H (A230: Nov. 19, 2010). These interests supported tool deployment because they thought it would bring greater transparency and predictability to the wetland regulatory process (ibid.; A009: Oct. 21, 2010; A380, A949: Nov. 19, 2010; F593: Feb. 20, 2011). This pressure from business interests and a state political culture attuned to those interests arguably smoothed the path toward tool adoption for street-level policy entrepreneurs in State H. State I, in contrast, appears to have a somewhat less conservative political culture, and interviewees

there did not report a similarly substantial amount of pro-assessment pressure from the business community.

Second, environmental regulatory agencies in the states have meaningfully different relationships with the U.S. Army Corps of Engineers. State I runs a state-level wetland regulatory program and has coordinated with the Corps to develop a joint permit application which allows entities seeking to develop wetlands to submit one application to state and federal review agencies, rather than two separate applications. The Corps also delegates some federal permitting responsibilities to the state. While State H regulates some wetlands independently, it does not have a joint permitting system with the Corps. The state also does not implement portions of the federal permitting system.

The consequence of these differences is that State I's wetland regulatory policies are more heavily influenced by the preferences of relevant Corps districts than are policies in State H. In the U.S. system of cooperative environmental federalism, the federal agency tends to be a dominant player in such state-federal collaborations, often successfully pressuring state governments to accept its direction (Fischman 2005; Kincaid 1990; Welborn 1988). For example, states generally acquiesce to the Corps' preferences about what a joint permit application will require (C104, C193: Oct. 30, 2010; C858: Dec. 8, 2010; C796: March 23, 2011), including whether it mandates a site review using a rapid wetland assessment tool. A state bureaucrat said of the Corps, "We're at their complete mercy . . . that's what drives our program. If they change their direction, then we have to change our direction. . . . state regulators do not like to have something different from the federal government that requires business to do something twice as much or different" (A931: Dec. 14, 2010).

The problem for State I is that two of the three Corps districts with jurisdiction in the states are notably opposed to regulatory rapid wetland assessment (A941: Nov. 15, 2010; B289, B783: March 15, 2010; B312: Feb. 22, 2010; C104; C193: Oct. 30, 2010). While two of the three Corps districts with jurisdiction in State H also were strongly opposed to regulatory wetland assessment when that state began its assessment push (F693: Dec. 27, 2010), Corps bureaucrats have substantially less leverage over wetland regulatory activities in State H (A230: Nov. 19, 2010). Thus, State I's institutional structures have forced street-level policy entrepreneurs there to try to convince unwilling Corps bureaucrats to support state-level assessment, whereas Corps opposition was less of an obstacle in State H.

These differences between States H and I likely affected the tool adoption outcomes in the states. However, their impact does not diminish the importance of the quality and nature of the street-level policy entrepreneurship associated with the states' tool adoption efforts. The fact that the policy entrepreneurs' activities and prospects appear affected by these differences only further emphasizes the central roles of those entrepreneurs. Their roles are described next.

4.0 Case studies

4.1 State H

State H began its tool adoption efforts in 1995–1996 and adopted H Tool in 2002 (A009: Oct. 21, 2010). H Tool was revised six times between 1995 and 2001. Policy entrepreneurship was key to State H's success.

In the late 1990s, the State H Environmental Agency (HEA) had a biologist on staff, Helen, who was crucial in developing H Tool. Helen got her PhD from H State University

(located in the state's capital, the same as HEA headquarters), mentored by a nationally prominent wetland scientist. This background gave her the expertise and credibility necessary to pull resources from the scientific community and the literature. She cultivated a tight-knit, committed group of in-house experts who drafted a tool that recombined elements of assessment protocols developed in four other states and was tailored to State H's regulatory needs (A009: Oct. 21, 2010; A141: April 21, 2011; A230: Nov. 19, 2010; C114: Oct. 30, 2010; C306: March 24, 2010; E763: Nov. 5, 2010; F593: Feb. 10, 2011; F840: Oct. 13, 2010).

In 1998, Helen left for a position in academia. She was replaced in the assessment effort by Henry, a former HEA lawyer who also had a master's of environmental science and a growing interest in wetlands (F303: Nov. 18, 2010). Henry took a job as a wetland ecologist in a division of HEA devoted to water quality, and eventually became widely credited as "the one who really put it [H Tool] on the ground" (A119: Nov. 19, 2010; C104; C193: Oct. 30, 2010; C114, C796: March 23, 2011; C306: March 24, 2011; D731: Feb. 8, 2011).

Many interviewees noted how Henry's personal qualities helped him convince other bureaucrats and stakeholders to embrace H Tool. "He is probably one of the most rock-solid people in this line of work. He's brilliant, too" (C193: Oct. 30, 2010). Henry "had the vision and the ability to implement that vision" (C114: March 23, 2011) and he inspired confidence, even from skeptics: "Most people trust Henry, pretty much. Almost everything he did, he based it on statistics and science. He had the data. If you wanted to go over and question him, he could pull it out. He had piles. He would have statistic after statistic" (A949: Nov. 19, 2010).

Interviewees also highlighted how Henry's unique professional background gave him a range of entrepreneurship-facilitating resources. "He was an attorney, but he didn't want to be an attorney anymore. . . . He got involved with a lot of [wetland legal] cases . . . in the meantime he had a very strong background in bio or botany. So . . . we'd ask him about wetland plants periodically and then all this [the assessment effort] kind of evolved" (A119: Nov. 19, 2010). Similarly: "The thing that made Henry special, besides his leadership capabilities, is the fact that he also has a law degree" (C114: March 23, 2011) and "[That] guy's got more degrees than I have inches of height" (D336: Feb. 3, 2011).

Henry's strong commitment to assessment also helped him convince relevant policy actors to accept H Tool and institutionalize it: "He was an anomaly, I think, in terms of the amount of work he produced. You have to have a whole section over there [at HEA] to produce that amount of work. I don't know how he got all that done" (A476: Nov. 19, 2010). "I think another part [of the reason why State H achieved adoption] might be just . . . his personal drive or background" (ibid.). Henry's commitment persists. Although he no longer works for the state, he continues to speak nationally about H Tool, promoting it as a model for regulatory programs (A009: Oct. 21, 2010).

Both Helen and Henry secured buy-in from peer bureaucrats who had to integrate H Tool into their standard operating procedures. "We worked really well together as a group," recalled a bureaucrat who worked with both, ". . . that's where we've been strongest" (A230: Nov. 19, 2010). Said a regional expert, "[State H] had a group of [staff] people who worked well together . . . you have to have that" (C306: March 24, 2011).

Henry continued Helen's practice of cultivating in-house expertise to enhance the tool's scientific rigor (A009: Oct. 21, 2010; A141: April 21, 2011; A230: Nov. 19, 2010). He

also facilitated the building of a diverse stakeholder coalition whose support helped usher the tool through a formal rulemaking (A141: April 21, 2011; A230: Nov. 19, 2010; C306: March 24, 2011). That rulemaking was central to Henry's plan for building long-term institutional capacity that supported H Tool's implementation.

Henry used federal EPA funds to position the state's assessment program for long-term viability (C114: March 23, 2010). "Henry was a prolific grant writer. . . they [the EPA] would say, '[Do] you need more funding?' And he'd say, 'Yeah, pretty much'" (A949: Nov. 29, 2010). "Henry went in and . . . built, brick by brick, his program. He had a strategy. . . . Henry used that [federal] money both to build his staff and to put down the basis for an administrative rule so that it supported his program. He knew he had to get it [the program] into the [state's] regulations" (C114: March 23, 2010). Henry realized that once use of H Tool was codified by the state's administrative code, state commitment to its implementation would be more secure. Consequently, he pushed for the formal rulemaking which ultimately stated that "the [HEA] director will consider the results of an appropriate wetland evaluation method(s) [in wetland regulatory activities]." That method invariably is H Tool (A041: Nov. 18, 2010; A230: Nov. 19, 2010; F303: Nov. 18, 2010).

In 2000, a developer challenged HEA's use of H Tool in what became a major legal battle. "They sued us . . . I was on cross-examination for two weeks. Just nuclear warfare litigation, basically," recalled Henry. "Three law firms got involved and this dragged on for about six months. Eventually, in a sense, we won the case—we forced them to settle" (A009: Oct. 21, 2010). Henry relied on his expertise as a lawyer to defend H Tool (ibid., C104: Oct. 30, 2010). "Henry maybe told you that in his other life, he was an attorney? . . . I think he always did have an eye towards the enforceability and the defensibility of H Tool as

a method, when he wrote it" (A230: Nov. 19, 2010). Henry's court triumph laid to rest many challenges to the tool, and he worked doubly hard to eliminate any remaining vulnerabilities:

> I pretty much spent the next seven years collecting the data that would make it impossible for that to happen again. I made myself litigation proof. I would never go through that again and H Tool would never deal with a challenge like that. That mountain of intense biological data we have, it would show that H Tool was calibrated against it over and over and over. It was a life-changing event. It motivates me to this day. It really drives my whole approach to data collection and program development. I never want to be called out like that again. (A009: Oct. 21, 2010)

Henry's efforts appeared to have paid off. No interviewee could think of a conceivable scenario under which H State's implementation of H Tool would falter. When Henry left HEA in 2007 for an environmental job in the non-profit sector, he gave over stewardship of H Tool to a bureaucrat and associated staff widely regarded as highly competent (A041: Nov. 18, 2010; C306: March 24, 2011), albeit not innovative at the same level as Henry and not likely to make drastic changes to the course Henry set (A041: Nov. 18, 2010; A380, A476: Nov. 19, 2010).

4.2 State I

State I's attempts at adopting a rapid wetland assessment tool can be divided into two phases: 1996–2005 and 2005–present. A 1996 consent decree required the EPA to support the development of assessment approaches applicable to State I (E763: Nov. 5, 2010). Accordingly, the EPA poured money into I State University's academic wetland research center, I Institute (ibid.; C796: March 23, 2011). For roughly seven years, I Institute pursued many assessment projects, including developing a model rapid wetland assessment tool, I Tool, for the state (E763: Nov. 5, 2010). I Institute's scientists consulted regularly with state bureaucrats (A397: Dec. 13, 2010; E763: Nov. 5, 2010). Around 2004–2005,

however, the relationship between the institute and the state deteriorated (E763: Nov. 5, 2010), as did the practice of staff at the State I Environmental Agency (IEA) of consulting every three to four months with wetland stakeholders (A868: Nov. 15, 2010). While it is possible that the disconnect between I Institute and the state developed because the institute's contractual obligation to develop state-specific assessment products ended in 2004, the account below will show that a more plausible explanation for both sets of relationships deteriorating at roughly the same time is the exit of a relatively successful street-level policy entrepreneur from the State I wetland policy arena in 2005. Since then, the state has experienced less extensive and poorer quality street-level policy entrepreneurship, and its progress toward regulatory tool adoption has appeared at best ambiguous and at worst stalled or moving backwards.

Today, experts describe State I's assessment initiative as confusing (C104: Oct. 30, 2010; C796: March 23, 2011). One federal regulator asked, only half-jokingly, "When you figure it out, can you tell us?" (B205: March 15, 2011). A key state official indicated that State I is planning to integrate its tool into regulatory use soon (A369: Dec. 13, 2010), but past precedent encourages skepticism. Secondary sources indicate the state has been giving roughly the same status update since 2006 (ELI 2008). State I has been training regulatory stakeholders to use a draft version of I Tool. However, in October 2010, state officials told training participants that the tool would be revised again before implementation. In June 2011, training participants were told that the tool would integrated into state environmental assessment processes over the summer and fall of 2011.[69] In October 2011, a key state official reported planning to roll the tool out sometime in the next year (A369: Oct. 27,

[69] This information was gained via ethnographic experience.

2011). Stakeholders appear increasingly skeptical about whether I Tool will ever actually be used in regulatory applications (e.g., A560, A992: Dec. 13, 2010; A868: Nov. 15, 2010; B205, B289, B783: March 15, 2011; C104: Oct. 30, 2010; C796: March 23, 2011).

State I's rocky path toward tool adoption can be linked to street-level policy entrepreneurship. Until 2005, Ian, former head of the IEA wetland protection office, had strong relationships with scientists at I Institute. Ian's friendship with lead scientists Ivan and Irene particularly facilitated ongoing dialog over how I Institute's work could be used in the state. Irene noted that "It was really all about, I would say, a personal relationship between Ian and Ivan" (E763: Nov. 5, 2010). Ian himself recalled "I really enjoyed working with Ivan and Irene" (A397: Dec. 13, 2010).

Ian convened an advisory committee that allowed diverse stakeholders, including scientists, representatives of development interests and environmental groups, and bureaucrats from various state agencies, to give bureaucrats feedback about wetland issues. The committee also allowed stakeholders to learn about I Tool, an important precursor to their acceptance of it. The state seemed to be making progress toward tool adoption (C114: Oct. 30, 2010). "Ian was providing a kind of an amazing amount of leadership in the state for wetland policy and regulation" (E763: Nov. 5, 2010). In 2005, however, Ian moved to another IEA unit and lost touch with I Institute staff and the wetland policy realm (A397: Dec. 13, 2010).

The staff biologist who picked up the assessment effort, Irving, appears to lack Ian's capacity or inclination for building and maintaining professional networks to secure expertise and resources necessary for innovation implementation. One challenge states face in tool adoption is convincing regulators at the U.S. Army Corps of Engineers to accept the tool.

Irving has repeatedly proven unwilling to "sell" to the Corps. "They [IEA staff] are not asking the Corps' permission," said a regional policy expert. "They're just going ahead [with their assessment efforts]. [But the Corps is] uncomfortable with it [I Tool] and . . . as much as I like Irving, his approach is just 'We're going to do this and screw you.' And to me that's not the right approach" (C104: Oct. 30, 2010). Irving himself noted, 'Yeah, we were meeting regularly [with the Corps] and then we kind of broke it off, and then it got a little nasty . . . We were trying to work a little bit collaboratively, then we said, 'To hell with this'" (A369: Dec. 13, 2010).

Wetland advisory committee members said that meetings tapered off (A271, A560, 992: Dec. 13, 2010; A868: Nov. 15, 2010). Irving appears minimally interested in buy-in from stakeholders, bureaucratic and otherwise: "Everybody always wants the working committee, everybody always wants to do things collaboratively . . . It takes years and years to do it by committee and you end up with a product that is not perfect by nature" (A369: Dec. 13, 2010). Consultation among state wetland bureaucrats and I Institute also became notably less frequent (E763: Nov. 5, 2010). An interaction with I Institute that left Irving with a bitter taste in his mouth may partly explain this rift. Irving and other bureaucrats tested a version of I Tool developed by I Institute on more than 200 wetland sites—a substantial investment of time and resources—before realizing that they were using the wrong version of the tool, an error Irving appeared to blame on lead scientist Ivan (A369: Dec. 13, 2010).

Irving later concluded that the tool developed by I Institute was not suited to regulatory use and began revising it, largely without external consultation and with minimal participation from other implementing bureaucrats. For example, even though IEA and the

State I Natural Resources Agency share a building, and staff at the latter have assessment expertise, they work with Irving infrequently. "We've had, in State I, a kind of disconnect, even though we're only a few floors apart," acknowledged Irving (A369: Dec. 13, 2010). More generally, he noted, "We've been operating kind of in a vacuum over in our central office where a lot of the work is going on, in terms of what the tools are, their development, [and] collaboration with other regional partners" (ibid.). Those would-be partners seemed to concur. Bureaucrats at another state natural resource agency—policy actors who would potentially comment on IEA regulatory actions guided by I Tool—said that "You [the interviewer] know as much as we do about what is going on," noting they used to be involved in the tool development process but they were not anymore (A271, A560, A992: Dec. 13, 2010). Some stakeholders say that, as far as they can tell, the seemingly long and fraught tool revision process pursued by Irving has not necessarily produced a better assessment mechanism (ibid.; A868: Nov. 15, 2010). Said one national expert: "I just got . . . [a copy of] I Tool . . . I looked at it and it's terrible. And you kind of go, 'So . . . . we have spent millions of dollars through I State University to develop these tools, and then . . . *this* comes out the other end?' . . . It's like, 'Oh, my God. What happened?'" (C796: March 23, 2011).

Moreover, whereas Ian seemed adept at negotiating the policy process, Irving appears frustrated by it. "[Approaching a regulatory rulemaking is] . . . about a six-month process itself. And then [to] revise the [permit] applications, all that has to be done at the same time or leading up to it. It's a lot more work than one might think" (A369: Dec. 13, 2010). When asked about the point at which the state will move forward with tool adoption, Irving exclaimed "[We're] ten years into the process and we're past that point, way past it!"

(ibid.). His frustration may stem from a lack of policy acumen. Recounting the lawsuit which compelled the EPA to fund assessment research applicable to State I, one expert noted: "Irving may not understand the whole thing—I don't think he really understands the true facts of the history" (C104: Oct. 30, 2010). In short, Irving appears to be a poor street-level policy entrepreneur:

> Irving kind of talks good, but I'm just not sure if anything is really happening. . . . The trick and the hard thing with State I is that you need to have a savvy person . . . that's going to take it from the "OK, we have a protocol [tool] that we feel good about" into "I'm going to use it in my program." Now Irving says he's going to do that, but first of all, he's one person, and secondly, he's just not the kind of person who [off the record comment] . . . you know what I'm saying. He struggles . . . And he's got a lot going on and it's just not [working]. (C104: Oct. 30, 2010)

5.0 Conclusion

Contrary to prevailing themes in the literature, implementing bureaucrats can be innovative policy entrepreneurs. Although they are conventionally described as powerful only in certain, highly delimited arenas, and relatively helpless outside them, street-level bureaucrats can adopt or develop policy innovations intended to improve implementation processes in which they are embedded, then entrench their policy innovations in the practices of bureaucratic peers.

The cases of States H and I showed that street-level policy entrepreneurship both exists and matters for state-level adoption of science policy innovations. In State H, Helen and Henry had extensive and diverse professional resources. Helen drew upon these resources to collect State H-suitable elements from assessment tools developed in other states and to recombine those elements into a scientifically rigorous, innovative tool. Henry used his scientific training to further enhance the tool and employed his legal training and policy acuity to put the tool into on-the-ground policy and defend it in court. Both Helen

and Henry were skilled at convincing other implementing bureaucrats, whose support is critical for the success of an innovation that stands to change the ways in which they do business, to contribute to the development and support the implementation of H Tool. Henry secured federal funding that provided a sure foundation for H Tool, and then pushed for the tool's codification in the state's administrative code so that the state would be committed to long-run implementation. Two street-level bureaucrats, a staff biologist and a staff attorney turned wetland ecologist, played crucial roles in helping State H adopt an innovative tool for wetland management.

State I's less successful attempt at tool adoption underscores the importance of street-level policy entrepreneurship. Ian, an office head, appeared to push the state closer to the tool adoption goal. However, when he left the state's wetland policy arena and the assessment effort was pursued with less entrepreneurial effort and skill by staff biologist Irving, the state's progress toward tool adoption markedly faltered. While Ian productively worked with I Institute to develop I Tool and strategize about how the research center's policy products could be tailored to the needs of state bureaucrats, Irving did not maintain those ties. Irving also did not cultivate networks with important stakeholders outside the state bureaucracy, such as regulators with the U.S. Army Corps of Engineers, and with other implementing bureaucrats whose buy-in is vital for the adoption and entrenchment of a policy innovation at the street level. Far from being convinced that they ought to alter their standard operating procedures to accommodate I Tool, many bureaucrats interviewed for this research appeared pessimistic about I Tool's utility or Irving's ability to incorporate it into the state's regulatory program. Irving's frustration with the policy process, along with other evidence in the case, suggests that he is not effectively positioning State I to access

resources and institutional support for long-term innovation implementation. States I and H began their tool adoption effort at nearly the same time and in other important ways are very similar. However, the less extensive and skilled policy entrepreneurship of Irving, relative to the adept entrepreneurship of Helen and Henry, seems to explain State I's tool adoption struggles compellingly.

This chapter's primary contributions have been to illuminate the street-level blind spot in the conventional literatures on policy entrepreneurship, and to argue that—despite indications to the contrary in the street-level bureaucracy literature—on-the-ground bureaucrats can pioneer innovations that improve implementation and institutionalize them in state-level policy. In the process, this investigation has opened new avenues for research. The policy and management literatures contain a number of works investigating the behaviors, strategies, motivations, and challenges of policy entrepreneurs as conventionally characterized. The natural extension of this chapter is an investigation of whether and how those characteristics differ in street-level policy entrepreneurs, and the theoretical roots and practical implications of those potential differences.

Chapter 6: Conclusion

1.0 Dissertation take-home points and a review of central concepts

This dissertation has examined, with greater methodological rigor, a stronger theoretical orientation, and a different perspective than previous research, why state environmental bureaucrats fail to implement and state environmental bureaucracies fail to adopt rapid (non-tidal) wetland assessment tools. The dissertation makes four main contributions. First, it illuminates factors that influence whether street-level bureaucrats use policy innovations such as assessment tools when usage is largely a matter of discretionary choice rather than obedience to a centralized administrative mandate. Second, it contributes to the literature on cooperative environmental federalism in the United States by showing how perverse incentives emerging from the structures of cooperative environmental federalism and the Clean Water Act can undermine a main goal of the federalist structure, as well as how conflict among agencies at the federal level can make typically subordinate state agencies the most likely agents of policy change. Third, it develops the concept of synergistic institutional analysis and uses this approach to disentangle the complicated skeins of the federalism account. Fourth, it shows that policy entrepreneurship by street-level bureaucrats both exists and matters for the adoption of innovations intended to improve policy implementation.

This section briefly reviews the policy instruments on which the dissertation focuses. Rapid wetland assessment tools are a class of policy innovations developed in recent decades to aid wetland management; more than 100 tools exist nationwide (Kusler 2006). State environmental agencies first became aware of these tools around 1995, though few used

them until the late 1990s and 2000s (C104: Oct. 31, 2010). A rapid wetland assessment tool "(1) measures wetland condition, *functions, or value*, (2) includes a site visit, and (3) takes two people no more than a half day in the field and another half day in the office to complete" (Fennessy, Jacobs, and Kentula 2004, 543; own modifications in italics). These tools combine elements of a questionnaire and an instruction sheet. They highlight the data a bureaucrat should collect to evaluate the potential impacts of activities proposed for a wetland, and help him interpret those data when making a regulatory decision such as issuing a permit for development.

Rapid wetland assessment tools are technically complex policy instruments with relatively low salience or visibility to the general public. Tool use is often a discretionary choice by bureaucrats who implement day-to-day wetland policy. In the six states this investigation examines, many bureaucrats who might use these tools have not received explicit top-down direction from their administrative agencies about whether to use tools, which, and how. Only one of the six states (Ohio) has officially adopted a tool for regulatory use, and even there, the tool is not used for all regulatory activities and was not official practice for the entire study period. In other states, environmental agencies recommend use of some type of assessment tool but do not specify which. In still others, tool use is neither officially recommended nor prohibited. Tools could be used by a variety of state actors involved in wetland regulation (e.g., a wetland specialist, a transportation planner, or a biologist charged with safeguarding endangered species and habitat) working in a variety of positions in a variety of agencies.

This chapter next summarizes the methods used in the dissertation. That section is followed by three sections which summarize each of the dissertation's empirical chapters.

Next, three more sections lay out the lessons policy practitioners can draw from the empirical analysis. The chapter ends with a description of future research opportunities and a brief conclusion.

2.0 Methods

The dissertation uses data from a six-state survey of state wetland bureaucrats (n=149), interviews with wetland policy actors (n=98, approximately 58 interviewee hours), roughly 18 months of ethnographic data collection, and secondary sources. The survey targeted individuals employed at some point between 1995 and 2011 as state wetland bureaucrats in Delaware, Maryland, Ohio, Pennsylvania, Virginia, and West Virginia.

These states were selected based on a "most likely" case analysis (George and Bennett 2005, 121). The wetland policy community considers many of the states to have some of the most advanced wetland assessment initiatives nationwide (C104, C193: Oct. 30, 2010). Several of the states are home to public research institutions nationally known for wetland research, including work on assessment, and whose scientists work with state policy actors. Regulatory tool adoption should be more likely in these states than elsewhere, and if adoption does not occur, the reasons why should be particularly informative.

Individuals were eligible for the survey if, during the study time period, they had a job where wetland regulation was one of their main tasks or they participated in one or more projects where wetland regulations were involved. The survey was online and respondents were invited using email and postal invitations.

Survey outcome rates were calculated using best practices described by the American Association for Public Opinion Research (AAPOR 2011) and Smith (2009). The

proportional allocation-estimated cooperation rate was 28.6%. This figure is somewhat lower than the average reported by Shih and Fan (2008), whose meta-analysis of 39 web-based studies found a mean survey response rate of 34%. Sheehan (2001) reviewed 13 online surveys administered from 1998 to 1999 and calculated a more comparable average response rate of roughly 31%. The best estimate of the cooperation rate range for the survey was 28.6–40.4%. Thus, the true cooperation rate may be as high or higher than the averages reported in the literature.

The survey effort faced challenges, most notably a lack of an easily defined sample frame. This difficulty led to the use of a non-probabilistic sampling strategy, limiting some options for analysis. Contacting sample members and determining their eligibility were also challenging. The survey data best reflect the behaviors and perceptions of current state bureaucrats (91% of the n) directly involved in wetland regulation and/or interested in wetland issues and able and willing to complete a survey online. The data more poorly reflect characteristics of bureaucrats no longer in state employment, more tangentially involved in wetland regulation, uninterested in wetland issues, or unable or unwilling to complete an online survey. These biases do not substantially damage the research endeavor.

The 98 wetland policy actors targeted for interviews were state bureaucrats involved in wetland regulation; wetland regulators from the U.S. Environmental Protection Agency and the U.S. Army Corps of Engineers; state, regional, and national wetland scientists and policy experts; and members of the regulated community—generally environmental consultants—who regularly worked in the six states. These were elite expert interviews where the interviewees were involved in wetland assessment initiatives, regional or national policy experts, and members of the regulated community deemed by EPA or Corps staff as

reputable, knowledgeable, or highly active in the region. Elite interviewing helps trace complex causal mechanisms such as those that lead states to adopt or fail to adopt rapid wetland assessment tools (George and Bennett 2005; Phillips 1998; Tansy 2007).

Interviewees were initially selected because of their membership in a regional workgroup devoted to advancing the science and policy of wetland assessment; because their names were located in relevant secondary sources; or because they were recommended by EPA wetland regulators. Subsequent interviewees were selected via snowball sampling. The goal was to interview all state staff members who appeared to have high levels of responsibility for wetland regulatory activities during the target time period, with a minimum of at least two individuals with expertise in each state and in each of the four relevant job sectors (EPA, Corps, and state bureaucracies, and the regulated sector).

The interviews were semi-structured and relied heavily on open-ended questions, an approach particularly recommended for elite interviewing (Aberbach and Rockman 2002). The interview questions were based on hypotheses articulated in the dissertation proposal, but not all interviewees were asked the same questions; questions were selected based on the interviewee's expertise. Sometimes interviewees brought up unanticipated topics, and these conversations were allowed to flow naturally so as to illuminate how the topics connected to the dissertation's central questions. Interviews were completed in person and over the phone. Roughly two-thirds of the interviews were recorded and transcribed, while the others were documented by hand and later typed; the method depended on interviewee preference. Interviews ranged from roughly 20 minutes to more than an hour and a half.

NVivo, a software program designed to facilitate qualitative analysis, was used to code the interview transcripts and notes. The coding approach was both deductive and

inductive. A series of queries based on the initial research hypotheses was applied to the data, but unexpected ideas and themes also emerged during the coding process. Interviews were recoded as necessary when the coding process uncovered new concepts. The coding scheme was a modified version of the elite interview coding protocol sketched by Aberbach and Rockman (2002). Data were most frequently categorized using explicit manifest codes, indicating responses to direct interview questions, and implicit manifest codes, indicating responses wherein interviewees struck on topics they were intended to address even if they had not explicitly been asked about them. Modified global codes, such as "applicant culture" and "regulator preferences," captured judgments about general characteristics of interviewee groups.

Data from the interviews cannot be used to make inferences about a larger population of elites because the interviewees were selected purposively, not randomly. The interview data could be biased by the personal agendas of interviewees, selection bias created by potential omission of key actors from the sample, lack of generalizability, and memory lapses of interviewees.

These threats to validity were addressed by seeking to identify the personal biases of interviewees in advance, asking them differently phrased questions about the same issues to explore the nature of those biases, and asking multiple interviewees the same questions to get a more rounded collection of accounts; the last strategy also helped mitigate problems of memory lapses. Comprehensive pre-interview research and ethnographic work familiarized me with the policy system, helping minimize selection bias and also identifying potential agendas of interviewees. Generalizability of the research findings was bolstered by cross-case analysis as well as within-case process tracing (George and Bennett 2005).

By working at the EPA for three summers prior to beginning my dissertation research, and then for another full academic year, I was able to work with federal wetland regulators who work closely with the state bureaucrats and bureaucracies I studied. This ethnographic data-gathering process allowed me to learn a great deal about the people and processes I was investigating, gaining perspectives I would not have had as an outsider. I also was able to access EPA internal documents which, while not classified, were much easier for me to identify and access than they would have been for an outsider.

3.0 Chapter summaries

3.1 Chapter 3: Policy learning and science policy innovation implementation by street-level bureaucrats

Chapter 3 argues that U.S. environmental policy, particularly the day-to-day implementation decisions made by government bureaucrats, sometimes fails to integrate best available science into regulatory practice (Dilling and Lemos 2011; Husbands Fealing et al. 2011). The chapter examines when and why such failure may occur, focusing on regulatory use of rapid wetland assessment tools by state bureaucrats as a discrete, individual-level example of science policy implementation. The chapter statistically analyzes survey data, complementing this analysis with interviewee quotes, to show that many state wetland bureaucrats do not know about rapid wetland assessment tools and that policy learning by such actors is a critical precursor to their implementation of such innovations.

The conceptual framework for the chapter explains that state wetland bureaucrats are classic street-level bureaucrats (Lipsky 1980). They possess substantial technical expertise; are given fairly wide latitude by their superiors to shape implementation choices; face large workloads, tightly constrained budgets, and multiple and potentially competing

demands from superiors; and develop standard operating procedures to make their day-to-day work manageable. By creating policy through their daily choices, they effectively execute a series of policy adoptions. Yet most of the political science literature on diffusion and adoption of policy innovations does not focus on street-level bureaucrats, but rather on jurisdictions such as states or unitary entities such as legislators. The literature tends to put the actual practices associated with adoption and implementation into a black box that limits understanding of how street-level bureaucrats who ultimately execute policies make those choices. The rather smaller literature which does examine the adoption choices of bureaucrats usually focuses on bureaucrats with political connections and managerial responsibilities, not the front-line bureaucrats who put government programs on the ground.

The chapter seeks to fill these gaps in the literature, rooting its inquiry in the more general literature on innovation diffusion. Rogers' (1995) seminal work highlights the criticality of communication channels for spreading information about innovations. The political science literature on policy learning also emphasizes information transmission between policy actors as a precursor to policy change such as the implementation of an innovation (Bennett and Howlett 1992). The low-conflict, high-ambiguity nature of wetland policy implementation appears particularly susceptible to the influence of such learning (Matland 1995). Although some innovation diffusion scholars emphasize the importance of mass media outlets for spreading innovation information, bureaucrats who might adopt technically complex assessment tools of low public visibility and salience seem more apt to learn about them via interpersonal communication and observation of models of professional practice. The chapter moves from this general argument to three specific

hypotheses about the pathways by which state wetland bureaucrats might learn about, and thereby become more likely to implement, rapid wetland assessment tools.

The first hypothesis is that accruing job experience will cause bureaucrats to use tools less frequently. Bureaucrats develop standard operating procedures that can gain inertia over time, and more experienced bureaucrats have operated longer without these relatively new tools being part of their regulatory practice. Experienced bureaucrats may thus be less open to altering their institutionalized repertoires and learning how to use tools. Also, more experienced bureaucrats seem more apt to rely on best professional judgment (BPJ) when making regulatory choices. BPJ encompasses the knowledge bureaucrats gain through years of regulatory work and is recognized in the wetland policy community as legitimate grounds for decision-making. Interview data suggested that some bureaucrats view assessment tools as learning aids necessary for less experienced wetland regulators who have not yet developed quality BPJ.

The second hypothesis is that bureaucrats who have more opportunities for structured knowledge acquisition at training events will be more frequently exposed to wetland management best practices and thus more likely to hear about assessment tools. Since some training events are voluntary and others are not, this learning pathway may capture not only individual-level interest in policy learning, but also a vertical push for learning from a bureaucrat's administrative hierarchy.

The third hypothesis is that when a bureaucrat is connected via his policy network to individuals who know about rapid wetland assessment tools, the bureaucrat is more likely to learn about tools and how to use them. The policy network is operationalized as up to five individuals upon whom bureaucrats reported relying most for wetland regulatory advice.

Bureaucrats turn to other bureaucrats and experts in the private and public sectors for data necessary to shape and execute science-based policies. Bureaucrats use networks to learn what other units of government are doing to address policy problems and may model their own policies accordingly.

The explanatory leverage of variables operationalizing the hypotheses and theoretically rooted control variables were evaluated by correlating each with a variable describing whether a survey respondent used an assessment tool at some point since 1995. Variables statistically significant in the correlation analysis were used in two logistic regressions, the second of which was nested in the first. Job experience was statistically significant, but not in the manner posited by Hypothesis 1: experience appears to lead to increased rates of tool use. Participation in training (Hypothesis 2), while significant in the correlation analysis, was not significant in the regressions. Network ties through which respondents gain assessment information were consistently significant in the manner anticipated by Hypothesis 3. A control variable describing the extent of a state's progress toward officially integrating a rapid wetland assessment tool into its state regulatory program was also consistently significant.

Predicted probabilities run using the nested regression model suggested that a bureaucrat who communicates about assessment in his policy network is roughly 47% more likely to use a tool than one who does not; a bureaucrat in a state such as Maryland, which has made minimal progress toward tool adoption, is roughly 42% less likely to use a tool than a bureaucrat in state like Ohio, which has officially adopted a tool for use in many (but not all) regulatory activities; and a bureaucrat at the first percentile of job experience (0.02

years) is roughly 58% less likely to use a tool than a bureaucrat at the ninety-ninth percentile (22.5 years). The model explains roughly 33% of the variation in the outcome variable.

The chapter's analysis generally supports its core learning argument. More experienced bureaucrats may have more extensive knowledge than newer bureaucrats about the state of wetland science and associated best practices, and thus might be more likely to recognize the value of—and thus use—assessment tools. They might have had more experiences wherein they realized they could have better managed a wetland if they could have more specifically quantified its amenities, perhaps by using an assessment tools. Post-hoc analysis suggested that job experience is not correlated with usage of best professional judgment in regulatory decision-making, and that mere opportunities for tool exposure (of which more experienced bureaucrats would have had more) do not appear to be a significant driver of tool use. The relative unimportance of training opportunities seems reasonable given the importance of job experience: If repetitive experiential exposure to tools facilitates learning and subsequent tool use, it may be sensible that discrete, non-repetitive information-dissemination events have less influence.

The importance of network ties as a learning pathway was theoretically anticipated and is substantively sensible. In a decentralized and discretionary implementation context wherein bureaucrats often do not receive information about assessment tools from political or administrative superiors, those who learn relevant information from their peers appear more likely to use tools. This finding was affirmed by data from a survey question wherein bureaucrats were specifically asked how they first learned about rapid wetland assessment tools. Nearly 87% of respondents who knew the tools existed heard about them from

someone at a conference, a member of the regulated community, a scientist, or another state environmental employee.

Finally, the importance of the control variable describing state-level adoption progress also supports the learning argument, since the variable represents a vertical communication channel from administrative superiors to street-level bureaucrats through which the latter could learn about assessment. The more steps relevant state agencies have made toward adoption, the more likely are bureaucrats to have heard about rapid wetland assessment tools from their administrative hierarchy. State-level progress toward adoption also may send positive signals to bureaucrats about the desirability of using tools.

In sum, when bureaucrats have more opportunities to learn tool-related information and practice norms, they are more likely to implement tools. Learning, achieved via job experience, lateral communication through network ties, and vertical communication of organizational cues, has a meaningful impact on tool use likelihood. These findings have more general implications for the integration of best available science into on-the-ground environmental policy when such integration is largely a matter of individual choice by street-level bureaucrats rather than the result of a centralized mandate.

3.2 Chapter 4: The struggle for state-level adoption of rapid wetland assessment tools

Chapter 4 accomplishes three tasks. First, it answers a specific, applied research question: Why is state-level adoption of rapid wetland assessment tools into regulatory policy so difficult? Second, the chapter illuminates the nuances of that answer via synergistic institutional analysis, an approach to inquiry that uses the complementarities and connections among rational choice, sociological, and historical institutionalism to explain

policy phenomena more satisfactorily than could any one of those theoretical traditions alone. Third, it contributes to the literature on cooperative environmental federalism by showing that when federal-level influences on state environmental policies are uncoordinated, contradictory, and incomplete, one of the main goals of the federalist structure is undermined—and that in such situations, policy change may be more likely to be driven by state agencies than conflictive federal ones.

The puzzle of the chapter is that rapid wetland assessment tool adoption for regulatory purposes has occurred in only one of the six states in this investigation, even though officials in each state having been pursuing adoption. With the exception of Delaware's environmental regulatory agency, agencies in each state have (or had) spent more than a decade trying to adopt a tool. Similarly, at the national level, state-level regulatory tool adoption is fairly rare (Kusler 2006). This adoption failure is especially striking because scientists generally agree that, in principle, rapid assessment tools can be useful for regulation (e.g., Ainslie 1994; Sutula et al. 2006), and state bureaucrats in this investigation—while sometimes noting reservations about certain tool aspects—often seemed to view tools positively. Even more puzzling is the way adoption failure has occurred in all the states save Ohio: state officials develop, adapt, and revise tools, in some cases reaching points where experts say the tools are ready for regulatory roll-out, and then the adoption efforts seem to stall.

These puzzles are the consequence of interactions among the U.S. Army Corps of Engineers, the U.S. Environmental Protection Agency, and state environmental agencies. The Corps has primary responsibility for regulating impacts to wetlands under Section 404 of the Clean Water Act. In some states (e.g., Delaware, Ohio, and West Virginia), the agency

runs the Section 404 permitting program without state agency participation. In others (e.g., Maryland, Pennsylvania, and Virginia), it may delegate to state agencies implementation responsibility for some components of the program. When states have their own wetland statutes, as do the latter three, the Corps may work with state officials to implement a joint permitting process.

The Corps is the dominant partner in these dealings. When developing joint permit applications, state agencies tend to defer to Corps preferences regarding the kinds of wetland data to be collected, and how (e.g., via the application of an assessment tool). The Corps only delegates program implementation authority to state agencies which comply with the agency's regulatory standards and preferences. State officials also bend to the Corps' will because they sometimes perceive the agency as having greater relative expertise and because they do not want the political cost of burdening applicants with both state and federal regulatory procedures.

The Corps is hesitant to support regulatory wetland assessment for three reasons. First, the Corps' history and culture as a hierarchical, fairly rigid military organization makes the agency disinclined to accept tools developed or championed by states rather than by the Corps' own research command, or to work cooperatively with state officials to create tailored tools. Second, the Corps twice tried to integrate a rapid wetland assessment tool into nationwide wetland regulatory practice. Both attempts were high-profile policy failures that left Corps officials sour on the regulatory viability of assessment tools. Third, to the extent that Corps regulators might support tool adoption, their function-focused mandate under Section 404 of the Clean Water Act encourages them to prefer function-focused tools. However, many of the rapid wetland assessment tools that exist nationwide focus on

wetland condition. Thus, the Corps' heavy influence on state wetland regulatory practices dissuades state environmental agencies from regulatory tool adoption.

The EPA plays a secondary role in Section 404 wetland regulation, reviewing Corps permits and in rare cases vetoing them. More significant in this analysis is the EPA's charge, under Section 305(b) of the Clean Water Act, to report to Congress on the quality of the nation's waters. To meet this obligation, the EPA relies on data collected by states. Problematically, state officials have a long history of providing minimal or no data on the status of their wetlands.

The EPA's main mechanism for exerting pressure on state environmental agencies is funding. The EPA offers state agencies substantial monies for wetland activities via the Wetland Program Development Grants program, Clean Water Act Performance Partnership Grants, and other initiatives. Interviewees reported that these funds can be critical to the day-to-day operations of state wetland programs. Over roughly the past two decades, the EPA has increasingly targeted these monies to encourage state officials to develop or adopt assessment tools state wetland programs could use to gather wetland condition data.

The tools the EPA incentivizes state officials to develop or adopt thus tend to focus on wetland condition. While some experts argue that condition-focused assessment tools can usefully inform a wetland regulatory program, others, often including Corps regulators, argue the contrary. It is certainly true that the two types of tools may lead to opposite inferences about the value of a wetland. For example, a function-focused tool might indicate that a polluted wetland deserves stringent protection because it traps and prevents polluted runoff from entering a river used for recreation. However, a condition-focused tool would probably

rate the same wetland poorly, potentially indicating it should not be stringently protected because its ecosystem has been nearly obliterated.

The EPA thus encourages state agencies to embrace tools the Corps rejects, and state bureaucrats pursue these tools despite the Corps' discouragement so as to continue securing EPA funding. However, a primary source of EPA wetland funding, Wetland Program Development Grants, can actually only support research and development, not the implementation of assessment tools. State officials note that this constraint is a major obstacle for regulatory deployment, and it substantially explains why their assessment efforts often stall.

Less dysfunctional policy outcomes might result if the EPA and the Corps could coordinate the pressures they impose on states. However, the agencies have a history of contentiousness and limited coordination vis-a-vis wetland policy. Some state bureaucrats appear to believe that if they can educate Corps district regulators about the value of regulatory assessment, the regulators might be convinced to accept state-championed tools. While this strategy is not wholly implausible, the agency's dominant norms and incentives make winning district regulators over via education potentially difficult.

The chapter concludes with a case study of Ohio, which managed to adopt a tool for regulatory assessment. There are three explanations for Ohio's success. First, the Ohio EPA (OEPA) employed an infrequently used Clean Water Act provision to flip the power dynamic with the Corps and get the federal agency to bend to state wetland regulatory preferences, which included assessment tool usage. Section 401 allows state officials to condition or deny federal permits whose impacts would violate state water quality standards. While many states treat Section 401 certification as a rubber stamp, OEPA pursues it

vigorously. The Corps initially balked at this strong-arming, but because OEPA does not implement portions of the federal wetland permitting program or engage in joint permitting, the federal agency did not have leverage to make the state agency heed the federal agency's preferences. Second, OEPA managed to integrate a condition-focused tool into its regulatory program. The agency had a relatively long history of scientifically rigorous stream condition assessment. Its bureaucrats were accustomed to using condition data to inform regulatory decisions and had the expertise to craft a condition-based wetland assessment tool amenable to regulatory processes. By establishing wetland-specific water quality standards and an anti-degradation provision, Ohio officials committed OEPA to reporting wetland condition data to the federal EPA and deploying an assessment tool in that task. Third, Ohio's tool adoption was facilitated by skilled policy entrepreneurs.

Synergistic institutional analysis is used to structure and contextualize Chapter 4's presentation of the above account. This analytical approach has two main ideas. The first is that different institutional theories can be used to analyze different dimensions of a policy puzzle, holding other dimensions constant. The second is that rational choice, sociological, and historical institutionalism are in some ways fundamentally interrelated. For example, institutions cast by rational choice scholars as functionalist solutions to problems may, over time, become the sticky, path-dependent institutions described in historical accounts. The mutual adaptation that entrenches social conventions in rational choice theorizing may also create social narratives which, according to scholars of sociological institutionalism, become so ingrained in daily life that they are no longer consciously recognized by humans whose behaviors they shape.

Finally, the chapter contributes to the literature on cooperative environmental federalism. One goal of this federalist system is for the federal government to enable state officials to prosecute environmentally beneficial policies the officials may recognize as valuable but struggle to pursue independently because of state-level obstacles such as political pressure or lack of expertise. Chapter 4 shows that the opposite outcome can occur: states wetland bureaucrats appear to want to use rapid wetland assessment tools for regulation, but struggle to do so because of uncoordinated federal influences that often are at cross-purposes or do not offer sufficient support. Regulatory tool adoption was actually easier for the state that maximized its independent regulatory authority and was less enmeshed in state-federal interplays. The chapter concludes by discussing how states actors can promote policy changes (e.g., tool adoption) by pressuring or interacting with federal principals in ways that diminish the problematic impacts of those principals' lack of coordination.

3.3 Chapter 5: Street-level policy entrepreneurship

Chapter 5 contends that—despite the inattention of conventional political science literature on policy entrepreneurship to the entrepreneurial activities of street-level bureaucrats, and despite the slant in the street-level bureaucracy literature which does not necessarily expect these actors to be entrepreneurial—street-level bureaucrats can, in fact, be policy entrepreneurs. The term "street-level bureaucrat" is used broadly, not only encompassing implementing agents whose sole focus is client service, but also including low- and middle-level bureaucrats who do not necessarily spend all their time with clients but also do not have substantial political or managerial responsibilities.

A policy entrepreneur is an actor who leverages resources to generate a favored policy outcome (King and Roberts 1992; Kingdon 1984). Policy entrepreneurs creatively recombine ideas and resources to create policy innovations (Oliver and Paul-Shaheen 1997, 744), then entrench new policies in place of old ones (Beckert 1999; Maguire, Hardy, and Lawrence 2004; Sheingate 2003). Their innovations often disrupt existing social, political, or economic arrangements (Etzioni 1987; King and Roberts 1992; Kingdon 1984; Mintrom 1997; Schumpeter 1942).

Three lines of evidence reveal that policy entrepreneurship scholarship overlooks street-level bureaucrats. First, much of the literature focuses on early stages of the policy process wherein action is dominated by elites rather than implementing actors. Although scholars sometimes contend that policy entrepreneurs intervene in the policy process wherever necessary to secure their preferred policies—an argument that casts entrepreneurs as elite "fixers"—much of the empirical analysis focuses on agenda-setting and adoption. Second, that focus highlights a flawed assumption in the literature that once a policy entrepreneur has successfully set an agenda or persuaded elites to adopt a policy, policy implementation will occur seamlessly. Third, when the literature argues that policy entrepreneurs levy influence from outside the policy process and must secure the support of bureaucratic insiders, it implies that the latter are not policy entrepreneurs.

The policy entrepreneurship literature's inattention to implementing agents may be related to the pessimism in the street-level bureaucracy literature concerning the entrepreneurial capacity of such actors. Although street-level bureaucrats have significant power to shape their implementation decisions based on personal discretion (Fineman 1998; Maynard-Moody and Musheno 2003; Riccucci 2005; Walker and Gilson 2004; Winter 2002),

they are often characterized as too overwhelmed by resource constraints and large, competing mandates from superiors to craft coping strategies that qualify as true innovations developed via creative recombination and advanced in an entrepreneurial manner. As conventionally described, street-level bureaucrats work with available materials to develop heuristics rather than reach outside their purviews for new ideas; lack resources to change the discretionary practices of peers; and seek to protect, rather than entrepreneurially disrupt, the status quo. Accordingly, the literature on adoption of policy innovations by bureaucrats tends to focus on those with substantial political or managerial responsibilities rather than on low-rung implementers (e.g., Sapat 2004; Teodoro 2009, 2010).

This focus, however, does not give street-level bureaucrats enough credit. For example, Borins (2002, 2001a, 2001b) found that low-rung implementers in public bureaucracies actually developed a majority of the policy products submitted to competitions in the 1990s designed to highlight public management innovations. The case studies in Chapter 5 further show that street-level bureaucrats have entrepreneurial ability. The cases support the proposition that street-level policy entrepreneurs seek to develop or adopt policy innovations intended to improve the implementation processes they prosecute, and to entrench these innovations in the day-to-day activities of their bureaucratic peers. Successful street-level policy entrepreneurs have networks which help them secure policy innovations tailored to the needs of implementers. They convince other bureaucrats to change their standard operating procedures and deploy policy innovations. They also secure resources for and mitigate threats to ongoing innovation implementation.

Chapter 5 relies on a "most similar" case comparison to show the existence of street-level policy entrepreneurship and its importance for state-level regulatory adoption of

science policy innovations such as rapid wetland assessment tools. States H and I began their tool adoption efforts in the mid-1990s and in many ways are similar.[70] They are geographic neighbors whose wetland bureaucrats participate in a workgroup devoted to assessment science and policy. They have comparable populations per square mile, per-capita GDPs, state land area covered by wetlands, and policies protecting federally non-jurisdictional wetlands, as well as similarly structured state environmental agencies. However, State H adopted a tool into regulatory policy in 2002, while State I is still struggling. Although these different outcomes may be related to variables on which the states differ, the process-tracing in the case studies shows that policy entrepreneurship substantially affected the tool adoption outcomes.

State H had two street-level policy entrepreneurs widely credited with substantially facilitating state-level regulatory tool adoption. Helen, a State H Environmental Agency staff biologist with strong academic credentials, cultivated a tight-knit, committed group of in-house experts who drew elements from assessment tools developed in other areas to create a rigorous tool suited to State H's implementation needs. When Helen left the agency in the late 1990s, a staff attorney turned ecologist named Henry took over the assessment effort, driven by a personal interest in wetlands. Henry had many qualities that appeared to facilitate his entrepreneurship, including a unique professional background in both law and applied science; a commitment to rigorous, data-rooted assessment; credibility among stakeholders;

[70] Though the states obviously are two of the six investigated in the dissertation, they, along with actors, organizations, and tools associated with them, are anonymized in Chapter 5. Though this anonymity was neither required by the institutional review board nor requested by interviewees, it seemed appropriate because of the personal nature of accounts provided by some interviewees concerning the states' street-level policy entrepreneurs. A reader of the entire dissertation may be able to infer which state is which. However, a main goal of the anonymization is to provide some measure of protection for the research subjects when Chapter 5 is published as a stand-alone paper.

and a strong work ethic. Both Helen and Henry secured buy-in from other implementing bureaucrats whose commitment to tool deployment is necessary for adoption success. Henry continued Helen's practice of building in-house expertise and also assembled a broader stakeholder group that propelled the assessment tool through a formal rulemaking that put its usage into the state's administrative code. This codification was part of Henry's strategy to ensure long-term state support for the tool's implementation. Henry institutionalized the tool in two other important ways: he skillfully leveraged a number of EPA grants to provide a solid foundation for tool implementation, and he successfully defended the tool in a high-profile court challenge.

State I also had two street-level bureaucrats pushing for regulatory assessment tool adoption, but the exit of the former from the state's wetland policy arena and the less extensive and skilled policy entrepreneurship of the latter compellingly explain the state's adoption struggles. Ian, the head of the state's wetland protection office, originally led the effort. He and other wetland bureaucrats worked closely with scientists at I Institute, a research center at I State University funded by the EPA to pursue assessment research and develop an assessment tool applicable to State I. Ian also convened a group of wetland stakeholders which met every three to four months and allowed I Institute scientists, representatives of development and environmental interests, and state bureaucrats inside and outside the wetland protection office to discuss wetland issues and learn about the tool being developed by I Institute. Ian seemed to be positioning the state effectively for tool adoption.

However, in 2005, Ian left his position and the assessment effort was picked up by a staff biologist, Irving. Irving exhibited few of the networking skills which defined Ian's entrepreneurship. Under Irving's tenure, ties between state wetland bureaucrats and I

Institute scientists grew strained and then essentially dissolved. Meetings of the wetland stakeholder group tapered off because Irving rejected stakeholder collaboration. Irving also was unwilling to lobby for the Corps to support tool development, even though the Corps is an important regulatory stakeholder. Irving viewed the I Institute-produced tool as poorly suited to the state's implementation needs and has been revising it with minimal participation or buy-in from stakeholders or many other implementing bureaucrats. Some observers say that this long revision process appears to have been difficult and has not necessarily produced a better tool; they are skeptical about whether the tool will ever be implemented in the state's wetland regulatory program.

The State H and I comparisons show that street-level policy entrepreneurship both exists and can affect state-level adoption of science policy innovations such as assessment tools. State H's street-level policy entrepreneurs secured adoption by applying expert knowledge to recombine existing tool elements and ultimately craft a tool suited to State H's needs. They cultivated facilitative network ties, particularly with other implementing bureaucrats. Henry entrenched H Tool by facilitating a formal rulemaking, creatively deploying federal funds, and defending the tool in court. While Ian in State I seemed equally adept at networking and positioning the state for adoption success, his exit from State I's wetland policy arena and the subsequent less extensive and skilled policy entrepreneurship of Irving appear to explain substantially the state's subsequent rocky path toward tool adoption.

Chapter 5's primary contributions are its illumination of the street-level blind spot in the conventional literature on policy entrepreneurship and its argument that, despite indications to the contrary in the street-level bureaucracy literature, on-the-ground bureaucrats can be policy entrepreneurs. The chapter opens new avenues for research. Its

natural extension is an investigation of whether and how the behaviors, motivations, and challenges policy entrepreneurs as conventionally characterized differ from those of street-level policy entrepreneurs, and the theoretical roots and practical implications of those potential differences.

4.0 Policy lessons

4.1 Policy lessons: Chapter 3

Chapter 3 can educate policy actors who want assessment tools (or similar policy innovations) used in regulatory policy and who are puzzled by their lack of use, such those at the helm of the National Wetland Condition Assessment, about why state street-level wetland bureaucrats are not using these tools and factors that facilitate usage. Six policy lessons flow from Chapter 3's analysis.

The first policy take-away is that policy actors seeking to encourage use of tools need to do more to ensure that information about tools reaches on-the-ground implementers who have discretion to use tools independent of a state-level mandate. Actors pushing assessment cannot assume that information will be filtered down through the ranks of a bureaucrat's administrative agency. Commented an environmental consultant: "Maybe there is encouragement from the top [to use tools], but it dies before it gets to the middle. And the bottom [of the administrative hierarchy] is discouraged from doing anything different. It has to get all the way down" (D556: Dec. 22, 2010). The most likely vehicles by which innovation information could flow more or less directly from innovation sources to street-level bureaucrats would probably be practitioner-oriented, profession-specific publications such as the *National Wetlands Newsletter* and state, regional, and national professional

associations such as the Virginia Association of Wetland Professionals, the Association of State Wetland Managers, and the Association of State Floodplain Managers.

Problematically, however, assessment-related information promoted through these channels still might not reach a substantial portion of the target population. Although I am not aware of any data on the extent to which street-level bureaucrats (particularly those in the environmental arena) belong to professional associations,[71] I am a former editor of the *National Wetlands Newsletter* and am familiar with its past and current subscriber lists. The state officials who subscribe tend to be relative elites (e.g., division or bureau directors), and public sector employees traditionally have not dominated the subscriber list. The Association of State Wetland Managers generously gave me access to its membership list when I was searching for state survey contacts. I observed the same problem there; most of the association's members appear to be wetland bureaucrats positioned fairly highly in various administrative hierarchies. My EPA colleagues affirmed that most of the field regulators with whom they interact in the Mid-Atlantic states are probably not members of any professional organizations. Thus, the prospects for implementing this policy recommendation appear fairly poor without greater professionalization of street-level bureaucrats, a point to which I return below.

Second, while it is clear that interpersonal ties which channel information are a key mechanism for facilitating the use of a policy innovation such as a rapid assessment tool, it is less clear how policymakers might directly structure those ties; policy networks are often

[71] Brudney and Hebert's (1987) investigation of the influence of professional association on state administrators surveyed heads of agencies, not street-level bureaucrats. Similarly, Teodoro's (2009, 2010) more recent scholarship documents bureaucratic membership in professional association, but he focuses on police chiefs and water utility managers, not field-level actors.

emergent, not necessarily amenable to external manipulation (Rhodes 1997). However, we may infer that policymakers trying to promote assessment could usefully communicate relevant information to "opinion leaders" (Muth and Hendee 1980), or what social network scholars call network nodes with high degree centrality (Wasserman and Faust 1994). These are individuals who have ties to many other actors in a policy field and whose knowledge about innovations thus could be particularly influential. These actors would have to be leaders specifically with respect to the opinions of street-level bureaucrats, that is, they would have to have ties with many field-level actors so as to avoid the problem described by the interviewee cited above: innovation information staying at the top of the administrative hierarchy. Although this dissertation's data were not sufficient to support a formal network analysis identifying actors positioned both to receive innovation information and to communicate it to many field-level bureaucrats, additional research specifically focused on network dynamics could uncover such individuals in this or a comparable policy arena.

Third, Chapter 3's analysis reveals that some strategies policy actors are using or plan to use to promote assessment are not likely to be very effective. The fact that nearly 87% of street-level bureaucrat survey respondents heard about assessment tools rather than read about them suggests that merely publishing information and providing documents to implementers is not sufficient to encourage their use of assessment tools or similar innovations.[72] This lesson is important for leaders of the National Wetland Condition Assessment, who want to "help states and tribes implement wetland monitoring and assessment programs to guide policy development and project decision-making" (EPA 2008,

[72] This statistic is another reason why this section's first policy recommendation—bringing information to field actors via practitioner publications or associations which often produce publications—is relatively weak.

2), but who aim to do this by creating a final report that summarizes the condition of wetlands nationwide and the assessment mechanisms used to gather wetland data (ibid.). A report is not enough.

Similarly, NWCA leaders also plan to present their findings, though it is unclear how widely or to whom (EPA 2008). While Chapter 3's analysis did suggest that verbal communication about innovations can shape the innovation uptake of street-level bureaucrats, the probable vehicles through which NWCA leaders will present their findings—training events and seminars—did not show a significant impact on bureaucratic tool usage in Chapter 3's regression analyses. Standard methods of information dissemination simply may not effectively reach this population.

Fourth, unlike training, job experience was significant in Chapter 3's regressions. Knowing that more experienced bureaucrats are more likely to use tools could lead decision-makers to encourage those bureaucrats to work more frequently with newer ones, perhaps via mentoring programs, leveraging both the facilitative influence of network ties and of experience to promote more widespread use of the assessment innovation. Decision-makers also could focus on retaining bureaucrats to build their job experience. The average survey respondent had worked for roughly 4.9 years in wetland regulation. This dissertation did not evaluate whether this degree of experience is anomalous relative to bureaucrats in other state agencies or in states beyond the sample, nor did it explicitly evaluate turnover in state wetland regulatory units. However, these topics may merit future inquiry. Discussing Virginia's plans to train bureaucrats to use the assessment tool the state is developing, a veteran consultant skeptically said:

> Yeah, I mean [that would be a good idea] if they could keep anybody long enough to go through the process. One of the biggest problems with

> [Virginia's state environmental agency] is turnover of employees . . . if they are very good, they often get snatched up by the consultants . . . [because the state is essentially a] cheap training program, a cheap training ground. They get an understanding of the regulations while they're working for the [state] and then . . . as consultants are out with them [in the field] reviewing a permit project or something, and they realize this person [bureaucrat] is pretty sharp, next thing you know, they can be had cheap because the state doesn't pay well. (D019: Feb. 8, 2011)

A federal expert echoed this comment about Virginia, also noting that Pennsylvania may face personnel issues (C114: March 23, 2011). Another federal expert, comparing Ohio to geographically proximate states less successful with tool adoption, said "[In those other states] they either don't have people [in their wetland regulatory units] or there is a lot of turnover there. . . . [in Ohio] there seems to be a lot less turnover" (C306: March 24, 2011). Retaining state employees seems important to building the job experience that encourages assessment tool use.

The first through fourth policy recommendations have all been building to the fifth: Street-level wetland bureaucrats, and probably street-level bureaucrats who manage natural resources more generally, would be more easily able to incorporate innovations into their management practices if they (and other individuals who share their occupation) had greater professionalization. That is, these bureaucrats do not appear to be exposed regularly, through publications or professional associations, to information about science or policy innovations relevant to their job activities. Participation in training events also does not appear to have a direct, significant impact on their uptake of a professionally relevant innovations, perhaps because the median number of events survey respondents reported attended annually was only two. Anecdotal evidence suggests that turnover among these bureaucrats may be high, and multiple interviewees commented that they not particularly

well paid (e.g., A159: Nov. 3, 2010; A397: Dec. 13, 2010; C796: March 23, 2011; D019: Feb. 8, 2011; D557: Nov. 29, 2010).

Hall's (1968) review of the attributes of a professionalized field noted that its affiliates occupy full-time jobs, have common training experiences, feel strongly connected to a professional association and its associated code of ethics, perceive a sense of calling to the profession and a belief in the value to the public of their professional service, and prefer self-regulation and autonomy. Street-level wetland bureaucrats seem to have some of these attributes—many of the interviewees who commented on bureaucrats' poor pay also commented that people work in this sector anyway because there are committed to resource stewardship—but certainly not others. Yet if bureaucrats had more common training experiences, if they belonged to professional associations and drew norms and professional practice guidance from those groups, and if they were led by their sense of autonomy and self-regulation to seek information on management best practices independently, we probably would be more likely to observe greater integration of rapid wetland assessment tools into on-the-ground practice and more uptake of innovation, in general, by field-level public servants.

The first step toward greater professionalization probably would be for state governments to invest more in bureaucrat training and to pay bureaucrats more, not only so that government training investments are not wasted on public servants who move to the private sector, but also so that bureaucrats' level of pay signals to them that their professional skills are valuable and worth cultivating. In an era of increasingly pinched public budgets, heeding this suggestion may be nearly impossible. But while the suggestion may be implausible, that does not make it invalid.

Sixth, it is important that high-level federal and state decision-makers know that their promotion and acceptance of innovations such as assessment tools matters for the behavior of front-line implementers. Despite arguments by some street-level bureaucracy scholars that managerial preferences have a muted impact on such behaviors (e.g., May and Winter 2009; Riccucci 2005), Chapter 3's analysis suggest that when it comes to the implementation of an innovation that may require more time from an already over-taxed street-level bureaucrat, the bureaucrat may be more willing to bear this burden when he perceives that his superiors support the activity.

4.2 Policy lessons: Chapter 4

There are six main policy lessons of Chapter 4. The first is that U.S. Army Corps of Engineers regulators charged with the Clean Water Act Section 404 program, U.S. Environmental Protection Agency bureaucrats charged with the Section 305(b) program, and EPA bureaucrats who play a secondary role with respect to Section 404 should work harder to find common ground vis-a-vis their assessment priorities for states. It seems reasonable that this effort at harmonizing should lead them to encourage states to develop and deploy assessment tools capable both of collecting wetland condition data and of evaluating wetland functions. It is true that interagency coordination has historically been difficult and that wetland experts have tended to argue that one assessment tool cannot perform both tasks well. However, there certainly are examples of Corps-EPA cooperation in the wetland regulatory realm (e.g., the publication of many joint guidances and policy memoranda), as there are examples of states (e.g., West Virginia) trying to develop multipurpose assessment tools. Harmonization is not an implausible goal.

Wetland assessment's relatively low salience on the national scale means that pressure for coordination is not likely to come from bureaucrats' political superiors. However, in the future, such pressures may rise from the bottom, propelled by the interests of incoming agency staff and ongoing lobbying by state officials. A long-time EPA wetland bureaucrat noted that "If you can get the states using them [tools] . . . these people [intransigent agency staff] are going to come around, because eventually all these curmudgeons at the Corps will retire and you'll get new younger people who are willing and more open-minded. And the same at the EPA" (C104: Oct. 30, 2010).

Pressure for coordination also may come from the top, increasingly prioritized by high-level agency administrators. A regulator at the Corps' Baltimore District noted that the district recently hosted a researcher commissioned by Corps headquarters to review existing assessment tools and comment on the decisions and implementation tasks they require and their strengths and weaknesses (B088: March 17, 2011). Though the regulator emphasized that the researcher's report is internal and no official guidance about tools has been issued from agency headquarters, she saw the project as a sign that the Corps is becoming more receptive to regulatory wetland assessment (ibid.). Relatively new wetland regulations issued jointly by the Corps and the EPA may be another sign. The agencies recently specified that "compensatory [wetland] mitigation should be located . . . where it is most likely to successfully replace lost functions and services" (USACE and EPA 2008, 19673). Ruhl, Salzman, and Goodman (2009, 251) called this action "a catalyst for advancing science and policy" concerning assessment, since the agencies are now committed to deploying in the regulatory process tools that assess wetland functions and services. Pursuing this deployment

could eventually lead the agencies to harmonize better the assessment-related pressures they exert on state environmental agencies.

Chapter 4's second policy lesson is that if the EPA wants state officials to report on the condition of their wetlands so the agency can transmit these data to Congress, the EPA must help those officials find funding to support implementation of assessment tools, not just their research and development. Problematically, an EPA grants expert said there have been repeated attempts, all unsuccessful, to get Congress to change the authorization for Wetland Program Development Grants so they can support implementation (C858: Dec. 8, 2010). EPA bureaucrats recognize the implementation challenges state wetland bureaucrats face, and try to direct them to potential sources of implementation funding. However, the grants expert acknowledged that these funding opportunities typically are "small potatoes" when compared to the EPA's larger funding commitments; some are not even wetland specific (ibid.). Arguably one of the reasons that the EPA has gotten away with not reporting wetland condition data to Congress for so long, despite its statutory mandate otherwise, is that wetlands still are relatively underappreciated resources within and outside the agency. Until this perception changes, the EPA as a whole may not be ready to absorb this policy lesson.

The third policy lesson of Chapter 4 comes from the Ohio case, which shows that states can get the most out of EPA funds which prioritize condition assessment by using a condition-focused tool in wetland regulation. The condition focus of Ohio's regulatory program meant that EPA-funded assessment research and development helped the state create a sturdy foundation of wetland quality data that informed tool development, undergirded the regulatory program in which the tool was deployed, and helped the state

fend off a court challenge to the legitimacy of that deployment. Ohio's tool has of course been criticized for potentially allowing the loss of high-functioning, low-quality wetlands. Substantive concerns aside, however, it seems clear that implementing a condition-focused assessment tool for regulation allows a state to make better use of condition-focused research funds than can a state which pursues function-focused regulatory activities and separately engages in condition-focused assessment research projects that, by their nature, less directly inform regulation.

The fourth lesson relates to the third. Arguably, one reason Ohio EPA (OEPA) had less trouble getting a condition-focused tool past function-focused critics is that, at roughly the same time that tool development began, the state became one of only 14 to promulgate condition-focused wetland-specific water quality standards and an associated anti-degradation provision pursuant to Section 303 of the Clean Water Act. Whereas many other states only have standards applicable to all waters and thus can more easily gloss over wetland quality, Ohio decision-makers committed OEPA to reporting on whether the state's wetlands were meeting resource-specific standards, boxing OEPA into a corner where it needed to implement a tool to facilitate that reporting.

The fifth policy lesson is that the Corps' dominance over states in Clean Water Act Section 404 wetland regulation can stifle state-level assessment efforts. State agencies which engage in joint permitting with the Corps or implement Corps-delegated portions of the federal wetland permitting program perceive that they generally must accept the Corps' preferences about wetland regulation and associated processes such as assessment. State officials should know that by partnering with the Corps, they are being yoked with the Corps' wariness about regulatory wetland assessment and are accepting that, if regulatory

assessment is a true priority for them, they likely will have to lobby the Corps hard for it and their payoff will not be assured.

The final lesson of Chapter 4 is that state agencies, even those enmeshed in Corps partnerships, may be able to compel the Corps to accept assessment tools. State officials can use two strategies, though the second may be more successful than the first. First, they can threaten to hand delegated wetland permitting program elements back to the Corps, potentially—and problematically—increasing that agency's workload. Pennsylvania bureaucrats have used this strategy to keep the Corps at the bargaining table vis-a-vis state assessment plans: "At one point they told us they weren't allowed to comment or make any recommendations on our tool development, and then we politely told them, 'Well, then I guess . . . you can have your [Section] 404 program back.' . . . They came back to the table quickly" (A369: Dec. 13, 2010). However, handing back delegated program elements would require state street-level wetland bureaucrats to upend the standard operating procedures to which they strongly hew. It would also undermine the predictability of the regulatory system; state bureaucrats are keenly aware that regulated entities prioritize predictability and may pressure bureaucrats' superiors to ensure it. Thus, if wielded by a less than resolute or politically strong state agency (or bureaucrat policy entrepreneur), such a threat may be relatively empty.

The second, potentially more powerful way in which state agencies can exert leverage over the Corps is to employ Section 401 of the Clean Water Act. This provision, which allows state officials to reject or condition federally approved permits for impacts to state waters if the impacts would violate state water quality standards, is notably underutilized. State environmental agencies often build Section 401 certification into

agreements they make with the Corps regarding general permits such that certification is no more than a rubber stamp. However, Section 401 does not have to be used in this manner, and environmental advocates have spent decades calling on state officials to use their Section 401 power more actively (e.g., Donahue 1996). OEPA took up this charge and built a regulatory program wherein, to secure Section 401 certification, a wetland slated for an impact must be evaluated using the state's rapid assessment tool. If state wetland bureaucrats truly want to manage their water resources in ways that do not align with the whims of federal agencies, they should seriously consider using Section 401 more vigorously.

4.3 Policy lessons: Chapter 5

Chapter 5 has fewer policy lessons because its primary goal was to address gaps in the scholarly literature on policy entrepreneurship by developing the concept of a street-level policy entrepreneur. Data from two state cases informed this exercise, but the chapter itself does not explicitly offer wetland policy practitioners many "lessons learned" about the motivations, behaviors, and challenges of such actors.[73] Nonetheless, the chapter offers two take-home points for practitioners.

The first take-away is that street-level bureaucrats can be entrepreneurial by trying to develop, champion, and entrench into regulatory policy innovations they believe will help improve the implementation processes they prosecute. The activities of street-level bureaucrats are often relatively opaque to outsiders because of the former actors' substantial discretion; their policy entrepreneurship is no exception. For example, Helen noted that H Tool was largely developed "under the radar" of higher-level policy actors. The development

[73] I am, however, writing a paper which focuses on just these issues.

process was not easy to follow, Helen explained, and "science-y types" mainly participated in it (F303: Nov. 18, 2010). By highlighting the existence of these relatively obscure processes, the chapter may be useful to scholars and policy actors who want to understand better how public bureaucracies operate.

Second, the chapter may raise policy practitioners' awareness of possibilities within the bureaucracy. It may make street-level bureaucrats reconsider whether they are truly as constrained as they often perceive themselves and whether they actually could find creative ways to improve their implementation mandates. The chapter may make those bureaucrats' superiors more aware of the innovative capacity of the agents they manage. Whether this knowledge leads those superiors to foster innovation or try to squelch it will likely depend on agency culture and the broader political culture of the state, among other variables.

5.0 Future research

This section briefly describes seven opportunities for additional research using data collected for the dissertation and for related research drawing upon other data. The first five research proposals are relatively applied and specific to wetlands and water resources, while the latter two focus more on policy puzzles that analysis of rapid wetland assessment can inform.

First, the data already collected could provide a foundation for a practitioner's guide to rapid wetland assessment tools. This dissertation treated all rapid wetland assessment tools as essentially the same, and Chapter 1 justified this approach. Articles and books have been written about rapid wetland assessment tools as a class (e.g., Sutula et al. 2006; Thiesing 2001; Van Dam, Camilleri, and Finlayson 1998), implying that the adoption, use, and

entrepreneurial promotion of such tools can be analyzed without necessarily distinguishing one from another. Moreover, some practitioners appear to regard which tool they use as less important than the institutions, both formal and informal, that encourage or discourage tool use (e.g., A009: Oct. 21, 2010; A343: Nov. 18, 2010; A369: Dec. 13, 2010; C796: March 23, 2011).

In reality, however, assessment tools vary in many ways. Policy actors interviewed for this project discussed, extensively and in detail, their experiences with and perceptions of different tools. Some tools focus on condition, others focus on function, and some try to do both. Some tools are tailored to specific regions or ecosystems, while others are meant to be more generally applicable. Some are more scientifically rigorous and accurate than others. Some tools require the user to collect data only on site characteristics, while others account for landscape-level influences on a site. Some tools need more time than others; while Fennessy, Jacobs, and Kentula (2004) specified that a tool is only rapid if its use requires no more than a half-day in the field and a half-day of desk work, the rapid tools profiled by Bartoldus (1999) range in time requirements from 15–20 minutes to one day. Some tools use weights and formulas to produce a numeric rating of a wetland, while others use logic models to lead users to qualitative evaluations of wetland attributes.

There is lack of practitioner-targeted literature describing available assessment tools and their foci, strengths, and weaknesses, particularly as understood by users themselves rather than by scholars or tool developers. Fennessy, Jacobs, and Kentula (2004) created the only semi-comprehensive encyclopedia of rapid wetland assessment tools of which I am aware. However, not only is that work almost a decade old, but it also excludes function-focused tools which other scholars certainly argue count as rapid wetland assessment

procedures (e.g., Ainslie 1994; Cole 2006; Hruby 1999). Bartoldus (1999) edited an anthology of 40 tools, but not all were rapid; that publication, too, does not include many tools pioneered in recent years. The National Biological Information Infrastructure maintained a more current online database of ecological assessment methods, rapid and otherwise, applicable to wetlands and other ecosystems, but that project was terminated in 2012 and all web resources removed (NBI 2012). Although Kusler's (2004, 2006) work focused on the regulatory utilization of rapid wetland assessment tools, his comments and critiques were not offered tool-by-tool.

The practitioner's guide proposed here would focus on tools developed for and/or used in the U.S. Mid-Atlantic region, but could be expanded to a larger geographic area and a broader range of tools with additional data collection. The guide would follow Bartoldus's (1999) model of explaining the tool's purpose, requisite user expertise, applicability, quantities evaluated, time requirements, and similar elements. It would also give significant attention to each tool's strengths and weaknesses as perceived by users and members of the regulated community.

Second, and related to the first research proposal, data collected for this dissertation could inform a paper or series of papers, ideally published in journals that span the scholar-practitioner divide, concerning what users want from a rapid wetland assessment tool. These papers would present, compare, and contrast the preferences of bureaucratic users with the preferences of users in the regulated community who generally are environmental consultants.

Evaluating tools from both angles is important. This dissertation only examined tool use by bureaucrats, a focus useful because it provided analytical clarity and made the scope

of the project manageable. In reality, however, rapid wetland assessment tools are used by both bureaucrats and members of the regulated community. In Ohio, for example, wetland bureaucrats may do an on-site evaluation using the state's tool, analyze data provided by a regulated entity who himself evaluated the site using the tool, or do both by following up on a consultant's report with an in-the-field check. Who uses the tool first and how depends on the nature of the impact, the type of ecosystem, and the phase of the regulatory process, among other variables. This mutual, iterated use means that tool-related perceptions and behaviors of bureaucrats affect the perceptions and behaviors of the regulated community and vice-versa.

This proposed research would not dig deeply into how regulators and regulated entities influence one another, though such an inquiry is proposed later in this section. Rather, this project would present to practitioners and scholars what both sides of the regulatory equation think about assessment, highlighting where preferences and opinions meet and diverge. Although such analysis may seem rudimentary, it is in fact a contribution to a literature that has largely evaluated assessment tools from a technical, academic perspective that some practitioners find frustrating or incomprehensible (e.g., A009: Oct. 21, 2010; D019: Feb. 8, 2011; F078: March 15, 2011; F111: March 15, 2011), including a former wetland consultant who said "They [academics] don't know anything about how the world works" (F042: Nov. 16, 2010), or via anecdotal, impressionistic accounts of practitioner perspectives published in the gray literature (e.g., Kusler 2004, 2006; Stetson 2008), the rigor, methods, and generalizability of which are unclear. The proposed research would hew more closely to the second perspective, but would employ stronger research methods and a more comprehensive focus that would include regulated entities. The dissertation data could be

systematically queried to identify the tool qualities that emerge as most important to bureaucrats and consultants. The data also allow for cross-tabulation of those qualities with potentially relevant attributes of the individuals noting them, such as level of job experience or training and state regulatory regime. This research would be useful to current users of tools, bureaucrats and environmental consultants considering which tools to use, and tool developers.

Third, a valuable albeit tricky research initiative would inquire whether regulatory application of rapid wetland assessment leads to better environmental outcomes. The natural focus for this investigation would be Ohio, since data from the pre- and post-tool adoption periods should in principle be available there. This research would require collaboration with wetland science experts and might require buy-in from Ohio wetland bureaucrats and those in a neighboring state.

The investigation would involve a matched-pairs research design. It would analyze the quality of wetlands along the border of Ohio and a neighboring state with a wetland regulatory structure (and thus regulatory options available to bureaucrats) similar to Ohio's, but which has not officially adopted an assessment tool for regulatory use. A sample of border wetlands slated for development by public entities such as transportation agencies in both states would be selected such that the wetlands on either side of the border would be similar on important variables such as size and wetland type, quality, and functionality.[74]

[74] Public works projects are generally planned in advance and described in publicly available documents, whereas private citizens have no obligation to announce their wetland development plans until they apply for a permit. Targeting the former would allow investigators lead time necessary to identify and match wetlands.

These attributes would be evaluated by wetland science experts, either by using publicly available data or by going on-site.[75]

As part of the normal regulatory process, the sites would be evaluated before development commenced, with Ohio bureaucrats using the state's officially adopted tool and bureaucrats in the neighboring states using their more informal, discretionary practices. The regulatory choices those bureaucrats would then make about the wetland pairs, such as the kinds of conditions to put on permits, could be compared by accessing publicly available permit data. The wetland science experts could comment on whether the protections appeared appropriate given the resource quality.

This project could be logistically difficult to execute and the research design would involve some difficult trade-offs (e.g., see footnote 75). Nonetheless, if successfully executed, the project could make a major contribution to a field of scholarship which often assumes (as does this dissertation) that merely because wetland assessment tools appear more rooted in peer-reviewed science, their use leads to better environmental outcomes than does the application of best professional judgment by bureaucrats.

Fourth, and related to the third research project, additional data collection could allow analysis of whether using an assessment tool has increased or decreased permit processing efficiency in Ohio. One way of analyzing whether rapid wetland assessment tools

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[75] An on-site evaluation would yield much richer and more nuanced data. However, bringing scientists on-site would make apparent to bureaucrats which sites were being evaluated for the project. This could lead to a Hawthorne effect wherein bureaucrats deviate from normal behavior because they know they are being studied. The benefits and costs of working closely with the state regulatory agencies on this project would have to be carefully studied. The cost of the Hawthorne effect would have to be weighed against the fact that all the data for this project likely could be more easily gathered with buy-in from state bureaucrats. Also, environmental agency buy-in might allow for the assembly of special teams of bureaucrats selected in each state to participate in the project because of the comparability of their training and years and kinds of job experience.

are generally useful for policy and society is to examine their environmental outcomes; another is to look at the burdens tool use has placed on bureaucrats and members of the regulated community.

A number of interviewees worried about the additional resources tool use might require from such actors, arguing that using best professional judgment is quicker and less resource-intensive than completing forms associated with an assessment tool (e.g., A927: Feb. 23, 2011; D444: Jan. 4, 2011; F384: Jan. 23, 2011). However, that claim ignores the fact that tool use could reduce time spent debating the judgment of an environmental consultant versus the judgment of a permit-reviewing bureaucrat. The typical problem, noted an EPA expert, is that "essentially every project is a negotiated settlement . . . [and] it's not efficient" (C796: March 23, 2011). A major advantage interviewees attributed to the Ohio tool is that it allows "everybody [to be] on the same page . . . [and] it [has] eliminated some arguments" (A119: Nov. 19, 2010; see also A009: Oct. 21, 2010; A476: Nov. 19, 2010; F693: Dec. 27, 2010). Moreover, "I don't think it takes too much more time, energy, and money to write out those [Ohio tool] forms," said a federal expert (C336: Feb. 3, 2011).

The simplest way to test this proposition is to examine time burdens of bureaucrats, though a survey of regulated entities (proposed below) also could ask Ohio consultants to estimate their pre- and post-tool workloads. The Section 401 wetland certifications Ohio bureaucrats process are public documents. Thus, certifications from a period of years before tool adoption and a period of years after could be sampled, and the average amount of time associated with start-to-end processing could be calculated.

The fifth research project that could grow from this dissertation is not specifically related to wetlands, but rather concerns water resources more generally. Chapter 4 noted

that states largely do not use their Section 401 authority. The scholarly literature analyzing Section 401 implementation mainly comes from law journals, wherein authors draw lessons from court cases, regulatory guidance, and the public record to speculate on why states generally do not use Section 401 more stringently (e.g., Donahue 1996; Johnson 1999; Miles 1998; Hansel 1995; Hansel and Meyers 1987–1988). These analyses are useful but incomplete in that the scholars do not investigate whether and how the sources they analyze filter into the cognition and affect the behavior of state water policymakers and implementers.

This scholarship could be enriched by a research project that would use surveys and interviews to investigate what state water policy actors know about Section 401, since some of the above-mentioned scholars argue that state policy actors often do not understand all the authority Section 401 actually gives them. This investigation would study the ways in which states use Section 401 certification; the rationales for that use as understood by policy actors; and whether (and if so, how) the state has any imminent plans to use Section 401 more actively. This research would inform the literature on the science-policy divide, wherein legal experts are the "scientists" whose research on the power of Section 401 appears not to be reaching policy practitioners. Like this dissertation, the research would also speak to puzzling dynamics of cooperative environmental federalism as implemented on the ground.

The sixth research project that could flow from the dissertation research is an inquiry into what a bureaucrat's choice to use an assessment tool in regulation versus to use discretionary best professional judgment, or a bureaucracy's choice to adopt a tool versus allow bureaucrats to continue exercising such judgment, implies for bureaucratic

accountability. The narratives of many bureaucrats interviewed for this research exhibit a tension. On one hand, bureaucrats want to be taken seriously as applied scientists and given latitude to make resource management choices informed by their training, professional norms, and expert knowledge. On the other, they want to make decisions they can be confident will be acceptable to their political and administrative superiors and which they believe they could defend if challenged in court or another arena (while being assured to the greatest extent possible that they will not be challenged).

In many cases these are competing preferences. A bureaucrat who follows standard procedures for evaluating a wetland, such as those specified in an assessment tool, is less likely to be challenged because he did not act in an arbitrary or capricious manner. If the tool was officially adopted by his agency, challenges to its legitimacy likely came during tool development, stakeholder vetting, or formal rulemaking, and thus were largely settled before the bureaucrat began using the tool. However, that same bureaucrat is bound by the strictures of the tool. If his professional expertise convinces him that a wetland has more value than is recognized by the tool, his options for acting on that conviction may be limited. If he does, he surely becomes more vulnerable to challenges from superiors or regulated entities wanting to know why he did not accept the tool's indications.

These preferences seem associated with two different notions about to whom or what a bureaucrat ought to be accountable. Bureaucrats who value maintaining discretion often argue that this latitude allows them to protect resources better, making case-specific decisions to maximize the quality of the state's wetland stock. These bureaucrats seem to feel most accountable to the resources they regulate, to their professional communities and associated norms, and/or to their legal mandates to manage resources effectively.

Bureaucrats who prioritize defensibility seem to perceive themselves as most accountable to political or administrative superiors, the courts, and members of the regulated community who tend to prefer the standardization of decision-making and predictability that regulatory tool use offers.

This sixth research project would investigate the tentative theorizing above by systematically querying the dissertation interview data to examine whether these different notions of accountability do in fact emerge and whether they (or others uncovered via analysis) appear associated with different patterns of tool use. Whether a bureaucrat used a tool, and when or how, could be cross-tabulated with the accountability themes and the extent to which interviewees appeared committed to them. These latter quantities could be measured via word count queries identifying the number of times a bureaucrat mentioned litigation, emphasized his professional training, discussed the importance of predictability, referenced defensibility, and more. This content analysis could illuminate distinctive characteristics of both types of accountability, potentially highlighting the justifications affiliates of each type give for their allegiance or the behaviors of bureaucrats who adhere to one or the other type. The data also could be used to construct profiles of bureaucrats who hew more to one concept of accountability or the other; these individuals may vary in terms of their training, state, job experience, age, or other factors.

This research could contribute to scholarship on the nature and consequences of organizational professionalism (accountability to the organization) versus occupational professionalism (accountability to professional norms and standards) in public service bureaucracies (e.g., Evets 2003, 2005) and how public servant role identity affects perceptions of appropriate levels of discretion (Padding 2005). It also could inform the

public management literature which explores when and why bureaucrats embrace discretion versus standardization (e.g., Bodkin 2006; Pires 2011).

Finally, the seventh research proposal would investigate two power dynamics potentially surrounding state regulatory adoption and bureaucrat use of rapid wetland assessment tools. The first is addressed in the young but growing literature on the power shift in some public bureaucracies from street-level policy implementers to systems-level designers of policy protocols which often are computerized. Ovens and Zouridis (2002) explore this issue by examining how the power to enforce traffic regulations in the Netherlands has shifted from street-level police officers, who previously caught violators and decided whether to issue tickets and the amount of the penalties, to technocrats who designed the information and communication technology systems which now photograph cars that (for example) run red lights, transmit that information to a database which identifies the offender, filters the violator's speed and other variables through a matrix to determine the penalty, and notifies the violator of his case disposition. The authors worry over the lessened ability of street-level bureaucrats to make expert judgment calls in difficult cases and a lack of supervision, and thus a potential lack of democratic accountability, of the technical experts designing such systems (ibid.). Zuurmond (1998) similarly debates whether this power shift, by centralizing so much control with the "infocracy," undermines democratic institutions. While presenting evidence suggesting that citizens can more easily interact with a systems-level bureaucracy, Reddick (2005, 40) acknowledges the plight of the street-level bureaucrat in such systems: "any remaining discretion has shifted to the back room of information system departments."

Although rapid wetland assessment tools are not computerized, it is easy to see their similarities to information technology-based systems designed by technical experts and imposed on street-level actors. The movement towards rapid wetland assessment in the states this dissertation examines can be studied through a street versus systems lens, potentially contributing to this line of research. The interview texts can be analyzed for words and phrases which indicate whether interviewees perceive the assessment push as a power play designed to shift control from front-line implementers to tool designers. If evidence for this perception exists, the data may also illuminate whether or how front-line bureaucrats resist this power reallocation and how it affects their perception of their professional roles.

The second power dynamic that can be explored with the dissertation data and potentially via additional data collection is the interplay between state wetland regulators and members of the regulated community. As noted above, actors in both sectors use rapid wetland assessment tools and mutually shape each others' opinions and perceptions about tools. This dynamic is natural given that "A lot of consultants in this area have been doing this work for a very long time and so they have developed very tight relationships with the agency members" (B921: March 15, 2011). One consultant observed that "Having a good relationship with the agencies is everything, because if they [like you], they'll give you more slack [and] they'll process your permits more efficiently or quickly, whereas if you're a jerk . . . they are not motivated to do work for you" (D222: Feb. 16, 2011).

While the nature of both tool-related influence flows (bureaucrat to consultant and consultant to bureaucrat) is interesting, the proposed project could contribute to the scholarship on regulatory capture by examining how the regulated community affects

whether bureaucrats use tools, in which kinds of cases, and at what points in the regulatory process, and what bureaucrats consequently think about the utility and validity of tools. The project also could examine how the regulated community affects state-level tool adoption processes and outcomes. Ohio would be a particularly interesting case for the latter study, since interviewees noted that Ohio developed and deployed an assessment tool in part because of calls from the regulated community. An interesting counter-point might be a case wherein the regulated community seems particularly intransigent toward state-level regulatory tool adoption.

This investigation could use the existing data as a starting point; for example, the survey actually asked respondents whether their network alters were members of the regulated community.[76] However, the analysis also would require more data collection that specifically targets the regulated community. The current data, for example, do not clearly point to a state that offers a marked contrast to Ohio in terms of the regulated community's tool receptivity; more investigation would be necessary to determine whether any of the other five states fit these criteria. A survey of the regulated community was suggested by a state wetland bureaucrat (A369: Dec. 13, 2010) and seems a logical next step. Environmental consultants could be asked about how often they communicate with state wetland bureaucrats, the quality of their relationships, how well they think state bureaucrats listen and respond to concerns the consultants express related to wetland policy, and similar issues intended to elicit the nature, extent, and impact of regulatory influence.

[76] These data were not used in Chapter 3 because the chapter's hypotheses concerned whether survey respondents had network ties, not with whom they had them. I do plan to use the more nuanced network data in a future paper.

6.0 Conclusion

This dissertation addressed two very applied policy questions: Why do state bureaucrats fail to implement rapid (non-tidal) wetland assessment tools, and why do state environmental bureaucracies fail to adopt these tools? Its answers to these questions should be useful to policy actors interested in wetland policy and management. The dissertation's contributions to theory, however, make it relevant to a broader audience. Scholars interested in the behavior of street-level bureaucrats, communication of policy-relevant information through interpersonal network ties, implementation of policy innovations, cooperative environmental federalism, institutional analysis, policy entrepreneurship, and innovation in public bureaucracies all should find this research interesting. This work represents the beginning rather than the end of a policy relevant and theoretically promising research program. I am very eager to keep going.

Chapter 7: References

Aberbach, J. D., and B. A. Rockman. 2002. Conducting and coding elite interviews. *PS: Political Science and Politics* 35 (4): 673–676.

Adamus, P. R., E. J. Clairain Jr., R. D. Smith, and R. E. Young. 1987. *Wetland Evaluation Technique (WET), v. 2: Methodology*. Vicksburg, MS: U.S. Army Corps of Engineers Waterways Experiment Station.

Adamus, P. R. and L. T. Stockwell. 1983. *A method for wetland functional assessment, v. 1: Critical review and evaluation concepts*. Washington, DC: Federal Highway Administration. Report no. FHWA-IP-82-23.

Ainslie, W. B. 1994. Rapid wetland functional assessment: Its role and utility in the regulatory arena. *Water, Air, and Soil Pollution* 77 (3–4): 433–444.

Allen, R., and J. Clark. 1981. State policy adoption and innovation: Lobbying and education. *State and Local Government Review* 13 (1): 18–25.

Amara, N., M. Ouimet, and R. Landry. 2004. New evidence on instrumental, conceptual, and symbolic utilization of university research in government agencies. *Science Communication* 26 (1): 75–106.

American Association for Public Opinion Research (AAPOR). 2011. *Standard definitions: Final disposition of case codes and outcome rates for surveys*, 7th ed. Deerfield, IL: AAPOR.

Ammann, A. P., and A. Lindley Stone. 1991. *Method for the comparative evaluation of nontidal wetlands in New Hampshire*. Concord, NH: New Hampshire Department of Environmental Services. NHDES-WRD-1991-3.

Anderson, J. 1979. *Public policy making*, 2nd ed. New York: Holt, Rinehart.

Arnold, R. D. 1990. *The logic of Congressional action*. New Haven: Yale University Press.

Association of State Wetland Managers (ASWM). n.d. State wetland programs: Ohio. Berne, NY: ASWM. http://www.aswm.org/swp/ohio.pdf.

Association of State Wetland Managers (ASWM). 2011. State programmatic general permits. Berne, NY: ASWM. http://old.aswm.org/swp/pgp/index.htm.

Baker, D. L., and T. Steuernagel. 2009. Comparative policy entrepreneurship: The case of autism-related policy in North America. *Journal of Comparative Policy Analysis: Research and Practice* 11 (2): 233–248.

Baker, G. P., M. C. Jensen, and K. J. Murphy. 1988. Compensation and incentives: Practice vs. theory. *Journal of Finance* 33 (3): 593–561

Balla, S. J. 2001. Interstate professional associations and the diffusion of policy innovations. *American Politics Research* 29 (3): 221–245.

Bardach, E. 1977. *The implementation game: What happens when a bill becomes a law*. Cambridge, MA: MIT Press.

Bartley, T. 2007. Institutional emergence in an era of globalization: The rise of transnational private regulation of labor and environmental conditions. *American Journal of Sociology* 113 (2): 297–351.

Bartoldus, C. C. 1999. *A comprehensive review of wetland assessment procedures: A guide for wetland practitioners*. St. Michaels, MD: Environmental Concern.

Beckert, J. 1999. Agency, entrepreneurs, and institutional change: The role of strategic choice and institutionalized practices in organizations. *Organization Studies* 20 (5): 777–799.

Bennett, C. J., and M. Howlett. 1992. The lessons of learning: Reconciling theories of policy learning and policy change. *Policy Sciences* 25 (3): 275-294.

Benson, J. K. 1982. A framework for policy analysis. In *Interorganizational coordination: Theory, research, and implementation*, eds. D. L. Rogers and D. A. Whetton, 137–201. Ames, IA: Iowa State University Press.

Berglund, S., I. Gange, and F. van Waarden. 2006. Mass production of law: Routinization in transposition of European directives: A sociological-institutionalist account. *Journal of European Public Policy* 13 (5): 692–716.

Berry, F. S., and W. D. Berry. 1999. Innovation and diffusion models in policy research. In *Theories of the policy process*, ed. P. A. Sabatier, 169–200. Boulder: Westview Press.

Berry, F. S., and W. D. Berry. 1990. State lottery adoptions as policy innovations: An event history analysis. *The American Political Science Review* 84 (2): 395–415.

Berry, J. M. 2002. Validity and reliability issues in elite interviewing. *PS: Political Science and Politics* 35 (4): 679–682.

Beyer, J. M., and M. T. Harrison. 1982. The utilization process: A conceptual framework and synthesis of empirical findings. *Administrative Science Quarterly* 27 (4): 591–622.

Boehmke, F. J., and R. Witmer. 2004. Disentangling diffusion: The effects of social learning and economic competition on state policy innovation and expansion. *Political Research Quarterly* 57 (1): 39–51.

Borins, S. 2002. Leadership and innovation in the public sector. *Leadership and Organization Development Journal* 23 (8): 467–476.

Borins, S. 2001a. Encouraging innovation in the public sector. *Journal of Intellectual Capital* 2 (3): 310–319.

Borins, S. 2001b. Public management innovation: Toward a global perspective. *The American Review of Public Administration* 31 (5): 5–20.

Boudon, R. 1981. *The logic of social action: An introduction to sociological analysis*. London: Routledge & Kegan Paul Books.

Bovens, M., and S. Zouridis. 2002. From street-level to system-level bureaucracies: How information and communication technology is transforming administrative discretion and constitutional control. *Public Administration Review* 62 (2): 174–184.

Bowles, S. 1998. Endogenous preferences: The cultural consequences of markets and other economic institutions. *Journal of Economic Literature*: 36 (1): 75–111.

Bradshaw, J. G. 1991. *A technique for the functional assessment of nontidal wetlands in the coastal plain of Virginia*. Gloucester Point, VA: Virginia Institute of Marine Science. Special Report No. 315 in Applied Marine Science and Ocean Engineering.

Brancheau, J. C., and J. C. Wetherbe. 1990. The adoption of spreadsheet software: Testing innovation diffusion theory in the context of end-user computing. *Information Systems Research* 1 (2): 115–143.

Brinson, M. M. 1993. *A hydrogeomorphic classification for wetlands*. Vicksburg, MS: U.S. Army Corps of Engineers Waterways Experiment Station. Wetlands Research Program Technical Report WRP-DE-4.

Brodkin, E. Z. 2006. Bureaucracy redux: Management reformism and the welfare state. *Journal of Public Administration Research and Theory* 17 (1): 1–17.

Brudney, J., and F. T. Herbert. 1987. State agencies and their environments: Examining the influence of important external actors. *Journal of Politics* 49 (__): 186–206.

Burkhardt, R. W. 1996. *National action plan to develop the Hydrogeomorphic Approach for assessing wetland functions*. Washington, DC: U.S. Army Corps of Engineers Directorate of Public Works.

Carlin, J. B., N. Li, P. Greenwood, and C. Coffey. 2003. Tools for analyzing multiple imputed datasets. *The Stata Journal* 3 (3): 1–20.

Carpenter, D. P. 2001. *The forging of bureaucratic autonomy: Reputation, networks, and policy innovations in executive agencies, 1862-1928*. Princeton: Princeton University Press.

Carroll, G. 1984. Organizational ecology. *Annual Review of Sociology* 10: 71–93.

Chaun, M. 1993. *Plowing through the muck: A review of wetland assessment/evaluation methods*. Gloucester Point, VA: Virginia Institute of Marine Science (VIMS). VIMS Wetlands Program Technical Report No. 93-11. http://www.ccrm.vims.edu/publications/wetlands_technical_reports/93-11-Plowing-muck.pdf.

Clark, R. E., P. A. Kirschner, and J. Sweller. 2012. Putting students on the path to learning. *American Educator* Spring: 6–39.

Coase, R. H. 1960. The problem of social cost. *The Journal of Law and Economics* 3 (1): 1-44.

Cohen, M. J., S. Carstenn, and S. R. Lane. 2004. Floristic quality indices for biotic assessment of depressional marsh condition in Florida. *Ecological Applications* 14 (3): 784–792.

Cole, C. A. 2006. HGM and wetland functional assessment: Six degrees of separation from the data? *Ecological Indicators* 6 (3): 485–493.

Coleman, J. S. 1990. *Foundations of social theory*. Cambridge, MA: Harvard University Press.

Cook, C., F. Heath, and R. L. Thompson. 2000. A meta-analysis of response rates in web- or internet-based surveys. *Educational and Psychological Measurement* 60 (6): 821–836.

Copeland, C. 2011. *Clean Water Act Section 401: Background and issues*. Washington, DC: Congressional Research Service. CRS 7–5700, 97–488.

Copeland, C. 2010. *Wetlands: An overview of issues*. Washington, DC: Congressional Research Service. CRS 7–5700, RL33483.

Dahl, T. E. 2006. *Status and trends of wetlands in the conterminous United States, 1998 to 2004*. Washington, DC: U.S. Department of the Interior; Fish and Wildlife Service.

Dale, L., and A. K. Gerlak. 2007. It's all in the numbers: Acreage tallies and environmental program evaluation. *Environmental Management* 39 (2): 246–260.

Delaware Department of Natural Resources and Environmental Control (DNREC). 2004. *State of Delaware surface water quality standards*. Dover: DNREC. http://www.dnrec.state.de.us/DNREC2000/Divisions/Water/WaterQuality/WQStandard.pdf.

Diermeier, D., and K. Krehbiel. 2003. Institutionalism as methodology. *Journal of Theoretical Politics* 15 (2): 123–144.

Dilling, L., and M. C. Lemos. 2011. Creating usable science: Opportunities and constraints for climate knowledge use and their implications for science policy. *Global Environmental Change* 21 (2): 680–689.

Donahue, D. L. 1996. The untapped power of Clean Water Act Section 401. *Ecology Law Quarterly* 23: 201–779.

Doremus, H. 2009. EPA asserts itself on mountaintop removal mining. Washington, DC: Center for Progressive Reform. April 6. http://www.progressivereform.org/CPRBlog.cfm?idBlog=7BAB3B9F-1E0B-E803-CAA5E222833E7F8B.

Dowding, K. 1994. The compatibility of behavioralism, rational choice, and new institutionalism. *Journal of Theoretical Politics* 6 (1): 105–117.

Elster, J. 1986. *Rational choice*. New York: New York University Press.

Environmental Council of States (ECOS). 2010. *Status of state environmental agency budgets, 2009–2011*. Washington, DC: ECOS. http://www.ecos.org/files/4157_file_August_2010_Green_Report.pdf.

Environmental Law Institute (ELI). 2008. *State wetland protection: Status, trends, and model approaches*. Washington, DC: ELI.

Etzioni, A. 1987. Entrepreneurship, adaptation and legitimation: A macro-behavioral perspective. *Journal of Economic Behavior and Organization* 8 (2):175–189.

Evans, T., and J. Harris. 2004. Street-level bureaucracy, social work and the (exaggerated) death of discretion. *British Journal of Social Work* 34 (6): 871–895.

Evetts, J. 2005. Organizational and occupational professionalism: The legacies of Weber and Durkheim for knowledge society. ISA Executive Committee International Symposium on Culture Change, Social Problems, and Knowledge Society, Zaragoza, Spain.

Evetts, J. 2003. The sociological analysis of professionalism: Occupational change in the modern world. *International Sociology* 18 (2): 395–415.

Feiock, R. C., and J. P. West. 1993. Testing competing explanations for policy adoption: Municipal solid waste recycling programs. *Political Research Quarterly* 46 (2): 399–419.

Feller, I. 1980. Managerial response to technological innovation in public sector organizations. *Management Science* 26 (10): 1021–1030.

Fennessy, M. S., A. D. Jacobs, and M. E. Kentula. 2007. An evaluation of rapid methods for assessing the ecological condition of wetlands. *Wetland*s 27 (3): 504–521.

Fennessy, M. S., A. D. Jacobs, and M .E. Kentula. 2004. *Review of rapid methods for assessing wetland condition*. Washington, DC: U.S. Environmental Protection Agency. EPA/620/R-04/009.

Fineman, S. 1998. Street-level bureaucrats and the social construction of environmental control. *Organization Studies* 19 (6): 853–974.

Fischman, R. 2005. Cooperative federalism and natural resources law. *New York University Environmental Law Journal* 14: 179–231.

Fowler, F. 2009. *Survey research methods*. Thousand Oaks, CA: Sage.

Fudenberg, D., and K. Levine. 1998. *The theory of learning in games*. Cambridge: MIT Press.

Gamm, G., and K. Shepsle. 1989. Emergence of legislative institutions: Standing committees in the House and Senate, 1810-1825. *Legislative Studies Quarterly* 14 (1): 39–66.

Garud, R., C. Hardy, and S. Maguire. 2007. Institutional entrepreneurship as embedded agency: An introduction to the special issue. *Organization Studies* 28 (7): 957–967.

George, A. L., and A. Bennett. 2005. *Case studies and theory development in the social sciences*. Cambridge, MA: MIT Press.

Ghigiarelli, E., and C. Conn. 2007. *Maryland wetland monitoring strategy background and discussions, years 1–3*. Baltimore, MD: Maryland Department of the Environment Wetland and Waterways Program.

Glick, H. R., and S. P. Hays. 1991. Innovation and reinvention in state policymaking: Theory and evolution of living will laws. *Journal of Politics* 53 (3): 835–850.

Glicksman, R. L. 2006. From cooperative to inoperative federalism: The perverse mutation of environmental law and policy. *Wake Forest Law Review* 41: 719–803.

Goldsmith, S., and W. D. Eggers. 2004. *Governing by network: The new shape of the public sector*. Washington, DC: The Brookings Institution.

Gorman, O. T., and J. R. Karr. 1978. Habitat structure and stream fish communities. *Ecology* 59 (3): 507–515.

Gormley, W. T. 1986. Regulatory issue networks in a federal system. *Polity* 18 (4): 595–620.

Graham, J. W., and S. M. Hofer. 2000. Multiple imputation in multivariate research. In *Modeling longitudinal and multiple-group data: Practical issues, applied approaches, and specific examples*, eds. T. D. Little, K. U. Schnabel, and J. Baumert, 201–218. Hillsdale, NJ: Erlbaum.

Graham, J. W., S. M. Hofer, S. I. Donaldson, D. P. MacKinnon, and J. L. Schafer. 1997. Analysis with missing data in prevention research. In *The science of prevention: Methodological advances from alcohol and substance abuse research*, eds. K. Bryant, M. Windle, and S. West, 325–366. Washington, DC: American Psychological Association.

Gray, V. 1973. Innovation in the states: A diffusion study. *The American Political Science Review* 67 (4): 1174–1185.

Green, D., and I. Shapiro. 1996. *Pathologies of rational choice theory*. New Haven: Yale University Press.

Greif, A., and D. D. Laitin. 2004. A theory of endogenous institutional change. *American Political Science Review* 98 (4): 633–652.

Greve, M. S. 2000. Against cooperative federalism. *Mississippi Law Journal* 70: 557–623.

Griswold, T. 1990. Wetland protection under Section 404 of the Clean Water Act: An enforcement paradox. *San Diego Law Review* 27: 139–181.

Groves, R. M. 2006. Nonresponse rates and nonresponse bias in household surveys. *Public Opinion Quarterly* 70 (5): 646–675.

Groves, R., M. Couper, S. Presser, E. Singer, R. Tourangeau, G. P. Acosta, and L. Nelson. 2006. Experiments in producing nonresponse bias. *Public Opinion Quarterly* 70 (5): 720–736.

Hall, P., and R. C. R. Taylor. 1996. Political science and the three new institutionalisms. *Political Studies* 44 (5): 936–957.

Hall, R. H. 1968. Professionalization and bureaucratization. *American Sociological Review* 33 (1): 92–104.

Hays, S. P., and H. R. Glick. 1997. The role of agenda setting in policy innovation. *American Politics Research* 25 (4): 497–516.

Heichel, S., J. Pape, and T. Sommerer. 2005. Is there convergence in convergence research? An overview of empirical studies on policy convergence. *Journal of European Public Policy* 12 (5): 817–840.

Honig, M. I. 2006. Street-level bureaucracy revisited: Front-line district central-office administrators as boundary spanners in education policy implementation. *Educational Evaluation and Policy Analysis* 28 (4): 357–383.

Horne, J. H., and T. Lupton. 1965. The work activities of "middle" managers: An exploratory study. *Journal of Management Studies* 2 (1): 14–33.

Houck, O. A. 1989. Hard choices: The analysis of alternatives under Section 404 of the Clean Water Act and similar environmental laws. *University of Colorado Law Review* 60: 773–840.

Houck, O. A., and M. Rolland. 1995. Federalism in wetlands regulation: A consideration of delegation of Clean Water Act Section 404 and related programs to states. *Maryland Law Review* 54: 1242–1314.

Howell, D. C. 2007. The analysis of missing data. In *Handbook of social science methodology*, eds. W. Outhwaite and S. Turner, 208–224. London: Sage.

Hruby, T. 1999. Assessment of wetland functions: What they are and what they are not. *Environmental Management* 23 (1): 75–85.

Hruby, T., W. E. Cesanek, and K. E. Miller. 1995. Estimating relative wetland values for regional planning. *Wetlands* 15 (2): 93–107.

Huberman, M. 1994. Research utilization: The state of the art. *Knowledge, Technology & Policy* 7 (4): 13–33.

Hubíková, O., and J. Havlíková. 2011. Reforming Czech social services: Influence of the implementation of national quality standards active user imperative on the primary Process. *Sociológia* 43 (3): 219–241.

Hupe, P., and M. Hill. 2007. Street-level bureaucracy and public accountability. *Public Administration* 85 (2): 279–299.

Husbands Fealing, K., J. I. Lane, J. H. Marburger III, and S. S. Shipp. 2011. *The science of science policy: A handbook*. Palo Alto, CA: Stanford University Press.

Huy, Q. N. 2002. Emotional balancing of organizational continuity and radical change: The contribution of middle managers. *Administrative Science Quarterly* 47 (1): 31–69.

Hwang, H., and W. W. Powell. 2005. Institutions and entrepreneurship. In *Handbook of entrepreneurship research,* eds. S. A. Alvarez, R. A. Agarwal, and O. Sorenson, 201-232. New York: Springer.

Jasanoff, S. 1990. *The fifth branch: Science advisers as policymakers*. Cambridge: Harvard University Press.

Johnson, A. T., J. B. Hirt, and P. Hoba. 2011. Higher education, policy networks, and policy entrepreneurship in Africa: The case of the Association of African Universities. *Higher Education Policy* 24 (1): 85–102.

Johnson, K. 1999. The mythical giant: Clean Water Act Section 401 and nonpoint source pollution. *Environmental Law* 29: 417–461.

Jones, Bryan D. 2002. Bounded rationality and public policy: Herbert A. Simon and the decisional foundation of collective choice. *Policy Sciences* 35 (3): 269–284.

Karr, J. R., P. R. Yant, K. D. Fausch, and I. J. Schlosser. 1984. *Evaluation of an index of biotic integrity: Temporal variability and regional application in the Midwest*. Corvallis, OR: U.S. Environmental Protection Agency. EPA-600/D-94-083.

Keeter, S., C. Kennedy, M. Dimock, J. Best, and P. Craighill. 2006. Gauging the impact of growing nonresponse on estimates from a national RDD telephone survey. *Public Opinion Quarterly* 70 (5): 759–770.

Keeter, S., C. Miller, A. Kohut, R. M. Groves, and S. Presser. 2000. Consequences of reducing nonresponse in a national telephone survey. *Public Opinion Quarterly* 64 (2): 125–148.

Keiser, L. R. 2010. Understanding street-level bureaucrats' decision making: Determining eligibility in the Social Security Disability Program. *Public Administration Review* 70 (2): 247–257.

Kerwin, C. M. 1994. *Rulemaking: How government agencies make law and write policy*. Washington, DC: CQ Press.

Kettlewell, C., V. Bouchard, D. Porej, M. Micacchion, J. Mack, D. White, and L. Fay. 2008. An assessment of wetland impacts and compensatory mitigation in the Cuyahoga River watershed, Ohio, USA. *Wetlands* 28 (1): 57–67.

Kincaid, J. 1990. From cooperative to coercive federalism. *Annals of the American Academy of Political and Social Science* 509: 139–152.

King, P. J., and N. C. Roberts. 1992. An investigation into the personality profile of policy entrepreneurs. *Public Productivity and Management Review* 16 (2): 173–190.

Kingdon, J. W. (1984) *Agendas, alternatives, and public policies*. Boston: Little, Brown.

Kling, R., and S. Iacono. 1984. The control of information systems developments after implementation. *Communications of the ACM* 27 (2): 1218–1226.

Knight, J. 1992. *Institutions and social conflict*. Cambridge: Cambridge University Press.

Knott, J., and A. Wildavsky. 1980. If dissemination is the solution, what is the problem? *Science Communication* 1 (4): 537–578.

Kolka, R. K., E. A. Nelson, and C. C. Trettin. 2000. Conceptual assessment framework for forested wetland restoration: The Pen Branch experience. *Ecological Engineering* 15 (1): S17–S21.

Krehbiel, K. 1993. Where's the party? *British Journal of Political Science* 23 (2): 235–266.

Kusler, J. 2011. *State water quality standards for wetlands*. Berne, NY: Association of State Wetland Managers.

Kusler, J. 2006. *Recommendations for reconciling wetland assessment techniques*. Berne, NY: Association of State Wetland Managers.

Kusler, J. 2004. *Wetland assessment for regulatory purposes: Assessing functions and values*. Berne, NY: Association of State Wetland Managers.

Kusler, J., and J. Christie. 2006. *Common questions: State wetland regulatory programs*. Berne, NY: Association of State Wetland Managers.

Kusler, J., and P. Riexinger. 1986. *Proceedings of the National Wetland Assessment Symposium*. Albany, NY: Association of State Wetland Managers.

Landry, R., M. Lamari, and N. Amara. 2003. Extent and determinants of utilization of university research in public administration. *Public Administration Review* 63 (2): 191–204.

Latin, Howard. 1988. Good science, bad regulation, and toxic risk assessment. *Yale Journal on Regulation* 5: 89–148.

Lee, J. 2008. Determinants of government bureaucrats' new PMIS adoption. *The American Review of Public Administration* 38 (2): 180–202.

Legal Information Institute (LII). 2010. Environmental law overview. Ithaca, NY: Cornell University Law School. http://www.law.cornell.edu/wex/Environmental_law.

Leip, D. 2012. Atlas of U.S. presidential elections. http://www.http://uselectionatlas.org/.

Leonard, D. G. 1998. "PUD 1, Thomas," and the future of Section 401 of the Clean Water Act: An expansion of state regulation. *Journal of Land, Resources, and Environmental Law* 18: 293–309.

Lester, J. P., and L. J. Wilds. 1990. The utilization of public policy analysis: A conceptual framework. *Evaluation and Program Planning* 13 (3): 313–319.

Levin, M., and B. Ferman. 1986. The political hand: Policy implementation and youth employment programs. *Journal of Policy Analysis and Management* 5 (2): 311–325.

Lipsky, M. 1980. *Street-level bureaucracy*. New York: Russell Sage.

Long, J. S. 1997. *Regression models for categorical and limited dependent variables*. Thousand Oaks, CA: Sage.

Long, J. S., and J. Freese. 2006. *Regression models for categorical and dependent variables using Stata*. College Station, TX: Stata Press.

Lopez, R. D., and S. Fennessy. 2002. Testing the floristic quality assessment index as an indicator of wetland condition. *Ecological Applications* 12 (2): 487–497.

Ma, S. Y. 2007. Political science at the edge of chaos? The paradigmatic implications of historical institutionalism. *International Political Science Review* 28 (1): 57– 78.

McGinnis, M. 2011. An introduction to IAD and the language of the Ostrom workshop: A simple guide to a complex framework. *Policy Studies Journal* 39 (1): 169–183.

McLaughlin, M. W. 1987. Learning from experience: Lessons from policy implementation. *Educational Evaluation and Policy Analysis* 9 (2): 171–178.

Maguire, S., Hardy, C., and Lawrence, T. B. 2004. Institutional entrepreneurship in emerging fields: HIV/AIDS treatment advocacy in Canada. *The Academy of Management Journal* 47 (5): 657–679.

March, J. G., and J. Olsen. 1996. Institutional perspectives on political institutions. *Governance* 9 (3): 247–264.

March, J. G., and J. Olsen. 1984. The new institutionalism: Organizational factors in political life. *The American Political Science Review* 78 (3): 734–749.

Martin, C. 2010. The Clean Water Act suffers a crushing blow: The U.S. Supreme Court clears the way for the mining industry to pollute U.S. waters. *Washburn Law Journal* 49: 933–962.

Maryland Department of the Environment (MDE). n.d.a. *Nontidal wetland regulations and the property owner*. Baltimore, MD: MDE Wetlands and Waterways Program. http://www.mde.state.md.us/programs/Water/WetlandsandWaterways/DocumentsandInformation/Documents/www.mde.state.md.us/assets/document/WetlandsWaterways/property.pdf.

Maryland Department of the Environment (MDE). n.d.b. *About wetlands*. Baltimore, MD: MDE Wetlands and Waterways Program. http://www.mde.state.md.us/programs/Water/WetlandsandWaterways/AboutFloodplainsandWaterways/Pages/Programs/WaterPrograms/Wetlands_Waterways/floodplains_waterways/index.aspx.

Matland, R. E. 1995. Synthesizing the implementation literature: The ambiguity-conflict model of policy implementation. *Journal of Public Administration Research and Theory* 5 (2): 145–174.

May, P. J. 1992. Policy learning and failure. *Journal of Public Policy* 12 (4): 331–354.

May, P. J., and S. C. Winter. 2009. Politicians, managers, and street-level bureaucrats: Influences on policy implementation. *Journal of Public Administration Research and Theory* 19 (3): 453–476.

Maynard-Moody, S., and M. C. Musheno. 2003. *Cops, teachers, counselors: Stories from the front lines of public service*. Ann Arbor: University of Michigan Press.

Maynard-Smith, J. 1982. *Evolution and the theory of games*. Cambridge, UK: Cambridge University Press.

Meltz, R., and C. Copeland. 2006. *The state role in federal licensing of hydropower dams: S.D. Warren Co. v. Maine Board of Environmental Protection*. Washington, DC: Congressional Research Service. RS22429.

Meyer, J. W., and B. Rowan. 1977. Institutionalized organizations: Formal structure as myth and ceremony. *The American Journal of Sociology* 83 (2): 340–363.

Mid-Atlantic Wetland Workgroup (MAWWG). n.d. Overview. http://mawwg.psu.edu/overview/default.asp.

Mid-Atlantic Wetland Workgroup (MAWWG). 2005. Minutes of the NEBAWWG/MAWWG joint meeting in Poughkeepsie, NY.

Mid-Atlantic Wetland Workgroup (MAWWG). 2004. Minutes of the MAWWG meeting in Baltimore, MD.

Miles, A. S. 1998. Searching for the definition of discharge: Section 401 of the Clean Water Act. *Environmental Law* 28: 191, 196–198.

Miller, G. J. 1997. The impact of economics on contemporary political science. *Journal of Economic Literature* 35 (3): 1173–1204.

Miller, G. J. 1992. *Managerial dilemmas: The political economy of hierarchy*. Cambridge, UK: Cambridge University Press.

Mintrom, M. 1997. Policy entrepreneurs and the diffusion of innovation. *American Journal of Political Science* 41 (3): 738-770.

Mintrom, M., and P. Norman. 2009. Policy entrepreneurship and policy change. *Policy Studies Journal* 37 (4): 649–667.

Mintrom, M., and S. Vergari. 1998. Policy networks and innovation diffusion: he case of state education reforms. *Journal of Politics* 60 (1): 126–148.

Mitsch, W., and J. Gosselink. 2007. *Wetlands*, 4th ed. New York: John Wiley & Sons.

Mitsch, W. J., and R. F. Wilson. 1996. Improving the success of wetland creation and restoration with know-how, time, and self-design. *Ecological Applications* 6 (1): 77–83.

Moe, T. M. 2005. Power and political institutions. *Perspectives on Politics* 3 (2): 215–233.

Moe, T. M. 1990. The politics of structural choice: Toward a theory of public bureaucracy. In *Organization theory: From Chester Barnard to the present and beyond*, ed. Oliver Williamson, 116–53. New York: Oxford University Press.

Mortimer, M. 1998. Irregular regulation under Section 404 of the Clean Water Act: Is Congress or the Corps of Engineers to blame? *Journal of Environmental Law and Litigation* 13: 445–474.

Muth, R. M., and J. C. Hendee. 1980. Technology transfer and human behavior. *Journal of Forestry* 78 (3): 141–44.

National Biological Inventory Infrastructure (NBII). 2012. *Termination of the NBII program*. Reston, VA: U.S. Geological Survey. http://www.nbii.gov/termination/index.html.

National Governors Association (NGA). 2011. Past governors' bios. Washington, DC: NGA. http://www.nga.org/cms/home/governors/past-governors-bios.html;jsessionid=24C1E516949793E5D0E0447C063C61A8.

Nevel, B., J. Milam, G. Arnold, and R. Harris. 2004. *Measuring mitigation: A review of the science for compensatory mitigation performance standards*. Washington, DC: Environmental Law Institute.

North, D. 1990. *Institutions, institutional change, and economic performance*. New York: Cambridge University Press.

Novitzki, R. P., R. D. Smith, and J. D. Fretwell. 1997. *Restoration, creation, and recovery of wetlands: Wetland functions, values, and assessment*. Reston, VA: U.S. Geological Survey. National Water Summary on Wetland Resources, United States Geological Survey Water Supply Paper 2425. http://water.usgs.gov/nwsum/WSP2425/functions.html.

Ohio Environmental Protection Agency (OEPA). n.d. *401 certification contacts*. Columbus, OH: OEPA Division of Surface Water. http://www.epa.ohio.gov/dsw/401/contacts.aspx.

Ohio Environmental Protection Agency (OEPA). 2003. *A guide to Ohio's anti-degradation rule*. Columbus, OH: OEPA Division of Surface Water. http://www.epa.ohio.gov/dsw/rules/antidegguide_2003.aspx.

Ohio Environmental Protection Agency (OEPA). 1987. *Biological criteria for the protection of aquatic life: Standardized biological field sampling and laboratory methods for assessing fish and macroinvertebrate communities*, vol. 3. Columbus, OH: OEPA.

Oliver, T. R., and P. Paul-Shaheen. 1997. Translating ideas into actions: Entrepreneurial leadership in state health care reforms. *Journal of Health Politics, Policy & Law* 22 (3): 721–788.

Olsen, T., and M. Scozzafava. 2008. Survey design for the 2011 National Wetland Condition Assessment. Presentation at the 2008 National Water Quality Monitoring Council Conference, Atlantic City, New Jersey. http://acwi.gov/monitoring/conference/2008/presentations/sessionK/K6_Olsen-NWCA_Design.pdf.

Osborne, M. J., and A. Rubinstein. 1990. *Bargaining and markets*. San Diego: Academic Press.

Ostrom, E. 2005. *Understanding institutional diversity*. Princeton, NJ: Princeton University Press.

Parding, K. 2005. Analyzing teachers' discretion: The influence of role identity. Working paper, Lulea University of Technology, Department of Human Work Science.

Pavalko, E. K. 1989. State timing of policy adoption: Workmen's compensation in the United States, 1909-1929. *American Journal of Sociology* 95 (3): 592–615.

Pennsylvania Department of Environmental Protection (PADEP). 2006. *State Programmatic General Permit 3*. Harrisburg, PA: PADEP Bureau of Watershed Management. http://www.dep.state.pa.us/dep/deputate/watermgt/wc/subjects/wwec/general/wetlands/paspgp3.pdf.

Pennsylvania Department of Environmental Protection (PADEP). 2001. *Environmental Assessment Form instructions*. Harrisburg, PA: PADEP Bureau of Watershed Management. 3930-PM-WM0017.

Pennsylvania Department of Environmental Protection (PADEP). 1997. *Procedure for 401 water quality certification*. Harrisburg, PA: PADEP. Section 400.2, 362-2000-001.

Percival, R. 1995. Environmental federalism: Historical roots and contemporary models. *Maryland Law Review* 54 (4): 1141–1182.

Peters, B. G.. 2005. *Institutional theory in political science: The new institutionalism*. New York: Continuum.

Pfeffer, J., and G. Salanick. 1978. *The external control of organizations*. New York: Harper and Row.

Phillips, R. 1998. The politics of history: Some methodological and ethical dilemmas in elite-based research. *British Educational Research Journal* 24 (1): 5–19.

Pierson, P. 2000. Increasing returns, path dependence, and the study of politics. *American Political Science Review* 94 (2): 251–267.

Pierson, P. 1996. The path to European integration: A historical institutionalist analysis. *Comparative Political Studies* 29 (2): 123–163.

Pierson, P., and T. Skocpol. 2002. Historical institutionalism in contemporary political science. In *Political science: State of the discipline*, eds. I. Katznelson and H. V. Milner, 693-721. New York: W. W. Norton.

Pires, R. R. C. 2011. Beyond fear of discretion: Flexibility, performance, and accountability in the management of regulatory bureaucracies. *Regulation and Governance* 5 (1): 43–69.

Posner, R. A. 1980. A theory of primitive society, with special reference to law. *Journal of Law and Economics* 23 (1): 1–53.

Pralle, S. 2006. The "mouse that roared": Agenda setting in Canadian pesticides politics. *Policy Studies Journal* 34 (2): 171–194.

Ramsar Convention on Wetlands (Ramsar). 2000. Climate change mitigation. Gland, Switzerland: Ramsar. Wetland Values and Functions Background Paper 5. http://195.143.117.139/info/values_climate_e.htm.

Rankin, E. 1989. *The Qualitative Habitat Evaluation Index: Rationale, methods, and application*. Columbus, OH: Ohio Environmental Protection Agency Ecological Assessment Section.

Ransel, K. P. 1995. Sleeping giant awakens: Pud No. 1 of Jefferson County v. Washington Department of Ecology. *Environmental Law* 25: 255, 268–269.

Ransel, K. P., and E. Meyers. 1987–1988. State water quality certification and wetland protection: A call to awaken the sleeping giant. *Virginia Journal of Natural Resources Law* 7: 339–379.

Reddick, C. G. 2005. Citizen interaction with e-government: From the streets to servers? *Government Information Quarterly* 22 (1): 38-57.

Rheinhardt, R. D., M. M. Brinson, and P. M. Farley. 1997. Applying wetland reference data to functional assessment, mitigation, and restoration. *Wetlands* 17 (2): 195–215.

Rhodes, R. A. 1997. Forward. In *Managing complex networks: Strategies for the public sector*, eds. W. J. M. Kickert, E.-H. Klijn, and J. F. M. Kppenjan, xi-xv. London: Sage.

Riccucci, N. M. 2005. *How management matters: Street-level bureaucrats and welfare reform*. Washington, DC: Georgetown University Press.

Ritter, A. 2008. Speaking truth to power. *Drug & Alcohol Review* 27 (2): 113–114.

Rivers Unlimited. 1997. Court strikes down anti-degradation law. *Rivers Quarterly* Fall. http://www.riversunlimited.org/download/newsletters/Rivers_Quarterly_Fall_97.pdf.

Robb, D. 1992. The role of wetland water quality standards in nonpoint source pollution control strategies. *Ecological Engineering* 1 (1–2): 143–148.

Rogers, E. M. 1995. *Diffusion of innovations*, 4th ed. New York: Free Press.

Roland, G. 2004. Understanding institutional change: Fast-moving and slow-moving institutions. *Studies in Comparative International Development (SCID)* 38 (4): 109–131.

Rose, R. 1991. What is lesson-drawing? *Journal of Public Policy* 11 (1): 3–30.

Rubin, D. 1976. Inference and missing data (with discussion). *Biometrika* 63 (3): 581–592.

Ruhl, J. B., and J. Salzman. 2007. Thinking inside the box: Looking for ecosystem services within a forested watershed. *Journal of Land Use and Environmental Law* 22: 173.

Ruhl, J. B., J. Salzman, and I. Goodman. 2009. Implementing the new ecosystem services mandate of the Section 404 compensatory mitigation program: A catalyst for advancing science and policy. *Stetson Law Review* 38: 251–272.

Sabatier, P. A. 1978. The acquisition and utilization of technical information by administrative agencies. *Administrative Science Quarterly* 23 (3): 396–417.

Sabatier, P. A., and C. M. Wieble. 2007. The advocacy coalition framework: Innovations and clarifications. In *Theories of the policy process*, ed. P. A. Sabatier, 189–220. Cambridge, MA: Westview Press.

Sandfort, J. 2000. Moving beyond discretion and outcomes: Examining public management from the front lines of the welfare system. *Journal of Public Administration Research and Theory* 10 (4): 729–756.

Sapat, A. 2004. Devolution and innovation: The adoption of state environmental policy innovations by administrative agencies. *Public Administration Review* 64 (2): 141–151.

Sax, L. J., S. K. Gilmartin, and A. N. Bryant. 2003. Assessing response rates and nonresponse bias in web and paper surveys. *Research in Higher Education* 44 (4): 409–432.

Schneider, M., and P. Teske. 1992. Toward a theory of the political entrepreneur: Evidence from local government. *The American Political Science Review* 86 (3): 737–747.

Schoch, D. 2001. Report finds deep flaws in wetlands program. Los Angeles Times. June 27.

Schumpeter, J. A. 1942. *Capitalism, socialism, and democracy*. New York: Harper and Row.

Shallat, T. 1994. *Structures in the stream: Water, science, and the rise of the U.S. Army Corps of Engineers*. Austin: University of Texas Press.

Sheehan, K. B. 2001. Email survey response rates: A review. *Journal of Computer Mediated Communication* 6 (2): online.

Sheingate, A. D. 2003. Political entrepreneurship, institutional change, and American political development. *Studies in American Political Development* 17 (2): 185–203.

Shepsle, K. A. 2006. Rational choice institutionalism. In *The Oxford handbook of political institutions*, eds. S. Binder, R. Rhodes, and B. A. Rockman, 23–38. New York: Oxford University Press.

Shih, T.-H., and X. Fan. 2008. Comparing response rates from web and mail surveys: A meta-analysis. *Field Methods* 20 (3): 249–271.

Smith, R. D., A. Ammann, C. Bartoldus, and M. M. Brinson. 1995. *An approach for assessing wetland functions using hydrogeomorphic classification, reference wetlands, and functional indices*. Vicksburg, MS: U.S. Army Corps of Engineers Waterways Experiment Station. Wetlands Research Program Technical Report WRP-DE-9.

Smith, T. 2009. A revised review of methods to estimate the status of cases with unknown eligibility. NORC/University of Chicago working paper. http://www.aapor.org/AM/Template.cfm?Section=Standard_Definitions1&Template=/CM/ContentDisplay.cfm&ContentID=1815.

Soss, J., S. F. Schram, T. P. Vartanian, and E. O'Brien. 2001. Setting the terms of relief: Explaining state policy choices in the devolution revolution. *American Journal of Political Science* 45 (2): 378–395.

Spicer, J. 2005. *Making sense of multivariate data analysis*. Thousand Oaks, CA: Sage.

Stein, E. D., E. A. Fetscher, R. P. Clark, A. Wiskind, J. L. Grenier, M. Sutula, J. N. Collins, and C. Grosso. 2009. Validation of a wetland rapid assessment method: Use of EPA's 1-2-3 framework for method testing and refinement. *Wetlands* 29 (2): 648–665.

Stein, E. D., and R. F. Ambrose. 1998. A rapid impact assessment method for use in a regulatory context. *Wetlands* 18 (3): 379–392.

Stetson, L. 2008. Wetland assessment: Measuring the quality of the nation's wetlands. *Wetland News* February. http://www.aswm.org/pdf_lib/wetland_assessment_0208.pdf.

Stevenson, R. J., and F. R. Hauer. 2002. Integrating hydrogeomorphic and index of biotic integrity approaches for environmental assessment of wetlands. *Journal of the North American Benthological Society* 21 (3): 502–513.

Sudman, S. 1976. *Applied sampling*. New York: Academic Press.

Sutula, M. A., E. D. Stein, J. N. Collins, A. E. Fetscher, and R. Clark. 2006. A practical guide for the development of a wetland assessment method: The California experience. *Journal of the American Water Resources Association* 42 (1): 157–175.

Tansy, O. 2007. Process tracing and elite interviewing: A case for non-probability sampling. *PS: Political Science and Politics* 40 (4): 1–23.

Tarlock, A. D. 2004. A first look at the modern legal regime for a "post-modern" United States Army Corps of Engineers. *University of Kansas Law Review* 52: 1285–1325.

Tarrow, S. 1995. Bridging the quantitative-qualitative divide in political science. *The American Political Science Review* 89 (2): 471–474.

Teodoro, M. P. 2010. Contingent professionalism: Bureaucratic mobility and the adoption of water conservation rates. *Journal of Public Administration Research and Theory* 20 (2): 437–459.

Teodoro, M. P. 2009. Bureaucratic job mobility and the diffusion of innovations. *American Journal of Political Science* 53 (1): 175–189.

Teske, P., and M. Schneider. 1994. The bureaucratic entrepreneur: The case of city managers. *Public Administration Review* 54 (4): 331–340.

Thelen, K., and S. Steinmo. 1992. Historical institutionalism in comparative politics. In *Structuring politics: Historical institutionalism in comparative analysis*, eds. S. Steinmo, K. Thelen, and F. Longstreeth, 1–32. New York: Cambridge University Press.

Thiesing, M. A. 2001. An evaluation of wetland assessment techniques and their applications to decision-making. In *Wetland inventory, assessment and monitoring: Practical techniques and identification of major issues*, eds. C. M. Finlayson, N. C. Davidson, and N. J. Stevenson NJ. Proceedings of Workshop 4, 2nd International Conference on Wetlands and Development, Dakar, Senegal.

Thompson, C. R. 1994. The cabinet member as policy entrepreneur. *Administration and Society* 25 (4): 395–409.

True, J., and M. Mintrom. 2001. Transnational networks and policy diffusion: The case of gender mainstreaming. *International Studies Quarterly* 45 (1): 27–57.

Turner, R. E., A. M. Redmond, and J. B. Zeller. 2001. Count it by acre or function—mitigation adds up to net loss of wetlands. *National Wetlands Newsletter* 23 (6): 5–6, 14–16.

Ugur, M., and D. Yankaya. 2008. Policy entrepreneurship, policy opportunism, and EU conditionality: The AKP and TÜSİAD experience in Turkey. *Governance* 21 (4): 581–601.

University of California Los Angeles (UCLA). Multiple imputation in Stata, part I. UCLA: Academic Technology Services, Statistical Consulting Group. Los Angeles, CA: http://www.ats.ucla.edu/stat/stata/seminars/missing_data/mi_in_stata_pt1.htm.

U.S. Army Corps of Engineers (USACE). n.d. *About ERDC: Organizational chart*. Vicksburg, MS: U.S. Army Corps of Engineers Engineer Research and Development Center (ERDC). http://www.erdc.usace.army.mil/pls/erdcpub/www_org_info.show_page?f_id=61242&f_parent=54984.

U.S. Army Corps of Engineers (USACE). 2011. *Jurisdictional information sheets*. Philadelphia, PA: U.S. Army Corps of Engineers Philadelphia District. http://www.nap.usace.army.mil/cenap-op/regulatory/spgp.html.

U.S. Army Corps of Engineers (USACE). 2010a. *Definitions of terms*. Philadelphia, PA: U.S. Army Corps of Engineers Philadelphia District. http://www.nap.usace.army.mil/cenap-op/regulatory/definitions.html#Non-tidal%20Wetland.

U.S. Army Corps of Engineers (USACE). 2010b. *ERDC fact sheet*. Vicksburg, MS: U.S. Army Corps of Engineers Research and Development Center (ERDC). http://www.erdc.usace.army.mil/pls/erdcpub/docs/erdc/docs/Fact_Sheet-ERDC.pdf.

U.S. Army Corps of Engineers (USACE). 2009. *USACE districts by state*. Memphis, TN: U.S. Army Corps of Engineers Memphis District. http://www.mvm.usace.army.mil/USACEDistrictsList.asp.

U.S. Army Corps of Engineers (USACE). 1995. *The highway methodology workbook supplement: Wetland functions and values: A descriptive approach*. Concord, MA: U.S. Army Corps of Engineers New England Division. NENEP-360-1-30a. 32.

U.S. Army Corps of Engineers (USACE). 1987. *Corps of Engineers wetlands delineation manual*. Vicksburg, MS: U.S. Army Corps of Engineers Waterways Experiment Station. Wetlands Research Program Technical Report Y-87-1.

U.S. Army Corps of Engineers and U.S. Environmental Protection Agency (USACE and EPA). 2008. Compensatory mitigation for losses of aquatic resources: Final rule. *U.S. Federal Register* 73: 19593-19705.

U.S. Bureau of Economic Analysis (BEA), U.S. Department of Commerce. 2011. *Gross domestic product by state, 1997–2010*. Washington, DC: BEA. http://www.bea.gov/regional/gsp.

U.S. Census Bureau. 2010. *State and county quickfacts*. Washington, DC: U.S. Census Bureau. http://quickfacts.census.gov/qfd/index.html.

U.S. Environmental Protection Agency (EPA). 2012a. *Mid-Atlantic wetland permit reviews*. Philadelphia, PA: EPA Region 3. http://www.epa.gov/reg3esd1/wetlands/permits.htm.

U.S. Environmental Protection Agency (EPA). 2012b. *Impaired waters and total maximum daily loads*. Washington, DC: EPA Office of Water. http://water.epa.gov/lawsregs/lawsguidance/cwa/tmdl/index.cfm.

U.S. Environmental Protection Agency (EPA). 2012c. *What are wetlands?* Washington, DC: EPA Office of Water. http://water.epa.gov/type/wetlands/what.cfm.

U.S. Environmental Protection Agency (EPA). 2012d. *Surface waters standards and guidance*. Washington, DC: EPA Agency Office of Water. http://water.epa.gov/scitech/swguidance/.

U.S. Environmental Protection Agency (EPA). 2012e. *Water quality standards for wetlands*. Washington, DC: EPA Office of Water. http://water.epa.gov/grants_funding/wetlands/quality.cfm.

U.S. Environmental Protection Agency (EPA). 2012f. *Wetlands status and trends*. Washington, DC: EPA Office of Water. http://water.epa.gov/type/wetlands/vital_status.cfm.

U.S. Environmental Protection Agency (EPA). 2011a. *Region 5 water: Wetlands*. Chicago, IL: EPA Region 5. http://www.epa.gov/r5water/wshednps/topic_wetlands.htm.

U.S. Environmental Protection Agency (EPA). 2011b. *Clean Water Act Section 404*. Washington, DC: EPA Office of Water. http://water.epa.gov/lawsregs/guidance/wetlands/sec404.cfm.

U.S. Environmental Protection Agency (EPA). 2011c. *Wetland Program Development Grants*. Washington, DC: EPA Office of Water. http://water.epa.gov/grants_funding/wetlands/grantguidelines/index.cfm.

U.S. Environmental Protection Agency (EPA). 2011d. *Fiscal Year 2011 Region 3 Wetland Program Development Grants*. Philadelphia, PA: EPA Region 3.

http://www.epa.gov/reg3esd1/wetlands/pdf/FY11-WPDG-RFP-RG3-Final2.pdf

U.S. Environmental Protection Agency (EPA). 2010. *Building state and tribal wetland programs: Core elements framework, Wetland Program Development Grants changes, and wetland program plans (revised)*. Washington, DC: EPA Office of Water. http://www.epa.gov/region8/water/wetlands/WetlandProgramPlanMemorandumModified02Feb2010.pdf.

U.S. Environmental Protection Agency (EPA). 2009a. *National Water Quality Inventory: Report to Congress, 2004 reporting cycle*. Washington, DC: EPA Office of Water. EPA 841-R-08-001. http://water.epa.gov/lawsregs/guidance/cwa/305b/upload/2009_05_20_305b_2004report_report2004pt1.pdf.

U.S. Environmental Protection Agency (EPA). 2009b. *Building state and tribal wetland programs: Core elements framework, Wetland Program Development Grants changes, and wetland program plans*. Washington, DC: EPA Office of Water. http://www.epa.gov/region8/water/wetlands/WetlandProgramPlanMemorandumModified02Feb2010.pdf.

U.S. Environmental Protection Agency (EPA). 2009c. *Section 401 certification and wetlands* Washington, DC: EPA Office of Water. http://www.epa.gov/owow/wetlands/facts/fact24.html.

U.S. Environmental Protection Agency (EPA). 2008. *National Wetland Condition Assessment fact sheet*. Washington, DC: EPA Office of Water. EPA-843-F-08-001. http://water.epa.gov/type/wetlands/assessment/survey/upload/Wetland-Survey-Fact-Sheetv6.pdf.

U.S. Environmental Protection Agency (EPA). 2006. *Application of elements of a state water monitoring and assessment program for wetlands*. Washington, DC: EPA Office of Water. http://www.epa.gov/owow/wetlands/pdf/Wetland_Elements_Final.pdf.

U.S. Environmental Protection Agency (EPA). 2002. *Wetland monitoring and assessment: A technical framework*. Washington, DC: U.S. EPA Office of Water. EPA 843-F-02-002(h). http://www.epa.gov/owow/wetlands/pdf/techfram.pdf.

U.S. Environmental Protection Agency (EPA). 2000. *Ohio wetland bioassessment program*. Washington, DC: EPA Office of Water. http://water.epa.gov/type/wetlands/assessment/oh1.cfm.

U.S. Environmental Protection Agency (EPA). 1994. *Water quality standards handbook*, 2nd ed. Washington, DC: EPA Office of Water. EPA-823-B-94-005. http://water.epa.gov/scitech/swguidance/standards/handbook.

U.S. Environmental Protection Agency (EPA). 1990. *National guidance: Water quality standards for wetlands*. Washington, DC: EPA Offices of Water Regulation and Standards and Wetlands Protection. http://water.epa.gov/lawsregs/guidance/wetlands/quality.cfm.

U.S. General Accounting Office (GAO). 2004. *Corps of Engineers needs to evaluate its district office practices in determining jurisdiction*. Washington, DC: Government Printing Office. GAO-04-297.

U.S. General Accounting Office (GAO). 1988. *Wetlands: The Corps of Engineers' administration of the Section 404 program*. Washington, DC: Government Printing Office. RCED-88-110.

Van Dam, R. A., C. Camilleri, and C. M. Finlayson. 1998. The potential of rapid assessment techniques as early warning indicators of wetland degradation: A review. *Environmental Toxicology and Water Quality* 13 (4): 297–312.

van der Knaap, P. 1995. Policy evaluation and learning: Feedback, enlightenment or argumentation? *Evaluation* 1 (2): 189–216.

Van Der Steen, M., and J. Groenewegen. 2009. Policy entrepreneurship: Empirical inquiry into policy agents and institutional structures. *Journal of Innovation Economics* 2 (4): 41–61.

Van Maanen, J. 1977. Experiencing organizations. In *Organizational careers: Some new perspectives*, ed. J. Van Maanen, 15-45. New York: John Wiley & Sons.

Van Maanen, J., and E. H. Schein. 1979. Towards a theory of organizational socialization. In *Research in organizational behavior*, ed. B. M. Staw, 209–264. Greenwich, CT: AJ Press.

Virginia Department of Environmental Quality (VDEQ). 2011a. *Wetlands: Mitigation*. Richmond, VA: http://www.deq.state.va.us/wetlands/mitigate.html.

Virginia Department of Environmental Quality (VDEQ). 2011b. *Wetlands: Permits, fees, and regulations*. Richmond, VA: http://www.deq.state.va.us/wetlands/permitfees.html.

Virginia Department of Environmental Quality (VDEQ), Virginia Marine Resources Commission (VMRC), and U.S. Army Corps of Engineers (USACE). 2008. *Standard Joint Permit Application*. Richmond: VDEQ Virginia Water Protection Program.

Walker, J. L. 1969. The diffusion of innovations among the American states. *The American Political Science Review* 63 (3): 880–899.

Walker, L., and L. Gilson. 2004. "We are bitter but we are satisfied": Nurses as street-level bureaucrats in South Africa. *Social Science & Medicine* 59 (6): 1251–1261.

Wardrop, D. H., M. E. Kentula, D. L. Stevens, S. F. Jensen, and R. P. Brooks. 2007. Assessment of wetland condition: An example from the Upper Juniata Watershed in Pennsylvania, USA. *Wetlands* 27 (3): 416–431.

Wasserman, S., and K. Faust. 1994. *Social network analysis: Methods and applications*. New York: Cambridge University Press.

Wayman, J. 2003. Multiple imputation for missing data: What is it and how can I use it? Paper presented at the Annual Meeting of the American Educational Research Association, Chicago, IL.

Weatherley, R., and M. Lipsky. 1977. Street-level bureaucrats and institutional innovation: Implementing special education reform. *Harvard Education Review* 47 (2): 171–197.

Weimer, D., and A. Vining. 2004. *Policy analysis concepts and practice*. Upper Saddle River, NJ: Pearson Education.

Weingast, B. R., and W. J. Marshall. 1988. The industrial organization of Congress; or, why legislatures, like firms, are not organized as markets. *The Journal of Political Economy* 96 (1): 132–163.

Welborn, D. M. 1988. Conjoint federalism and environmental regulation in the United States. *Publius: The Journal of Federalism* 18 (1): 27–44.

Westley, F. R. 1990. Middle managers and strategy: Microdynamics of inclusion. *Strategic Management Journal* 11 (5): 337–351.

Wetland Grants Database. U.S. Environmental Protection Agency. http://iaspub.epa.gov/pls/grts/f?p=101:1:645745996693101::NO:::.

West Virginia Department of Environmental Protection (WVDEP). 2005. *Application for individual water quality state 401 certification, State of West Virginia*. Charleston, WV: WVDEP Division of Water and Waste Management.

West Virginia Department of Natural Resources (WVDNR). 2009. *West Virginia Wetland Program development assistance*. Charleston, WV: WVDNR.

Whitford, W. G., A. G. De Soyza, J. W. Van Zee, J. A. Herrick, and K. M. Havstad. 1998. Vegetation, soil, and animal indicators of rangeland health. *Environmental Monitoring and Assessment* 51 (1–2): 179–200.

Williamson, J. G. 1991. Productivity and American leadership: A review article. *Journal of Economic Literature* 29 (1): 51–68.

Winter, S. 2002. Explaining street-level bureaucratic behavior in social and regulatory policies. Paper prepared for the XIII Research Conference of the Nordic Political Science Association in Aalborg, Denmark.

Zuurmond, A. 1998. From bureaucracy to infocracy: Are democratic institutions lagging behind? In *Public Information in an information age*, eds. I. Snellen and W. Van Der Donk, 260–272. Lansdale, PA: IOS Press.

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CONTACT INFORMATION

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EDUCATION

Indiana University, Bloomington, IN
Doctor of Philosophy in Public Policy expected August 2012
Concentrations: Environmental Policy and Political Theory and Methodology
Dissertation: *Assessing Wetland Assessment: Understanding State Bureaucratic Use and Adoption of Rapid Wetland Assessment Tools*
Dissertation committee: Professors Elinor Ostrom (chair, deceased), Burney Fischer (chair), Marjorie Hershey, Michael McGinnis, and David Reingold

University of Michigan, Ann Arbor, MI
B.A. Political Science (Minor: Global Change), May 2003

PEER-REVIEWED PUBLICATIONS

Published

Arnold, Gwen. 2012. Enhancing college students' environmental sensibilities through online journaling. *Environmental Education Research* 18 no. 3: 133–150.

Cox, Michael, **Gwen Arnold**, and Sergio Villamayor Tomás. 2010. A review and reassessment of design principles for community-based natural resource management. *Ecology and Society* 15 no. 4: 38. http://www.ecologyandsociety.org/vol15/iss4/art38/.

Revise and Resubmit

Arnold, Gwen, and Forrest Fleischman. The influence of organizations and institutions on wetland policy stability: the *Rapanos* case. Submitted to *Policy Studies Journal* in August 2011, resubmitted in February 2012, under second revision in July 2012.

Arnold, Gwen. Policy learning and science policy innovation implementation by street-level bureaucrats. Submitted to *Journal of Public Policy* in April 2012, under revisions in July 2012.

Arnold, Gwen. Use of monetary wetland value estimates by EPA Clean Water Act Section 404 regulators. Submitted to *Wetlands Ecology and Management* in March 2012, under revision in July 2012.

FUNDING

External: U.S. Environmental Protection Agency

U.S. EPA STAR Fellowship, 2010 ($111,000)

U.S. EPA National Network of Environmental Management Scholars (NNEMS) Fellowship, 2010 ($13,600)
U.S. EPA NNEMS Fellowship, 2009 ($13,600)
U.S. EPA NNEMS Fellowship, 2008 ($13,952)

External: Other
National Science Foundation, Fellowship to Attend the Fourth Annual Political Networks Conference and Workshops, 2011 ($720)
International Symposium on Society and Resource Management, Student Scholarship, 2011 ($100)

Internal
School of Public and Environmental Affairs (SPEA) Conference Travel Grant, Indiana University, 2012 ($500)
Graduate and Professional Student Organization Conference Travel Grant, Indiana University, 2011 ($250)
School of Public and Environmental Affairs (SPEA) Conference Travel Grant, Indiana University, 2010 ($750)
Department of Political Science Conference Travel Grant, Indiana University, 2010 ($300)
School of Public and Environmental Affairs Conference Travel Grant, Indiana University, 2007 ($500)
Department of Political Science Conference Travel Grant, Indiana University, 2007 ($500)
Chancellor's Fellowship, Indiana University, 2006 (tuition and annual stipend of $25,000 for four years)

OTHER PUBLICATIONS

Arnold, Gwen. 2010. Estimating the public/societal values of wetlands, National Network of Environmental Management Scholars (NNEMS) Report, Fellowship No. U-91706801-0, U.S. Environmental Protection Agency (EPA) Region 3.

Arnold, Gwen. 2009. Research on and application of theory and practice of wetland assessment. NNEMS Report, Fellowship No. U-91700501-0, U.S. EPA Region 3.

Arnold, Gwen. 2008. Analyzing functions of mineral flats of the Atlantic coastal plain for significant nexus purposes. NNEMS Report, Fellowship No. U-91692901-0, U.S. EPA Region 3.

Arnold, Gwen, ed. 2005. *After the Storm: Restoring American's Gulf Coast Wetlands*. Washington, DC: Environmental Law Institute.*

Arnold, Gwen, ed. 2003–2005. *National Wetlands Newsletter* 25 no. 6 through 27 no. 6.*

Nevel, Bonnie, Joan Milam, **Gwen Arnold**, and Rachel Harris. 2004. *Measuring Mitigation: A Review of the Science for Compensatory Mitigation*. Washington, DC: Environmental Law Institute.*

Arnold, Gwen. 2003. Collective action for common-pool resource management in Michigan inland lake communities. *Michigan Journal of Political Science* 2 no. 36.

*I worked as a research associate and editor at the nonpartisan, nonprofit Environmental Law

Institute from 2003 through 2006.

CONFERENCES, PRESENTATIONS, AND ASSOCIATED WORKING PAPERS

Arnold, Gwen. 2012. Institutional analysis of a failure of cooperative environmental federalism: Why states struggle to adopt innovative tools for wetland management. Presented at the Indiana University School of Public and Environmental Affairs Governance and Management Research Speaker Series, Bloomington, IN, April 19.

Arnold, Gwen. 2012. Street-level policy entrepreneurship. Presented at the Midwestern Political Science Association 70th Annual Conference, Chicago, IL, April 12-15.

Arnold, Gwen. 2011. Saving wetlands from the ground up: Understanding the needs of state decision-makers to improve rapid wetland assessment. Presented at the 2011 EPA STAR Graduate Fellows Conference, Washington, DC, September 18–20.

Arnold, Gwen. 2011. Integration of wetland function and service estimates into U.S. wetland regulatory policy: progress and challenges. Presented at Joint Meeting of Society of Wetland Scientists, Wetpol, and Wetland Biogeochemistry Symposium, Prague, Czech Republic, July 3-8. (Invited talk.)

Arnold, Gwen. 2011. Cycles in policy network structure and adoption-implementation processes: the importance of alignment. Presented at the 14th Annual Political Networks Conference, Ann Arbor, MI, June 17-18.

Arnold, Gwen. 2011. The paradox of bureaucratic discretion: use of wetland value estimates by federal regulators. Presented at the International Symposium on Society and Natural Resource Management, Madison, WI, June 4-8, at a panel co-organized with Forrest Fleischman: Inside the Natural Resource Bureaucracy: Institutional Theories of the Effect of Bureaucratic Organization on Natural Resource Management.

Arnold, Gwen. 2011. Assessing wetland assessment: the role of bureaucrat networks. Presented at the International Association for the Study of the Commons Biannual Meeting in Hyderabad, India, January 10-14.

Arnold, Gwen, and Forrest Fleischman. 2010. Institutional analysis of the role of government organizations in managing natural resources. Presented at the International Association for the Study of the Commons North America Regional Meeting, Arizona State University, September 30 – October 2.

Arnold, Gwen, and Forrest Fleischman. 2010. Institutional analysis of the role of bureaucrats in social-ecological systems. Presented at the Workshop in Political Theory and Policy Analysis Colloquium Series on PIASES: Program in Institutional Analysis of Social-Ecological Systems, March 31. (Invited talk.)

Arnold, Gwen. 2007. Locked in: the fragility of surfing's social structures. Presented at the 2007 Hawaii International Conference on Social Sciences, May 30 – June 2.

TEACHING EXPERIENCE

Indiana University

Environment and People (E162), Associate Instructor, Fall 2009 and Spring 2010
Independently designed syllabi and taught one section in fall and two sections in spring, supervising one graduate TA in each section. Section sizes ranged from 40–60 students.

Why Don't Young People Vote? (POLS490), Teaching Assistant, Fall 2008
Co-taught classes and held office hours on the basics of statistical analysis and survey research.

International Forestry Resources and Institutions (AE622), Course Assistant, Fall 2007
Coordinated fieldwork logistics.

Other

English as a Second Language (ESL) instructor for the Bloomington, IN-based Broadview Learning Center, 2011–2012.

ESL instructor for the Washington, DC-based non-profit Language ETC, 2003–2006.

AWARDS

Best Paper on Institutional Analysis, Association of School of Public and Environmental Affairs (SPEA) PhD Students Conference, 2008
University of Michigan Gerald Ford Public Policy Award, 2003
University of Michigan William Jennings Bryan Prize for Promise in Political Science, 2003
University of Michigan Otto Graf Memorial Prize, 2001
University of Michigan Eldersveld Award for Political Science Writing, 2000

PROFESSIONAL ASSOCIATIONS AND PROFESSIONAL INVOLVEMENT

Member, American Political Science Association
Member, International Association for Society and Nature Resources
Member, Society of Wetland Scientists
Ad hoc reviewer, *American Journal of Political Science*
Ad hoc reviewer, *Ecology and Society*
Ad hoc reviewer, *Environmental Education Research*
Ad hoc reviewer, *Public Management Review*
Ad hoc reviewer, *Policy Studies Journal*

SERVICE: ORGANIZATION COMMITMENTS

Member, Conference Organizing Committee, Association of SPEA PhD Students, Indiana University, 2007-2010
Board Member, Association of SPEA PhD Students, Indiana University, 2009
Co-Chair, Political Science Graduate Student Association, Indiana University 2008–2009
Co-Chair, University Life Committee, Graduate Student and Professional Organization, Indiana

University, 2008
Program Chair, Association of SPEA PhD Students Conference, Indiana University, 2007–2008

SERVICE: TALKS AND PRESENTATIONS

Arnold, Gwen. Getting an academic job. Guest lecture at the 12th Annual Association of SPEA PhD Students Research Conference, Bloomington, IN, March 23, 2012. (Invited talk.)

Arnold, Gwen. Using nVivo for public policy research. Guest lecture in E606: Research Methods in Cultural Anthropology, Bloomington, IN, March 23, 2012. (Invited talk.)

Arnold, Gwen. Large bureaucratic organizations as social-ecological systems. Roundtable discussion with the Indiana University Student Organization for Cognitive Science, Bloomington, IN, February 28, 2012. (Invited talk.)

Arnold, Gwen. Preparing a teaching statement. Presented at the Indiana University Campus Instructional Consulting Teaching Statement Workshop, Bloomington, IN, September 9, 2011, and February 10, 2012. (Invited talk.)

Arnold, Gwen. Enhancing college students' environmental sensibilities through online journaling. Presented at the Indiana University "Spotlight on Innovation" Faculty Colloquium for Excellence in Teaching and Learning, Bloomington, IN, October 6, 2011. (Invited talk.)