Assessing Wetland Assessment: The Role of Bureaucratic Networks

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ABSTRACT

State-level environmental bureaucrats charged with wetland regulation in the United States struggle to find and use sound tools for evaluating wetland functions and services. Wetlands provide complex, fundamentally non-excludable benefit streams, offering myriad amenities at different geographic and temporal scales. This complexity often frustrates bureaucrats' attempts to employ tools meant to quantify wetland benefits in a manner that usefully informs regulatory decision-making. Although more than 100 such wetland assessment methodologies exist in the United States, research suggests that state bureaucrats apply these tools to regulatory decisions with marked infrequency. This paper explores the conditions under which sustained, successful implementation of wetland assessment tools by state environmental bureaucracies is more or less likely. Specifically, the paper focuses on state wetland regulators in the United States's Mid-Atlantic region and examines the influence on sustained, successful implementation exerted by the characteristics of a state bureaucrat's professional networks and the bureaucrat's relationships with those networks.

Keywords: *Wetlands, CPRs, government bureaucracy, networks, implementation*

1.0 INTRODUCTION

1.1 Wetlands in the United States: Critical resources, management challenge

Wetlands are one of the United State's most imperiled and important natural resources (Mitsch and Gosselink 2000). Wetlands provide myriad services that support healthy human communities and ecosystems. They resupply groundwater aquifers; receive, process, and retain upstream sediments and pollutants; purify water; regulate and reduce flood flows; buffer shorelines from erosion forces; provide habitat for migratory birds and many other species; offer opportunities for human recreation; and, as a major carbon sinks, can even help mitigate global warming (ibid.).

However, more than half of the roughly 220 million wetland acres that covered the United States in the 1600s has been destroyed by draining for agriculture, human development, or degradation and pollution (EPA 2009). Many remaining wetlands are functionally impaired. This degradation occurred because wetlands were traditionally considered valueless, pestilent areas only useful once drained. It was not until the latter

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half of the twentieth century that scientists and then later policymakers began to acknowledge the valuable services wetlands offer. This gradual recognition led the federal government in the late 1980s to establish the policy goal of “no net loss” of wetlands nationwide. However, only in the last few years has the United States actually stopped posting annual wetland losses (Dahl 2006). Moreover, the United States has only halted net wetland loss via compensatory mitigation, a practice that allows individuals who destroy wetlands to replace them with new wetlands (ibid.). However, analysis by the National Resource Council (Schoch 2001) casts serious doubts on whether compensatory wetlands function like those they replace. Replacement wetlands often are not of the same type and do not offer the same functions as the lost wetlands (Bonds and Pompe 2003, Zedler and Callaway 1999). Replacement wetlands may provide fewer useful services to different and often smaller chunks of the population (Mathews and Endress 2008, Ambrose et al. 2007).

Federal wetland bureaucrats are obligated by the Clean Water Act to protect the chemical, biological, and physical integrity of the nation’s waters. Most state wetland bureaucrats are similarly obligated, whether by state wetland statutes and/or by Clean Water Act responsibilities delegated to states. Regulators are supposed to ensure that wetlands and their associated values, functions, and services are protected. However, this task is quite difficult because there are no widely accepted mechanisms for quantifying these aspects of wetlands (Brouwer et al. 2005, Boyer and Polasky 2004).

1.2 Wetlands as common-pool resources

This difficulty arises in part because wetlands are a classic complex common-pool resource (CPR). A CPR is a resource from which it is difficult to exclude users and which is impacted by use such that the one individual’s use limits the resource benefits available to another user (Ostrom 1990). A wetland’s physical area might be confined to an individual’s private property around which he has built a fence. Nonetheless, the wetland may receive upstream stormwater runoff and collect it, preventing downstream areas from flooding. The wetland may be a key habitat corridor for migratory birds, the hunting of which boosts the economies of states throughout the region. The wetland sequesters carbon, helping reduce the dangers future generations will face from global warming impacts. Wetlands provide complex, fundamentally non-excludable amenities at different geographic and temporal scales. Moreover, if the property owner destroys part of the wetland, that resource use subtracts from the benefits available to other users.

1.3 Protecting a complex commons through assessment

The first step toward protecting wetlands would seem to involve quantifying their benefits. Because ours is a market-based economy that equates price with value, quantified benefits could, in theory, be monetized. Their true value could then be accounted for in political and market choices. However, attempts to monetize wetland values have generally failed fairly spectacularly (Mitsch and Gosselink 2000, Heimlich et al. 1998).

An enduring challenge for wetland scientists and policymakers has thus been to

develop tools that could more accurately capture wetland benefits. Interest in systematically evaluating wetland quality, condition, and function coalesced in the United States in the late 1970s and early 1980s. Paul Adamus (Adamus and Stockwell 1983) developed one of the first widely used U.S. assessment methodologies, the Wetland Evaluation Technique (WET). WET evaluated the functions and values of wetlands according to their social significance, contribution to habitat, efficacy of function, and opportunity for function performance. WET was originally championed by the U.S. Army Corps of Engineers (Corps) (Novitzki et al. 1997), the federal agency with significant responsibility for regulating wetland use in the United States. However, critics charged that WET was too complex, not sufficiently predictive, and inappropriately mixed scientific societal-value inferences. The Corps eventually abandoned the methodology (ibid.).

In the 1980s and 1990s, scientists developed other rigorous, data-intensive assessment methodologies such as the U.S. Fish and Wildlife Habitat Evaluation Procedures (U.S. Fish and Wildlife Service 1980), indices of biologic integrity that use the health and abundance of characteristic biota to evaluate wetland condition (e.g., Karr 1981), and the Hydrogeomorphic Approach (HGM) (Brinson 1993). However, implementing these methodologies required investing significant time and resources (Kentula 2007), and so wetland decision-makers tended to avoid using them in everyday wetland decisions (Mack 2010).

Recognizing this problem, in the 1990s and 2000s, some scientists began developing quicker, more qualitative assessment protocols. Early examples included the Connecticut Method (Ammann et al. 1986), the New Hampshire Method (Ammann and Stone 1990), and the Technique for Functional Assessment in Non-tidal Wetlands of the Coastal Plain of Virginia (Bradshaw 1991). These techniques generally inferred function from observable indicators rather than measuring function directly. Soon, these faster, more user-friendly but less detailed and more estimate-reliant methods began to proliferate, created by entities at every level of government and some public and private sector groups (Bartoldus 1999, Kusler 2006, Fennessy 2007).
Rapid wetland assessment methods have been the subject of much research and regulatory attention since their inception. For wetland managers, the possibility of tools that could help answer wetland-related questions quickly, easily, and reliably is compelling. However, significant literature documents these tools' scientific flaws and the difficulties would-be users face when implementing them (e.g., Bartoldus 1999, Cole 2006, Fennessy 2004, Kusler et al. 2006, Thiesing 2001).

On the science side, some experts argue that rapid wetland assessment tools rely too heavily on best professional judgment of the user, are insufficiently quantitative, have minimal predictive capability, and tend to ignore the influence a wetland's landscape context (Thiesing 2006). Critics say the findings these tools generate are "suspect" because the tools often are grounded in insufficient data and untested assumptions (Hruby 1999, 75). On the policy usability side, Kusler (2006), Stetson (2008), and Sutula and co-authors (2006) say that decision-makers often find rapid assessment tools still too time-consuming and expensive, too narrow in scope, or too reliant on

inappropriate assumptions about user contexts and needs.

Although wetland regulation in many states occurs both at the federal level and the state level, state environmental protection agencies often are on the front lines for gathering data necessary to make regulatory choices about wetland management. State wetland experts tend to have more direct, regular, on-the-ground experience with their resources (ELI 2008). However, when Kusler (2006) interviewed hundreds of state wetland decision-makers over a ten-year period, he found that those individuals report only "limited use" of the rapid wetland assessment tools specifically designed to help them gather wetland condition and function data—even though Kusler identified more than 100 such tools. State wetland managers reported often finding the tools "unrealistic, unusable, and impractical" (ibid., 5). This collective disinclination among state regulators to use such tools is part of the reason why only approximately 4 percent of wetlands nationwide have been assessed, leaving "insufficient data to evaluate the health of wetlands [on a national level] or to quantify the extent to which they are degraded" (Fennessy et al. 2007, 543).

The U.S. Environmental Protection Agency's National Wetland Condition Assessment (NCWA) is a currently ongoing multi-year, nationwide effort to identify the best scientifically grounded practices for wetland assessment. NWCA is squarely targeting the science-side critiques of rapid wetland assessment (Scozzafava 2008). However, minimal research has addressed the usability critiques, even though many experts say that use of wetland assessment protocols is an essential component of a sound state wetland management program. Scientists and policymakers need to know why state wetland decision-makers do or do not use the tools intended to help them learn about the condition of their wetlands and thereby make better, data-grounded wetland policy. When is sustained, successful implementation of rapid wetland assessment tools by state environmental bureaucracies more or less likely?

This paper explores only one of the potential answers to this question. A variety of factors probably affect the likelihood that a state bureaucrat will use a rapid wetland assessment tool, including the bureaucrat's training and experience, the culture and logics of appropriateness dominant in her regulatory agency, the structure and content of the tool, and the nature of the resource. My larger research project explores these factors and others. It also focuses on the issue central here: The ties that bureaucrats who potentially could use rapid wetland assessment tools have to other state bureaucrats, scientists with wetland expertise, and regional and national wetland policy experts, and the nature of those network ties.

The next section introduces four hypotheses concerning the impact of policy networks on tool implementation. The third section defines the relevant terms. The fourth explains the theory underlying the hypotheses. The fifth explains the way in which my current dissertation research is testing the theories, and the sixth uses case sketches to provide preliminary evidence for the hypotheses. The seventh section concludes.

2.0 HYPOTHESES

H1) When state bureaucrats have more numerous and stronger ties to scientists with expertise relevant to rapid wetland assessment tools, sustained, successful implementation of a rapid wetland assessment tool is more likely.

H2) When state bureaucrats have more numerous and stronger ties to regional and national wetland policy experts, sustained, successful implementation of a rapid wetland assessment tool is more likely.

H3) When state bureaucrats have more numerous and stronger ties to bureaucrats in states that have successfully sustained implementation of a tool, sustained, successful implementation of a rapid wetland assessment tool is more likely.

H4) When state bureaucrats' professional networks are more permeable, sustained, successful implementation of a rapid wetland assessment tool is more likely.

3.0 BACKGROUND AND DEFINITIONS

3.1 State bureaucrats

This research focuses on employees of American states who are charged with implementing, enforcing, and/or complying with state wetland laws and regulations and who use rapid wetland assessment tools to inform their regulatory choices. Many of these bureaucrats are housed in state departments of environmental protection or environmental quality, but they also may be employed by a state department of transportation or by a division of a state natural resource agency charged with habitat protection. Wetland assessment tools are used by state employees in non-regulatory environmental programs involving voluntary restoration projects or natural resource inventories. However, the manner and purposes for which assessment tools are used in non-regulatory and regulatory applications are quite different, and I focus only on the employees who engage in regulatory activities.

3.2 Rapid wetland assessment tool

A rapid wetland assessment tool (1) measures wetland condition, (2) includes a site visit, (3) takes two people no more than a half-day in the field and another half-day in the office to complete, and (4) produces results or indications that can be verified through more intensive biological, hydrological, or geomorphological research (Fennessy et al. 2007). Although in principle anyone with scientific training could develop such a tool, this research is concerned with tools that are recognized, at the state, regional, or national levels, as more or less legitimate techniques for wetland evaluation.

In the empirical portion of this research, I distinguish "formal" from "informal" rapid wetland assessment tools. Formal tools are those officially adopted by one or more state agencies. Informal tools are approaches regulators may independently choose to use when evaluating wetlands, such as application of best professional judgment or use of a combination of elements from different formal wetland assessment tools.

Because many U.S. states do not have a long history of using rapid wetland assessment tools (or have not used them at all), I discuss these tools as policy innovations and draw on innovation diffusion literature to help explain their implementation or lack thereof.

3.4 Implementation

"Implementation" of policy innovation such as a rapid wetland assessment tool is "what develops between the establishment of an apparent intention on the part of government to do something, or to stop doing something, and the ultimate impact in the world of action" (O'Toole 2000, 266). Implementation is operationalized as usage by state bureaucrats of a formal rapid wetland assessment tool.

In the empirical portion of this research, implementation is an ordinal variable that can take values from zero (no usage by a state bureaucracy) to some maximum value which indicates that the entire rapid assessment tool is being used by all bureaucrats in a state agency in every situation to which it is applicable. At the intermediate values, some bureaucrats in a state agency might use the tool but others might not, bureaucrats might use the tool for some applications but not for all the purposes the tool is applicable, or bureaucrats may only use portions of the tool.

3.5 Sustained

"Sustained" implementation of a rapid wetland assessment tool refers to the time that a state environmental bureaucracy has used the tool. The longer the use, the more sustained the implementation.

3.6 Successful

"Successful" implementation is an ordinal variable that can take values from zero (not successful) to some upper limit indicating total success. In the empirical portion of this research, success is measured using a composite index that incorporates evaluations of the tool's record of success by state regulatory users; members of the regulated community; members of the environmental advocacy community; policy experts in government, academia, and the public sector; and scientists.

Interviews with members of these groups completed thus far indicate that successful implementation is often understood as the ability of an implementation process and/or the tool it produces to withstand legal challenges from the regulated community. A successful implementation process manages to overcome political interests intent on blocking implementation. Success also appears to be measured by the ability of the implementation process to produce a tool that is free of structural flaws that could bias the tool's indicators, is widely understood and used by bureaucrats and members of the regulated community, and is respected by scientists with relevant expertise.

3.7 Policy network

A policy network is composed of linkages, nodes, and a setting variable. A network possesses at least two nodes, which can be individuals, organizations, or any other

type of actor.[1] It also possesses linkages, or relationships, among the nodes. A defining characteristic of policy network linkages is that they are conduits for the expression of dependency relationships (Benson 1982). The nodes require information, resources, or other goods from one another. The exchanges of these goods among nodes can be fruitfully analyzed using transaction cost analysis (van Waarden 1992); networks form and persist because they are the most efficient, least risky, and/or least costly mechanisms for nodes to meet their needs. The linkages tend to be both stable and nonhierarchical (Borzel 1998). The setting variable is a substantive issue in the policy arena that both affects and is affected by the activities of the network (Borzel 1998). Policy networks develop among nodes with expert knowledge in the issue area and also often foster such knowledge.

3.8 Key policy network dimensions

Networks have numerous characteristics potentially salient in policy research, including size, permeability, power distribution, centrality, age, institutionalization, stability, nature of linkages, and degree of duplication or overlapping of function with another network in the same policy (sub)system (van Waarden 1992, Knoke et al. 1996, Wasserman and Faust 1994). In this paper I focus on three characteristics: size, strength of ties, and permeability.

I follow the "realist" approach to describing network size (Knoke and Yang 2008), accepting as the boundaries of the network the limits actors within the network perceive. This approach begins with actors who are clearly enmeshed in a policy network, such as bureaucrats, and asks those actors about the connections to other actors they find relevant for their policy work. Someone is 'in" the network when most or all the relevant actors find that person's inclusion reasonable (ibid.).

Granovetter (1973, 1316) provides a basic and seminal definition of tie strength: "the strength of a tie is a (probably linear) combination of the amount of time, the emotional intensity, the intimacy (mutual confiding), and the reciprocal services which characterize the tie." Stronger ties tend to occur when linked actors spend more time with one another and share similar personal characteristics (ibid.).

Network permeability is the ease with which an actor can move in or out of the network. An entirely impermeable network would have compulsory and restricted membership and a highly permeable network would be characterized by entirely voluntary participation and no membership conditions (van Waarden 1992). Network permeability can refer to the network's resistance to or acceptance of both new ideas and new individuals (Carolan 2007).

3.9 Role of policy networks in assessment tool implementation

Bureaucrats in government agencies who implement policy turn to other bureaucrats and substantive issue experts in the private and public sectors when seeking policy-

[1] "Nodes" are referred to as "network members" in this paper.

relevant information.[2] This statement is particularly true in today's world of fast-paced information and communication flows; traditional bureaucracies cannot hope to generate independently all the information they need to make policy choices (Goldsmith and Eggers 2004). Bureaucrats rely on networks for data to inform science-based policies (Kerwin 1994, May 1992). Bureaucrats also may query networks for political and strategic information that they believe could deploy to help grease the wheels of implementation processes (Meier and Bohte 2007). Finally, bureaucrats may use networks to find out what other units of government are doing with respect to various problems so that the bureaucrats can inform their own activities with transferrable lessons (Mintrom 1997, Bennett and Howlett 1992, Heichel 2005). Thus, when a bureaucracy is implementing an innovative policy element such as a wetland assessment tool, bureaucrats will rely on their connections to other experts to determine how implementation should proceed.

4.0 THEORY

4.1 Policy network size and implementation outcomes

The extensive literature on adaptive management argues that successful implementation of natural resource management policies requires viewing implementation as experimentation (Lee 1999, Walters and Holling 1990). Optimally, policies are implemented, results are obtained and evaluated, and policies are subsequently modified and improved based on lessons learned; the process then repeats iteratively (Lee 1999, McLain and Lee 1996). When a bureaucrat engaging in adaptive management has more numerous sources from which she can draw evaluative criteria and innovative ideas for modifying a wetland assessment tool in its next iteration, the odds become better that she will hit upon strategies that improve the tool in genuinely adaptive ways (Jackson et al. 1991). A larger policy network can provide a larger number of sources.

Organizational theory can make the same argument. A policy network is a type of group; its members are only one degree of separation from one another. Some policy networks can resemble Sabatier-style advocacy coalitions (Sabatier and Jenkins-Smith 1993, Sabatier and Weible 2007) wherein members interact regularly and frequently over time.[3]

Olson (1965) observed that as a group grows larger, it becomes more difficult for members to monitor the behavior of others. Even in active networks/groups where members often interact, increasing network size increases the number of engagement

[2] Bureaucrats may also rely on networks for manpower to fuel implementation or financial or other types of resources to facilitate it. However, in this paper I focus only on the role networks play as information conduits.

[3] Policy networks might well *be* advocacy coalitions. The difference is perspective. Network analysis concerns itself with structure and linkages among nodes, while the ACF focuses on the beliefs and resources held by nodes.

options available to any one member and, in many cases, will reduce the frequency with which any two members interact. To the extent that members have fewer repeated interactions, they may perceive the network as less cohesive. Because of this perception, and because they have fewer opportunities to observe how their fellow network members behave, they are less interested in or able to learn the logics of appropriateness that ought to govern their behavior as network members. They are less likely to develop shared norms, values, and beliefs associated with their policy issue.

Whereas members of tight-knit, highly internally socialized networks may share cognitive filters that screen out information that contradicts the group's dominant policy narratives (Sabatier and Weible 2007), members of larger and thus looser networks may have fewer such compunctions. They thus may be more likely to bring to the implementation process new ideas and solutions. While there is likely some upper limit to the utility of introducing innovation into implementation—a point beyond which too much new information that forces reconsideration of an assessment tool leads to "paralysis by re-analysis"—infusion of new ideas is frequently desirable on the adaptive management grounds described above.

Finally, larger networks may be better than smaller networks at searching out and/or producing high-quality, tool implementation-facilitating information. Oliver and Marwell (1988) argue that larger groups are not necessarily less successful at collective action than small groups. If the costs of the collective good to be generated by the group increase as group size increases, then a larger group should be less likely to produce the good. However, if the costs are relatively invariant, then larger groups should be more successful relative to smaller ones because they "have more resources and are more likely to have a critical mass of highly interested and resourceful actors" (1).

The collective action in which the wetland policy network is engaging is the acquisition of information that could construct a better tool, smooth the political path for implementation of the assessment tool, or alert implementers to potential technical or legal challenges. I assume that high-quality information is more desirable than low-quality information, and that high-quality information is more costly to obtain. Producing high-quality effort is expensive; a triple-blind study likely would require from a researcher more time, coordination, and funding than a single-blind study, but the results are more likely to inspire confidence. The costs to a network of obtaining high-quality information also are larger than those associated with lower-quality information because the former is more scarce and search costs are greater.

These search costs, however, do not grow as the size of the network grows. The amount of high-quality, potentially relevant information available in the external world is unaffected by the number of policy network members looking for it. However, the search costs decline as the network grows because costs are distributed among more searchers. They also decline for the reasons Oliver and Marwell indicate: greater likelihood of the network containing a group of actors who will be exceptionally good at acquiring high-quality information.

4.2 Strength of policy network ties and implementation outcomes
A policy network can be mainly composed of strong ties, where all the members consider themselves friends or at least colleagues, or weak ties, where most of the members consider the others acquaintances at best. The composition may fall in the middle of these two extremes or may be heterogeneous, but it is generally possible to score the average strength of ties in a network along a continuum.

Coleman (1988, 1990) describes strong-tie networks as characterized by "closure," and argues that such networks foster norms of trust and cooperation among members better than more open networks with weaker ties. On the other hand, Burt (1992) contends that more open networks, where participants' relationships bridge more structural "holes"—dissimilarities, such as of experience or expertise—produce more social capital. Social capital can produce a variety of desirable outcomes, such as shared norms, trust, reciprocity, and cooperation (Woolcock and Narayan 2000), which can facilitate policy implementation. Flache and Macy (1996) point out that very strong group ties may co-occur with reduced collective action capability because group members devote more resources to maintaining relationships than to leveraging those resources for collective action. There is quite a large literature that explores the conditions under which stronger ties or weaker ties are more or less desirable; the take-home point seems to be that optimal tie strength is largely task- and context-dependent (e.g., Chwe 1999, Hansen 1999). Considering optimal tie strength is made even more complex by the fact that separating network size from strength of ties is difficult. Networks composed primarily of strong ties tend to be smaller than those composed of weak ties because the time investment required to forge strong ties often prevents actors from establishing as many such relationships.

In an ideal world, a policy network best positioned to facilitate implementation of a rapid wetland assessment tool would be large enough to draw in new ideas and high-quality information that allows implementers to avoid pitfalls and refine the tool to make it more usable, yet just small enough to develop the trust and cohesion necessary for the network to band together in the face of implementation challenges. Ruef (2002) comes to a similar conclusion when studying the factors that affect the ability of entrepreneurial teams to engage in creative action. Ruef finds that creative action is more likely when actors can secure from their social networks non-redundant information, avoid pressures for social conformity that stifle innovation, and draw on a reservoir of trust from supporters whose backing will help sustain the innovation.

Identifying one "correct" network size and associated strength of ties is impossible. The optimal values for these variables will depend on characteristics of the resource, the political culture of the state, the structure of the tool, the history of the policy network and the path dependencies that history creates, and other factors (Rhodes 2010). They also will depend on the composition of the network's membership, as explored below. However, it should be possible to make predictions about what different the configurations of these contextual variables suggest about potentially better or poorer variable settings (see Ostrom 2007).

4.3 Network composition and implementation outcomes
Hypotheses 1-3 argue that stronger and more numerous ties with three different types of actors facilitate sustained, successful implementation of rapid wetland assessment tools: scientists who can provide objective, technical information potentially useful in improving the tool; policy experts, who can combine technical advice with recommendations based on their knowledge of implementation attempts in other parts of the country and potentially with political/strategic insight; and other state bureaucrats, who can provide implementation advice based on their own experiences with rapid wetland assessment and/or informed by their intimate understanding of the opportunities and challenged faced by someone in their profession.

Concerning the relationship between scientists (and particularly scientists who developed assessment tools) and bureaucrats, Landry and co-authors (2003) examine the network ties between university researchers in Canada and potential users of research products in Canadian national-level administrative agencies. The authors find empirical support for the hypothesis that the intensity, or strength, of linkages between producers and would-be consumers of research products is significantly, positively correlated with adoption of research products. Amara and co-authors (2004) use a survey of 833 government officials to infer that use of university research by government agencies could be increased by, among other factors, more frequent interactions between researchers and policy users. Anderson and co-authors (1999), Oh and Rich (1996), Huberman (1994), and many other scholars reach a similar conclusion. Stone and co-authors (2001) highlight a laundry list of reasons why policy actors do not appear to use research findings frequently: policy actors lack access to research findings or do not even know they exist, researchers do not comprehend how the policy process works, researchers do not communicate their work to policy actors effectively, and government bureaucracies may have limited capacity to integrate research into day-to-day activities. Stronger relationships between policy actors and bureaucrats, characterized by both parties investing time in developing the linkage, could chip away at each of these challenges.

There is substantial research supporting the argument that strong relationships between potential-implementer bureaucrats and policy experts facilitates policy implementation. For example, Bennett (1997) suggests that European nation-states implemented some innovations in bureaucratic accountability, such as passage of freedom of information laws, in part due to their participation in international networks. In particular, the attendance of a nation-state's policymakers at meetings of international organizations appear correlated with increased likelihood of implementation for two of the three innovations Bennett examined.

Tews and co-authors (2001) highlight the role of networks of transnational experts in helping spread environmental policy innovations across Europe. True and Mintrom (2001) examine nation-state establishment of agencies for gender mainstreaming from 1975 to 1998. The authors found that when a state was exposed to advocacy activity by transnational networks, the likelihood that the nation-state would adopt policy reforms aimed at fostering gender equality increased significantly. These studies are a few

examples from a wealth of supporting literature.

There is similarly extensive literature supporting the notion that bureaucrats with stronger and more numerous ties to peers in states that have successfully implemented a policy will learn from those peers and be better equipped to advance implementation in their own state. The policy diffusion and policy learning literatures emphasize that successful implementation is more likely when bureaucrats have models from which to draw lessons and experiences (Rose 1991, Bennett and Howlett 1992). Policy learning is the process wherein experts in a specific policy field acquire new information. Rose (1991) says that those experts often draw lessons from interstate networks and epistemic knowledge communities, and the content of their policy learning focuses on policy instruments and concrete means of improving policy implementation.

Another explanation for why network ties to other state bureaucrats facilitate implementation comes from the literature on policy emulation. Emulation literature argues that rather than develop their own policy upon careful study of the experiences of others, policymakers instead may simply copy the seemingly successful behaviors of policy actors in other states (Meseguer 2005). Evidence for policy emulation has been found in arenas as diverse as the creation of independent regulatory agencies in European countries in the 1980s and 1990s (Gilardi 2005) to the internalization of taxes to mitigate externalities (Tyran and Sausgruber 2005). But whether the mechanism is true learning or mimicry, the bureaucrat responding to the experiences of her peers in other states must have ties to them that make her aware of their experiences.

Recent research by Volden (2006) is introduces a nuance that is important to consider going forward. Volden compares the policy emulation choices of state bureaucracies versus those of state legislatures, investigating whether states with successful child health insurance policies are more likely to see their policies emulated by other states than states with relatively less successful policies. While he found overall support for the hypothesis that successful policies see more emulation, he also found that only emulation via legislative processes seems to follow this trend. When bureaucracies emulate the policies of other states, they do not appear to differentiate in a statistically meaningful manner between successful and unsuccessful policies (Volden 2006).

This finding requires further investigation. It may be that for a policy innovation that is relatively technical and scientifically complex, such as a wetland assessment tool, bureaucrats may not be able to judge whether the tool used in another state is suited to their programmatic needs and ecosystems without studying the tool fairly carefully. However, time- and resource-crunched state bureaucrats may have few resources for such examination.

Because their ability to predetermine likelihood of successful implementation is limited, states may look for signals that a policy innovation is a good bet for emulation. When an assessment tool implemented by many other states, it may be more likely to be perceived as part of a suite of resource management best practices. Similarly, a tool that has been in use for a long time may gain credibility and may be perceived as more

desirable for emulation by mere virtue of its persistence. These ideas raise questions about whether Hypothesis 3 will see support in empirical evaluation, and suggest how the hypothesis could be reformulated if it is not supported.

4.4 Network permeability and implementation outcomes

Pinto (2006) argues that a low-permeability network is usually composed of strong ties, whereas a high-permeability network is more likely to have weaker ties. A network that is more permeable may be subject to more membership fluxes. Its membership may be characterized by shorter rather than longer tenures and it may have more tenure heterogeneity.

Length of tenure in a network is positively associated with development of an institutional culture and with organizational socialization. Brown (2006) links time individuals spend within an organization to their development of collective identities that begin to meld members' narratives and worldviews. Time within an organization or collectivity is required for individuals to begin to perceive the logics of appropriateness that apply to their actions as members of the group (March and Olsen 1984). Similarly, van Maanen and Schein (1977, 1) conceive of time spent within an organization as the key driver of organizational adoption of "long-standing rules of thumb, a somewhat special language and ideology that help edit a member's everyday experiences, [and] shared standards of relevance . . ."

A low-permeability network thus is likely to be cohesive. Its members are likely to share similar identities, beliefs, heuristics, worldviews, and standard operating procedures, making the network quite similar (as noted above) to an advocacy coalition. Sabatier frequently comments on the tendency of members of such coalitions to apply perceptual filters to incoming information and external events, dismissing or discounting what is not congruent with their belief systems.

The implications of network permeability for successful, sustained implementation of assessment tools appear mixed. When policy network members are cohesive, norm-sharing, and in agreement that implementation of a rapid wetland assessment tool is desirable, they may devote their collective energies to pushing tool implementation past obstacles. A more permeable network with less committed and fewer like-minded members might not agree as easily or fully about the content or structure of the tool or the way it should be implemented.

On the other hand, the adaptive management literature described above prioritizes the application of new ideas and learning to iterated implementation events. Network permeability, which involves the easy in- and out-migration of ideas and members, should allow more information, and more heterogeneous information, to reach bureaucrats during implementation processes. More closed networks with fewer structural holes may be less likely to draw in innovative ideas (Burt 2004).

On balance, I argue that a more permeable network that can facilitate adaptive management is more important for successful, sustained implementation of a rapid

wetland assessment tool than a less permeable one. After all, extreme group cohesion is considered a key antecedent to the phenomenon, frequently discussed in psychological literature, of “groupthink” (Janis 1971). In the classic conception of groupthink, in-group pressures and members’ desire for harmony generate agreement on ideas or plans of action even when consideration of alternate ideas and perspectives might enrich the decision process or outcome (ibid.). A policy network that is too highly closed might insulate itself from new ideas that could improve an assessment tool and its prospects for long-term use. As with number and strength of network ties, it is likely that there is some mid-level of permeability that is most optimal, a point at which the network is permeable enough to allow innovation inflows and yet closed enough to foster trust and cohesion. This point is likely a moving target both within and across states, varying with configurations of the contextual factors that I hope to uncover in the empirical research described next.

5.0 RESEARCH DESIGN

This network research is part of a larger dissertation project that focuses on the adoption and sustained, successful implementation of rapid wetland assessment tools in five states: Pennsylvania, Maryland, Ohio, Virginia, and West Virginia. The unit of analysis for this portion of the study is the state bureaucrats potentially or actually using a rapid wetland assessment tool for regulatory purposes in these states in the past 15 years. I focus particularly on state bureaucrats positioned to make decisions about whether a state officially adopts a rapid wetland assessment tool, since those decisions determine whether subsequent use of a tool by bureaucrats in the state is considered implementation of a formal or informal rapid wetland assessment tool (see Section 3).

The two dependent variables, successful and sustained implementation, will be operationalized as described in Section 3. Because both are ordinal variables, indicating the extent to which a tool is in the “sustained” fuzzy set and/or the “successful” fuzzy set, the data will be amenable to Qualitative Case Analysis (QCA) (Ragin 1987, 2000). The “cases” are tool implementation experiences in each of the five states. I will apply QCA’s Boolean algebra-based approach to assess the configurations of network variable values that appear to make sustained or successful implementation more likely. I will perform this assessment at the individual level (e.g., if an individual had a larger policy network, was she more likely to be associated with tool implementation adoption?) and at the aggregate level (e.g., was the average size of the network of an individual engaged in wetland management in the state associated with implementation likelihood?). Data on the policy networks upon which state bureaucrats rely will be gathered/are being gathered via two surveys, interviews, and case studies.

5.1 Surveys

The first online survey has been developed and will be launched as soon as the sample is finalized. The sample includes all current state employees who work in divisions or departments that may engage in wetland assessment for regulatory purposes. Because seemingly similar government units do not necessarily perform the same functions in different states, and their functions may have changed over time, the survey has a

screening question that asks the respondent if he or she has ever used a rapid wetland assessment tool for a regulatory purpose. If the respondent answers no, he or she is then asked whether his or her job responsibilities involve wetland assessment. If the answer to that question also is no, the respondent is screened out of the survey. This process ensures that only individuals who use or could have used rapid wetland assessment tools for a regulatory purpose are queried.

The primary challenge in gathering the sample, and the reason the survey has not yet gone live, is tracking down individuals who worked in state wetland regulation at some point in the past 15 years but no longer do so. The goal of putting former employees in the sample is to construct a picture of how wetland assessment has occurred in each state since the first rapid wetland assessment tools began to be implemented nationwide, not just how rapid wetland assessment tools are used now.

I am collecting the names of these individuals from secondary sources such as old permit files, regulatory letters and guidances, resource monitoring reports, and staff directories. I also am asking federal resource managers and current state employees who I contact for interviews to try to recall the names of past employees. I am locating the current postal addresses of these former employees (since their state email addresses no longer work) using the public records search tool Intelius. I plan to send them a link to the online survey via postal mail. I estimate that I may have 1,000-1,500 individuals ultimately in the five-state sample.

The survey asks both individuals who report having used rapid wetland assessment tools and those who do not report such usage a series of questions about their network ties. Asking tool users and non-users tests the implied null hypothesis: if both groups appear to have policy networks of similar size and composition, and do not vary significantly in the intensity of their linkages with those network members, then the policy network variables may not affect the implementation outcomes.

The survey first asks respondents to think of four individuals upon whom they have relied the most, in their professional capacity, for advice about wetland regulatory matters since 1995. Respondents are given the opportunity to indicate if they have more than four such contacts, and if so how many, or if they have fewer. This is an egocentric network design commonly used in social science research (Carrington et al. 2005). The respondent is the “ego” and each contact she reports is an “alter.” The survey asks the respondent for each alter’s name, the alter’s job title during the period the ego interacted with the alter, the year when the ego began relying on the alter for advice, and the year when the relationship ended (if applicable). The questions concerning the duration of network linkages are intended to access a dimension of network permeability; if relationships are generally long-lasting, the network may be relatively impermeable, and vice-versa.

The ego is not initially asked to report which of these alters (if any) the ego relied upon for advice concerning wetland assessment. This is because later analysis will compare, across states with different implementation outcomes, the average proportion of the

policy network of a wetland bureaucrat in the state that was made up of wetland assessment-relevant contacts.

For each alter, the ego responds to multiple choice questions that ask her to pick a professional descriptor for the alter (e.g., bureaucrat, scientist) and a personal descriptor (e.g., colleague, friend), as well as report the frequency of their interaction. Respondents who indicate that they discussed a wetland assessment tool with one or more alters are asked, for each alter and each tool they discussed with that alter, to answer “agree,” “disagree,” or “don’t know” to a series of statements describing the communication the ego and alter had about the tool. The statements attempt to tease out whether policy network members were communicating about tool substance, results of research or adaptive management-style experiments related to the tool, trends in tool usage among other states (suggestive of emulation or policy learning), or some other topic. There also is a third section of this first survey that explores network ties; it is described below.

The second online survey has been developed and will be administered to a sample of rapid wetland assessment tool developers. The survey sample, not yet finalized, will attempt to include all individuals whose names have been associated, in published reports or anecdotal references, with tools whose use has been previously reported in any of the five states. As with the first survey, sample members will be invited to the survey via email or postal mail, their postal or email addresses tracked down using Intelius as necessary. They will be screened out of the survey at the outset if they cannot affirm that they helped develop a rapid wetland assessment tool used for regulatory purposes in one of the target states during the last 15 years. The purpose of this survey is to explore from the opposite perspective the linkages between the scientists and policy experts typically involved in tool development and state bureaucrats who may or may not use their tools. Examining these linkages from both ends will help uncover any discrepancies between how scientists/policy experts and bureaucrats characterize their relationships, and the implications of these discrepancies for implementation outcomes.

Respondents are asked to report, via multiple choice responses, how frequently they initiated contact with state bureaucratic users to provide implementation advice or assistance and how frequently state bureaucrats initiated communication with them for this purpose. In open-ended response fields, respondents are asked to describe what they generally discussed when they communicated with state bureaucrats (as applicable). Finally, they are asked to rate on a multiple choice scale how helpful bureaucrats in each state seemed to have found the tool. In the survey of state bureaucrats, respondents (in the third section of questions investigating networks) are asked a nearly identical set of questions. The parallel lines of questioning will allow the responses of state bureaucratic users and the developers of the tools they were using to be compared directly during data analysis.

5.2 Interviews

I have begun interviewing state wetland bureaucrats who are or were highly involved in

wetland assessment activities for regulatory purposes. I have identified these individuals by their membership in a regional workgroup funded by the U.S. Environmental Protection Agency and devoted to advancing the science and policy of wetland assessment. I also have located them by searching through current and past state bureaucracy organizational charts, guidance documents, permit files, published versions of rapid wetland assessment tools, and other secondary sources, as well as recommendations from the individuals I initially identify and talk with (snowballing). I am making one to two trips to each state to interview as many as possible of these individuals in person and am scheduling phone interviews as follow-up and with individuals who whom I cannot meet. I also am interviewing wetland scientists and policy experts in the region and federal regulators who have supported the implementation of rapid wetland assessment tools in the states with technical advice and funding.

In these semi-structured interviews, I ask a series of questions concerning network ties. I ask state bureaucrats about who or what sources they relied upon for assistance and advice when implementing the tool or considering its implementation. Later, I specifically ask them about the nature of their relationship with the state land grant university or other state academic institution that usually provides the state with environmental policy-relevant research, as well as their relationship with members of the regional wetland workgroup and other policy experts they might have meet at conferences or workshops. Similarly, I ask scientists at the academic institutions to describe their interactions and relationship with state wetland bureaucrats and how they perceive state bureaucrats have utilized their expertise when implementing or considering tool implementation. I have asked EPA regulators about their relationships with the state bureaucrats and about how they would describe the bureaucrats' relationships with sources of wetland assessment expertise. The interviews are designed to complement the survey responses, bringing to light some of the *whys* and *hows* of trends revealed by multiple choice survey responses.

5.3 Case Studies

I have begun constructing case studies describing implementation efforts in each state. The cases are highly incomplete because they will be significantly informed by the survey data, which I do not yet have, and the interview data, of which I plan to gather much more in the next few months. I also am using secondary sources such as state wetland monitoring and assessment reports submitted to the state legislature and/or EPA, information and reports on webpages associated with the state's wetland program, minutes of and presentations given at the regional wetland assessment workgroup, and draft and published versions of wetland assessment tools implemented or considered for implementation in the region. These case studies ultimately will pull together all the data into a coherent story about the relationship between the network variables and implementation outcomes in each state.

6.0 CASE SKETCHES

Because I am still in very early stages of data gathering, the vignettes below are not full

case studies. They rely on the limited number of interviews I have conducted thus far and secondary source research and are insufficient for making inferences about the validity of the network hypotheses. However, I do highlight aspects of the case sketches that appear relevant to the hypotheses and which, with further investigation, may be developed into inferences. Before presenting the sketches, I provide some details about my current evaluation of the dependent variables.

Since the case sketches are largely based on information gained from state and regional wetland assessment experts or secondary-source materials documenting the plans and strategies of those individuals, they necessarily describe policy network linkages of those experts. They do not describe the policy networks of the average state bureaucrat except to the extent that the experts comment on their perception of the experiences of the average bureaucrat. The policy networks of experts may be different from those of non-experts in key ways. I hope to uncover those differences once I can use the survey data to construct the non-expert policy networks. Nonetheless, understanding the policy networks of wetland assessment experts is important because these individuals are the gatekeepers for implementation of formal rapid wetland assessment tools in the state. Unless specifically noted otherwise, the following discussion is only concerned with formal tool implementation; I cannot comment on the average bureaucrat's use of informal tools until I have the survey data.

6.1 Implementation Outcomes

My research thus far suggests that the states fall along a continuum with respect to the implementation outcomes:

Fully "out" of the successful fuzzy set — Fully "in" the successful fuzzy set

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Maryland — Pennsylvania/West Virginia — Virginia — Ohio

Maryland's wetland assessment program has been described by some regional experts as "dead in the water and "unsuccessful." It is the only state in the Mid-Atlantic region that does not have a rapid wetland assessment tool that it has recently developed and/or is actively considering or trying to implement state-wide. Since the early 2000s, the state has received money from EPA to develop such a tool. While it has developed implementation plans, strategies, and wetland classification systems, as well as performed at least two watershed pilot projects, these activities appear to be nearly the extent of its progress (ELI 2008). The biggest step the Maryland appears to have made toward developing a rapid wetland assessment protocol—a preliminary, GIS-based landscape assessment of the state's wetlands intended to be a precursor to development of a field-usable tool—was actually performed with significant assistance from its neighboring state of Virginia, and was performed by the state's department of natural resources rather than its environmental regulatory agency (Hershner 2010).

Pennsylvania's wetland assessment program has been described by regional experts as "confusing" and as an initiative that looks good on paper but may end up producing few results. A key official in the state's wetland assessment initiative has reported that

the state is planning to roll out a rapid wetland assessment tool in the near future, but federal officials say that the state has been planning such a roll-out for quite some time and has not yet produced much. Supporting this observation is a 2008 report on the state's wetland program by the Environmental Law Institute, which reported that in 2006 the state had completed and was field-testing an assessment protocol in preparation for roll-out (ELI 2008); this is essentially the same status report that a state employee provided four years later. The state is currently holding training events to familiarize state and federal wetland regulators with the new tool, but state officials have already told participants at these events that the tool will be revised again before it is actually used for official regulatory purposes. There appears to be a good deal of skepticism among expert observers concerning whether tool implementation is actually going to occur. No rapid wetland assessment tool has been adopted for statewide use thus far.

West Virginia came to the wetland assessment game later than the other states, but at least one federal assessment expert said that the state is coming up to speed more quickly than some states that have been involved in assessment for a long time (i.e., Maryland, Pennsylvania). Other regional experts are more skeptical about West Virginia's progress, wondering whether its steps forward will be only "on paper," as in Pennsylvania. West Virginia actually has a new rapid wetland assessment tool, the West Virginia Wetland Rapid Assessment Procedure, which was recently developed by West Virginia University using state grant monies. The tool is supposed to be field-tested soon by state and university staff. Unlike in Pennsylvania, the tool is publicly accessible. However, also like Pennsylvania, the state has not incorporated the tool into regulatory use. As in Maryland, the tool's development was steered primarily by the non-regulatory environmental agency in the state rather than the regulatory arm. The state does not have a rapid wetland assessment tool that it currently uses statewide.[2]

Virginia has a sophisticated, highly developed wetland assessment program. The Virginia approach incorporates a rapid wetland assessment component as part of a three-pronged strategy that also involves GIS analysis and intensive field-level verification. This program has been developed and refined over a period of years and is regionally recognized as scientifically sound. However, Virginia's state agencies, while ostensibly interested in using this approach for regulatory purposes, have not taken the final step to integrating assessment into regulatory activities. Regulators at the state's department of environmental quality are currently working with the state's research institute to test and refine the assessment tool; they are on a sixth round of revisions, after beginning the revision effort approximately one year ago. Officials at the state's department of transportation have also expressed interest in using the tool it their regulatory activities, but similarly have not taken the final step of actual implementation (Hershner 2010, Havens 2010). There are a variety of wetland assessment tools that have been developed in the state, both for tidal and non-tidal wetlands (e.g., Bradshaw

[2] One West Virginia regulator actually advised me that there has been so little progress on wetland assessment in the state in the last twelve years or so that there was not much point in me visiting the state agencies for interviews unless I was planning a ski or fishing trip to the area anyhow!

1991, MidTRAM 2010), but none of these tools have the official blessing of state regulatory agencies.

Ohio began implementing the Ohio Rapid Assessment Method (ORAM) in 1998. The tool has been revised five times, the last in 2001. The tool is fully integrated into the state's wetland regulatory program. All state wetland regulators must be familiar with it and all state wetland permit applications must demonstrate that they have used it (Mack 2010). The Ohio district offices of the nation's primary federal wetland regulatory agency, the U.S. Army Corps of Engineers, are very familiar with the tool and comfortable with its use on projects the districts supervise. The tool has become fully part of the state's wetland regulatory culture (Mack 2010) and is generally perceived by members of the wetland policy community as a major assessment success story.

Fully "out" of the sustained fuzzy set Fully "in" the sustained fuzzy set

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Pennsylvania/West Virginia Virginia Maryland Ohio

A knowledgeable state official reported that Pennsylvania's agencies responsible for wetland regulation have never officially adopted and implemented a rapid wetland assessment tool for statewide use. The same is true in West Virginia, though West Virginia appears closer to implementing such a tool that Pennsylvania. The ordering of these two states is a judgment call, as different informants have different levels of skepticisms about tool implementation in both states. Although Virginia has never officially used a rapid wetland assessment tool in statewide regulatory activities, the larger number of tools developed in and for the state suggests that wetland assessment practices may have permeated regulatory agencies to a greater extent, at least informally. The first of the notable tools in Virginia was developed in 1991 (Bradshaw 1991), well before most states began concerning themselves with wetland assessment.

Although Maryland's assessment program has not been given positive marks recently, in 1995 the state commissioned an environmental consulting firm, Fugro East, to develop a rapid wetland assessment tool for use in the state. Two years later, the state revised the tool on its own. It was field-tested at two sites and used in three watershed planning studies (ERDC n.d.) before being apparently abandoned by the state. Thus, at some point, the state did sustain at least a superficial level of implementation of a rapid wetland assessment tool. Finally, as should be clear from the description above, Ohio clearly has had a sustained history of implementing ORAM.

6.2 Maryland's network ties

Maryland has been a regular participant in the Mid-Atlantic Wetland Workgroup, where state bureaucrats have had contact with regional and national wetland policy experts. Additionally, state assessment officials have collaborated on pilot projects or assessment related research with state employees in Delaware and Virginia (ELI 2008). However, the state does not appear to have as strong a relationship to scientists at University of Maryland or another academic institution as state bureaucrats in other states do with their land-grant universities. The policy network surrounding wetland

assessment in Maryland may be relatively small and impermeable. Minutes from the regional wetland assessment workgroup suggest there has been minimal turnover among assessment staff. The same individual who was involved in commissioning the Fugro East assessment tool development still heads the assessment effort in the state today. The division within which this individual is housed has been headed by the same supervisor over that same period; according to some experts, this individual has "been there since the beginning of time." Moreover, the network's overall size may mask a structural hole that state employees rarely bridge. Multiple federal regulators with experience in the state have noted that there is a history of non-cooperative relations between the state's regulatory environmental agency and its natural resource management agency. While both agencies pursue wetland assessment-related activities, they apparently do not work together frequently or well.

The number of state staffers involved in wetland assessment in the state appears small relative to the number of staffers in other states in the sample. One EPA wetland assessment expert called the state's assessment program fairly "insulated." Unlike in a state such as Ohio, where the technical workgroup associated with assessment tool development involved a variety of actors such as scientists and policy experts, the Maryland workgroup is composed entirely of state agency staff (ELI 208). Moreover, when the state reached out to public sector environmental think tank to strategize about wetland assessment tool development, the individual with whom state staffers worked most closely is regarded by some experts as "behind the times"—someone who was current on the science of wetland assessment 10 or 20 years ago, but not today.

Maryland may provide evidence for how having a relatively small number of network ties with scientists, policy experts, and bureaucrats within and outside the state, as well as a low-permeability policy network, can inhibit the sustained, successful implementation of a rapid wetland assessment tool. Also, the fact that Maryland was able to sustain some level of tool implementation the past but cannot today potentially suggests that while a cohesive policy network can be facilitative of implementation in its early stages because it engenders trust and collaboration, as that cohesion grows and network permeability declines over time, network closure becomes less facilitative of implementation and more facilitative of institutional inertia.

6.3 Ohio's network ties

Although all the states report involvement in some sort of technical workgroup devoted to considering wetland assessment or developing and refining a rapid wetland assessment tool, the Ohio workgroup appears to have been most diverse. The workgroup that produced ORAM consisted of roughly 20 people, and it grew out of a much larger stakeholder group of 50–80 people gathered by the state for a negotiated rulemaking concerning state wetland regulation (Mack 2010). The ORAM workgroup involved scientists, members of environmental advocacy groups, consultants for the regulated community, representatives of regulated community advocacy groups such as the National Association of Homebuilders, and state bureaucrats from a variety of agencies. A scientist led the group's effort to find a workable assessment approach. After reviewing the scientific and gray literatures, the group decided that the rapid

wetland assessment tools already in use in two different states—Minnesota and Washington—would provide the most sound basis for Ohio's assessment effort. Presumably obtaining the tools from those states and learning how to use them involved communication with Minnesota and Washington (specifically western Washington) bureaucrats.

This account suggests that Ohio state wetland regulators had multiple strong ties to scientists, policy experts, and bureaucrats in other states. Moreover, the diverse technical workgroup not only facilitated the creation of ORAM and its implementation in 1998, but also helped the state revise the tool five times between 1998 and 2001. This policy network's involvement with state bureaucratic processes associated with tool revisions was regular, ongoing, and relatively intense. The strength of these ties may help explain Ohio's successful implementation record.

6.4 Pennsylvania's network ties

Both Pennsylvania wetland assessment officials and regional wetland assessment experts note that the relationship between the Penn State Wetlands Center (PWC, the state's primary source of wetland technical expertise) and state policymakers is not particularly strong or direct. Although the state regulators have worked with Penn State scientists on demonstration and pilot projects, their interaction does not appear highly frequent. PWC and the state may more frequently work in parallel rather than together.

Although the state's participation the regional wetland assessment workgroup, with Association of State Wetland Managers, and at other conferences and events suggests that state wetland staffers may be fairly well connected to policy experts and peers in other states, the number of Pennsylvania staffers with such connections may be relatively small. Multiple federal wetland assessment experts have pointed out that the leader of the assessment initiative in Pennsylvania is running the initiative largely independently, without significant agency support. It is not entirely clear whether this individual has sought such support and been denied it, or has simply chosen to go it alone; some interviewees suggest the latter. Thus, the policy network surrounding wetland assessment in Pennsylvania might be relatively small.

The policy network also may be notable for the structural holes it fails to bridge and the general restiveness of its members. Although a full discussion of the relationship between the U.S. Army Corps of Engineers and state wetland regulators cannot be included here, state bureaucrats' jobs are usually much easier when their regulatory practices are acceptable to the Corps and they have a cooperative relationship with that agency. However, one of the Corps districts that covers a wide swath of Pennsylvania has refused to engage with the state's assessment tool development process, failing to show up to meetings and training events and publicly suggesting that it is suspicious of the process and product and uninterested in accommodating the state's use of the new assessment tool. Leaders of the assessment initiative have reportedly been equally unwilling to "court" that Corps district or any others, apparently assuming that once the state adopts its assessment tool for regulatory purposes, the federal regulatory agencies will simply get on board. Regional experts have conflicting opinions about

whether this is a viable strategy.

There also appears to be some level of discontent and skepticism among other members of the policy network (e.g., representatives of other federal resource agencies such as EPA, representatives of state agencies outside the one primarily charged with tool development) concerning whether the tool will ever actually be used in regulatory applications. This restiveness stems from, among other reasons, members' worried observations about the assessment program's relationship with the Corps, members' past experiences with much-delayed tool roll-outs, and skepticism about the viability of the "go it alone" strategy employed by the assessment program. As one concerned federal regulator recently put it, network members suspect that "things are going to get ugly" in Pennsylvania's assessment attempt fairly soon. If sustained, successful tool implementation is not achieved in Pennsylvania, the divisions and discontent among members of the policy network – precisely the opposite of the strong, supportive linkages discussed in this paper's hypotheses – may help explain the failure.

6.5 Virginia's network ties

Virginia is unique among the states in the sample in that state law mandates that agencies dealing with environmental issues turn to the Virginia Institute of Marine Sciences (VIMS) for technical advice. The research institute is roughly 60 years old, employs 450 staff with technical expertise, and has served as an objective scientific advisor to state agencies throughout its history. VIMS developed Virginia's wetland assessment approach and worked very closely with state employees in the process, communicating almost daily during more intense phases of development and tool revision (Hershner 2010, Havens 2010). Virginia has also participated in the regional wetland assessment workgroup since its inception.

VIMS staff members appear to have multiple strong ties to researchers in other states and some wetland assessment staff in other states, such as Maryland (ELI 2008). However, it is less clear whether state wetland regulators in the state have similarly numerous or strong ties. It is possible that VIMS, which federal wetland assessment experts have praised for its scientific acumen and aggressiveness in positioning itself to be a state and regional source of wetland expertise, dominates the wetland assessment policy network in the state such that Virginia's wetland bureaucrats may have few ties with wetland scientists, policy experts, or other state bureaucrats that are not mediated or forged by VIMS. The implications of VIMS' dominance in the policy network for sustained, successful tool implementation are not immediately clear and require significant further investigation.

6.6 West Virginia's network ties

Because I am least familiar with the West Virginia wetland assessment program, and the program is relatively young, this account will be short. The state appears to be making good use of scientists at West Virginia University, collaborating with them to develop and test a rapid wetland assessment tool. However, the state's wetland staffers may not have strong or well-developed ties to national or regional policy experts. The state did not participate in the regional wetland workgroup until two years after it was

established, and a leader of the nationally recognized Association of State Wetland Managers reports the state has minimal participation in the association. It is not clear the extent to which state wetland bureaucrats have regular contact with peers in other states. I would suspect that their contact may be less regular than that of their peers in other states if only because much of the resources available to the state's environmental regulatory agency (resources which could otherwise support travel to conferences or workgroups where communication with such wetland regulatory peers could occur) appear devoted to dealing with mountaintop mining issues.

7.0 CONCLUSIONS

This has been a very preliminary description of a portion of my dissertation research on adoption and implementation of rapid wetland assessment tools by environmental bureaucracies in American states. The survey data will be critical in allowing me to examine the policy networks that state bureaucrats rely upon when making tool implementation choices. Scaling up from individual networks, I will be able to comment on the characteristics of the average policy network in a given state (or the average policy network among certain types of policy actors, such as experts versus non-experts) vis-à-vis the tool implementation outcomes. In that analysis I will evaluate whether having a more numerous or stronger ties to scientists, regional/national policy networks, or other state bureaucrats, and whether having a more permeable policy network, appears to facilitate successful and/or sustained tool implementation. The interviews and case studies will allow me contextualize the results of the network analysis and dig deeper into explanations for configurations of network variable values and implementation outcomes that I observe.

8.0 REFERENCES*

Adamus, P. R. and L. T. Stockwell. 1983. A Method for Wetland Functional Assessment, v. 1: Critical review and evaluation concepts. Report No. FHWA-IP-82-23. Washington, DC: Federal Highway AdministrationN

Aldag, R. J., and S. R. Fuller. 1993. Beyond fiasco: a reappraisal of the groupthink phenomenon and a new model of group decision processes. *Psychological Bulletin* 113(3): 533–552

Amara, Nabil, Mathieu Ouimet, and Rejean Landry. 2004. New evidence on instrumental, conceptual, and symbolic utilization of university research in government agencies. *Science Communication* 26 (1):75-106.

Ambrose, Richard, Steven Lee, and John C. Callaway. 2007. Success of wetland mitigation projects in California. Present at the ESA/SER Joint Meeting, August 5-10, San Jose, California.

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

Hampshire Department of Environmental Services.

Ammann, A. P., R. W. Frazen, and J. L. Johnson. 1986. Method for the Evaluation of Inland Wetlands in Connecticut. DEP Bulletin 9. Hartford, CT: Connecticut Department of Environmental Protection, Hartford, CT.

Anderson, Malcolm, Jarold Cosby, Bill Swan, Heather Moore, and Mike Broekhoven. 1999. The use of research in local health service agencies. *Social Science & Medicine* 49 (8):1007-1019.

Bartoldus, C. C. 1999. *A comprehensive review of wetland assessment procedures: A guide for wetland practitioners.* St. Michaels, MC: Environmental Concern.

Bennett, Colin J. 1997. Understanding ripple effects: The cross-national adoption of policy instruments for bureaucratic accountability. *Governance* 10 (3):213-233.

Bennett, Colin J., and Michael Howlett. 1992. The lessons of learning: Reconciling theories of policy learning and policy change. *Policy Sciences* 25 (3):275-94.

Benson, J. K. 1982. A framework for policy analysis. In *Interorganizational Coordination: Theory, Research, and Implementation*, eds. D. L. Rogers et al., 137–201. Ames, Iowa State University Press.

Bonds, Matthew H., and Jeffrey J. Pompe. 2003. Calculating wetland mitigation banking credits: Adjusting for wetland function and location. *Natural Resources Journal* 43:961–977.

Borzel, Tanja. 1998. Organizing Babylon: on the different conceptions of policy networks. *Public Administration* 76:253–273.

Boyer, T., and S. Polasky. 2004. Valuing urban wetlands: a review of non-market valuation studies. *Wetlands* 24 (4):744-755.

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

Brinson, M. M. 1993. A hydrogeomorphic classification for wetlands. Wetlands Research Program Technical Report WRP-DE-4. Vicksburg, MS: U.S. Army Corps of Engineers, Waterways Experiment Station.

Brouwer, R., I. H. Langford, I. J. Bateman, and R.K. Turner. 1999. A meta-analysis of wetland contingent valuation studies. *Regional Environmental Change* 1 (1):47-57.

Brown, Andrew D. 2006. A narrative approach to collective identities. *Journal of Management Studies* 43 (4): 731–53.

Burt, Ronald S. 2004. Structural holes and good ideas. *The American Journal of Sociology* 110 (2):349-399.

Burt, R. S. 1992. *Structural Holes*. Cambridge, MA: Harvard University Press.

Carolan, Brian V. 2008. The structure of educational research: The role of multivocality in promoting cohesion in an article interlock network. *Social Networks* 30 (1):69–82.

Carrigan, Peter, John Scott, and Stanley Wasserman. 2005. *Models and Methods in Social Network Analysis*. New York: Cambridge University Press.

Cole, Charles Andrew. 2006. HGM and wetland functional assessment: Six degrees of separation from the data? *Ecological Indicators* 6 (3): 485–493.

Coleman, J. S. 1988. Social capital in the creation of human capital. *American Journal of Sociology* 94 (S1):95.

Coleman, JS. 1990. *Foundations of Social Theory*. Cambridge, MA: Harvard University Press.

Dahl, T. E. 2006. Status and trends of wetlands in the conterminous United States, 1998 to 2004. Washington, DC: Fish and Wildlife Service, U.S. Department of the Interior.

Environmental Law Institute (ELI). 2008*. State Wetland Protection Status, Trends, and Model Approaches*. Washington, DC: ELI.

Engineer Research and Development Center. (ERDC). n. d. Method for assessment of wetland function (MDE method). http://el.erdc.usace.army.mil/emrrp/emris/emrishelp6/method_for_the_assessment_of_wetland_function.htm.

U.S. Environmental Protection Agency (EPA). 2009. National water quality inventory: Report to Congress, 2004 reporting cycle. EPA 841-R-08-001. Washington, DC: U.S. Environmental Protection Agency Office of Water. http://www.epa.gov/owow/305b/2004report/2004_305Breport.pdf.

U.S. Fish and Wildlife Service. 1980. Habitat Evaluation Procedure (HEP) Manual (102 ESM). U.S. Fish and Wildlife Service, Washington, DC.

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.

Flache, A., and M. W. Macy. 1996. The weakness of strong ties: collective action failure in a highly cohesive group. *The Journal of Mathematical Sociology* 21 (1):3-28.

Gilardi, Fabrizio. 2005. The institutional foundations of regulatory capitalism: The diffusion of independent regulatory agencies in western Europe. *Annals of the American Academy of Political and Social Science* 598.

Goldsmith, Stephen, and William D. Eggers. 2004. *Governing by network: The new shape of the public sector*. Washington, DC: Brookings.

Granovetter, Mark S. 1973. The strength of weak ties. *The American Journal of Sociology* 78 (6):1360–80.

Hansen, Morten T. 1999. The search-transfer problem: The role of weak ties in sharing knowledge across organization subunits. *Administrative Science Quarterly* 44 (1):82-111.

Havens, Kirk. 2010. Interview with Virginia Institute of Marine Science Assistant Director, Center for Coastal Resource Management, October 18.

Heichel, Stephan, Jessica Pape, and Thomas Sommerer. 2005. Is there convergence in convergence research? An overview of empirical studies on policy convergence. *Journal of European Public Policy* 12 (5): 817–40.

Heimlich, R. E., K. D. Wiebe, R. Claasen, D. Gadsbey, and Robert M. House. 1998. Wetlands and agriculture: private interests and public benefits. edited by E. R. S. Resource Economics Division, U.S. Department of Agriculture.

Hershner, Carl. 2010. Interview with Virginia Institute of Marine Science Director, Center for Coastal Resource Management, October 18.

Hruby, Thomas. 2006. Assessment of wetland functions: What they are and what they are not. *Environmental Management* 23 (1): 75–85.

Huberman, M. 1994. Research utilization: The state of the art. *Knowledge, Technology & Policy* 7 (4):13-33.

Jackson, S. E., J. F. Brett, V. I. Sessa, D. M. Cooper, J. A. Julin, and K. Peyronnin. 1991. Some differences make a difference: Individual dissimilarity and group heterogeneity as correlates of recruitment, promotions, and turnover. *Journal of Applied Psychology* 76 (5): 675–89.

Janis, I. L. 1971. Groupthink: The desperate drive for consensus at any cost. *Psychology Today* 344.

Karr, J. R. 1981. Assessment of biotic integrity using fish communities. *Fisheries* 6: 21–27.

Kentula, Mary. 2007. Monitoring wetlands at the watershed scale. *Wetlands* 27 (3): 412–415.

Kerwin, Cornelius M. 1994. *Rulemaking: How Government Agencies Make Law and Write Policy*. Washington, DC: CQ Press.

Knoke, David, Franz Urban Pappi, Jeffrey Broadbent, Yutaka Tsujinaka. 1996. *Comparing Policy Networks*. New York: Cambridge University Press.

Knoke, David, and Song Yang. 2008. *Social Network Analysis*. Thousand Oaks, CA: Sage Publications.

Kusler, Jon. 2006. *Recommendations for reconciling wetland assessment techniques*. Berne, NY: Association of State Wetland Managers.

Landry, R., Moktar Lamari, and Nabil Amara. 2003. The extent and determinants of the utilization of university research in government agencies. *Public Administration Review* 63 (2):192-205.

Lee, KN. 1999. Appraising adaptive management. *Conservation Ecology* 3 (2):3.

Mack, John. 2010. Interview with former Ohio EPA wetland specialist and ORAM author, October 21.

McLain, RJ, and RG Lee. 1996. Adaptive management: promises and pitfalls. *Environmental Management* 20 (4):437-448.

March, James G., and Johan P. Olsen. 1984. The new institutionalism: Organizational factors in political life. *The American Political Science Review* 78 (3): 734–49.

Matthews, Jeffrey W., and Anton G. Endress. 2007. Performance criteria, compliance success, and vegetation development in compensatory mitigation wetlands. *Environmental Management* 41 (1):130–141.

May, Peter J. 1992. Policy Learning and Failure. *Journal of Public Policy* 12 (4):331-354.

Meier, K. J., and J. Bohte. 2000. *Politics and the Bureaucracy: Policymaking in the Fourth Branch of Government*. Fort Worth: Harcourt College Publishers.

Meseguer, C. 2005. Policy learning, policy diffusion, and the making of a new order. *The Annals of the American Academy of Political and Social Science* 598 (1):67.

Mid-Atlantic Tidal Rapid Wetland Assessment Method (MidTRAM). http://www.dnrec.delaware.gov/Admin/DelawareWetlands/Documents/Tidal%20Rapid_Protocol%203.0%20Jun10.pdf.

Mintrom, M. 1997. Policy entrepreneurs and the diffusion of innovation. *American Journal of Political Science*: 738-770.

Mitsch, W. J., and Gosselink, J. G. 2000. *Wetlands*, 3rd ed. New York: John Wiley and Sons.

Novitzki, Richard P., R. Daniel Smith, and Judy D. Fretwell. 1997. Restoration, creation, and recovery of wetlands: Wetland functions, values, and assessment. National Water Summary on Wetland Resources, United States Geological Survey Water Supply Paper 2425. http://water.usgs.gov/nwsum/WSP2425/functions.html.

Oh, C. H., and R. F. Rich. 1996. Explaining use of information in public policymaking. *Knowledge, Technology & Policy* 9 (1):3-35.

Oliver, Pamela E., and Gerald Marwell. 1988. The paradox of group size in collective action: A theory of the critical mass. *American Sociological Review* 53 (1):1-8.

Olson, M. 1965. *The Logic of Collective Action*. Cambridge, MA: Harvard University Press.

Ostrom, E. 1990. *Governing the commons: The evolution of institutions for collective action*. New York: Cambridge Univ Press.

Ostrom, Elinor. 2007. A diagnostic approach for going beyond panaceas. *Proceedings of the National Academy of Sciences of the United States of America* 104 (39):15181-15187.

O'Toole, Laurence J., Jr. 2000. Research on policy implementation: Assessment and prospects. *J Public Adm Res Theory* 10 (2):263-288.

Pinto, R. M. 2006. Using social network interventions to improve mentally ill clients' well-being. *Clinical Social Work Journal* 34 (1): 81–100.

Ragin, C. C. 1987. *The comparative method. moving beyond qualitative and quantitative strategies*. Berkeley/Los Angeles/London: University of California Press

Ragin, C. C. 2000. *Fuzzy-set social science*. Chicago: University of Chicago Press.

Rhodes, Charlie. 2010. Interview with EPA wetland specialist, October 20.

Rose, Richard. 1991. What is lesson-drawing? *Journal of Public Policy* 11 (1):3-30.

Ruef, M. 2002. Strong ties, weak ties and islands: structural and cultural predictors of organizational innovation. *Industrial and Corporate Change* 11 (3):427.

Sabatier, P. A., and H. C. Jenkins-Smith. 1993. *Policy Change and Learning: An Advocacy Coalition Approach*. Boulder, CO: Westview Press.

Sabatier, Paul A., and Christopher M. Weible. 2007. The advocacy coalition framework. In *Theories of the Policy Process*, 2nd ed., ed. Paul Sabatier, 189–222.

Scozzafava, Michael. 2008. National Wetland Condition Assessment: Planning progress to date. Presentation at the NWQMC National Meeting held December 10 in Reston, Virginia. http://acwi.gov/monitoring/ppt/reston_120908/NWCA_NWQMC_2008.pdf.

Schoch, Debora. 2001. Report finds deep flaws in wetlands program. *Los Angeles Times*, June 27.

Stetson, Leah. 2008. Wetland assessment: Measuring the quality of the nation's wetlands. *Wetland News*, February. Association of State Wetland Managers. http://www.aswm.org/news/wetland_assessment_0208.pdf.

Stone, D, S Maxwell, and M Keating. 2001. Bridging research and policy. In *International Workshop Funded by the UK Department for International Development*. Radcliffe House, Warwick University.

Sutula, Martha A., Eric D. Stein, Joshua N. Collins, A. Elizabeth Fetscher, and Ross 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.

Tews, Kerstin, Per-Olof Busch, and Helge Jorggens. 2003. The diffusion of new environmental policy instruments. *European Journal of Political Research* 42 (4):569-600.

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 in Dakar, Senegal.

http://www.environment.gov.au/ssd/publications/ssr/pubs/techniques-ssr161.pdf.

True, Jacqui, and Michael Mintrom. 2001. Transnational networks and policy diffusion: The case of gender mainstreaming. *International Studies Quarterly* 45 (1):27-57.

Tyran, J. R., and R. Sausgruber. 2005. The diffusion of policy innovations-an experimental investigation. *Journal of Evolutionary Economics* 15 (4):423-442.

van Maanen, J. E., and E. H. Schein. 1977. Toward a theory of organizational socialization. In *Annual Review of Research in Organizational Behavior*, ed. Barry Staw, vol. 1. New York: JIP Press.

van Waarden, Frans. 1992. Dimensions and types of policy networks. *European Journal of Political Research* 21:29–52.

Volden, Craig. 2006. States as policy laboratories: Emulating success in the children's health insurance program. *American Journal of Political Science* 50 (2):294-312.

Walters, C. 1997. Challenges in adaptive management of riparian and coastal ecosystems. *Conservation Ecology* 1 (2):1.

Wasserman, S., and K. Faust. 1994. *Social Network Analysis: Methods and Applications*. New York: Cambridge University Press.

Woolcock, Michael, and Deepa Narayan. 2000. Social capital: Implications for development Theory, research, and policy. *The World Bank Research Observer* 15 (2):225-249.

Zedler, Joy B., and John C. Callway. 1999. Tracking wetland restoration: Do mitigation sites follow desired trajectories? *Ecological Economics* 37 (2):257-270.

*Interviewees who requested anonymity are not cited.