Four Decades of Polycentric Evolution in the Chesapeake Bay Watershed

Karen J. Baehler
American University, Washington, DC

Jennifer C. Biddle
University of North Carolina Wilmington, Wilmington, NC

With outstanding research support from two American University MPP students (now graduates):

Lindsay Selfridge

Taylor Thomas

Prepared for delivery at the Workshop on the Ostrom Workshop (WOW7)
Indiana University, Bloomington, June 19–21, 2024

1. Introduction

As the study of polycentric governance (PG) settles into its seventh decade, multiple analytical approaches and frameworks are available to researchers who wish to contribute to the growing knowledge base through case studies and other empirical methods. There is no shortage of relevant cases given PG's status as a "pervasive fact of life in all policy systems" (Lubell et al 2023, p. 263). One subtype of PG—collaborative watershed management—is widely practiced, and the collaborative model more generally has "spread to nearly every aspect of environmental management in the United States and most of the world" (Lubell, Gerlak & Heikkila 2012). Finding non-PG forms of governance to compare against PG forms is now considered virtually impossible (Lubell et al 2023). Although published research on PG has increased dramatically over the past 20-25 years, much more work is needed to advance understanding about PG heterogeneity, how the various forms of these systems emerge in different settings, how they evolve, and their positive, negative, and/or neutral impacts on ecosystems, communities, and economies (Baldwin et al 2024).

Researchers interested in pursuing these topics face a difficult decision: which of the many available analytical frameworks to adopt and/or adapt? Two often-cited, but less-often-applied options (Baldwin et al 2024) were developed by the Ostroms in conjunction with their many collaborators. These are the Institutional Analysis and Development (IAD) framework and the Social-Ecological Systems (SES) framework, which builds on the IAD (Cole et al 2019; McGinnis 2020; Ostrom 2010). A third notable option, the Ecology of Games Framework (EGF), is now considered among the elite eight core theories of the policy process based on its inclusion in the leading textbook on the subject, which also includes IAD among the elite eight (Weible 2023). EGF offers a different variation on IAD with different points of focus (Berardo & Lubell 2019; Lubell et al 2023).

Another option worth noting is Carlisle and Gruby's (2019) formulation of two overarching "attributes" that define PG plus a subsidiary set of seven "enabling conditions" that describe system features we might expect "to be necessary or conducive to achieving" PG's purported advantages over other governance types. Carlisle and Gruby closely modeled those nine elements on V. Ostrom et al's (1961) classic description of polycentricity, with modifications based on later writings of V. Ostrom, E. Ostrom, and other key figures in the history of PG. Carlisle and Gruby (2019) thus preserve the important normative foundations of PG as a concept, which include PG's roots in both political theory (e.g., separation of powers doctrine, institutional checks and balances, theories of federalism, and theories of democracy per V. Ostrom's deep engagement with Dewey and Tocqueville) and the science of complex adaptive systems (e.g., insights into the roles of modularity, heterogeneity, redundancy, self-organization, self-correction, communication, and learning in system resilience and adaptive capacity). We found this framework helpful in previous work while also noting gaps (Biddle & Baehler 2019).

Casual observation suggests that many PG researchers prefer to develop their own frameworks to suit their specific purposes rather than using any "off-the-shelf" option, no matter how distinguished its pedigree. Within the resulting multitude of tailored frameworks, there is much borrowing and tweaking of elements from each other, and comparing frameworks reveals a lot of overlap. Nonetheless, the sheer number of framework variants, no matter how small the differences between them, makes the systematic collection of empirical results across studies significantly more difficult.

To address this comparison problem and thereby improve the chances for effective "cumulation of knowledge" about the multitude of PG variations and their beneficial, harmful, and/or neutral roles in addressing collective action problems, Elizabeth Baldwin and colleagues (2024, p. 320) have recently published a composite framework with potential to become the field standard. Known as COOF (for Context – Operations – Outcomes – Feedback), the new framework combines elements from both IAD and SES with additional components designed to fill gaps identified in the authors' systematic review of

the PG literature to date. It thus maintains roots in the classic approaches to PG while also incorporating more recent insights from theory and practice.

This paper reports preliminary results from our application of COOF to the case of collaborative watershed management in the Chesapeake Bay region from the 1980s to the present. Applying COOF to a long-term analysis such as this has enabled us to observe the framework's utility in capturing evolving dimensions of one PG system over several decades. Baldwin et al (2024, p. 334) note the benefits to be gained from more longitudinal analysis of PG systems, including insights into "how governance arrangements change, how those changes affect the system's ability to function, and what possible safeguards might help ensure that change is adaptive, rather than maladaptive, over time."

The following sections describe how we structured our analysis using the COOF, our experiences to date using the framework, and a few preliminary results organized according to the five themes. Overall, our reading of 40 years of governance adventures in the Chesapeake Bay watershed leaves us somewhat overwhelmed by the extent to which this PG system has defied all odds in both its emergence and evolution. As explained below, the contextual factors strongly skew toward inhibiting rather than enabling factors in the case of the Bay, which would lead many experts to predict either failure of PG to form in the first place or early collapse of any arrangement that did manage to squeeze through a narrow window of opportunity.

Yet, squeeze it did, and more: despite the challenges of massive inter-jurisdictional externalities, highly asymmetric interests of key decision-making centers, 25+ years of weak cross-scale pressure from higher jurisdictional authorities, and initially weak pressure from civil society, the one-page-long 1983 Chesapeake Bay Agreement put in motion a 40+-year model of voluntary polycentric governance characterized by both pervasive weaknesses (i.e., chronic inability to put meaningful restrictions on powerful political interests) and notable achievements, including slow, but discernible progress toward more effective interventions. We hope our continued work on this case study, using the COOF framework, will illuminate the processes that have made this progress possible in spite of massive obstacles. This paper offers a few initial thoughts based on our analysis to date.

2. How We Applied COOF

The four main parts of the new composite framework create a quasi-cyclical model, as shown in Figure 1 below from Baldwin et al (2024, Figure 7, p. 335). As the solid arrows illustrate, the PG system's contextual characteristics shape operational arrangements, which lead to a variety of social, environmental, and governance outcomes. In time, outcomes may generate feedback that eventually influences operational arrangements, either directly or through changes to contextual characteristics, as illustrated by the dashed arrows. This simple four-part approach helps keep the framework user-friendly without sacrificing depth, thanks to the opportunities for detail provided by the sub-group categories listed in each main box.

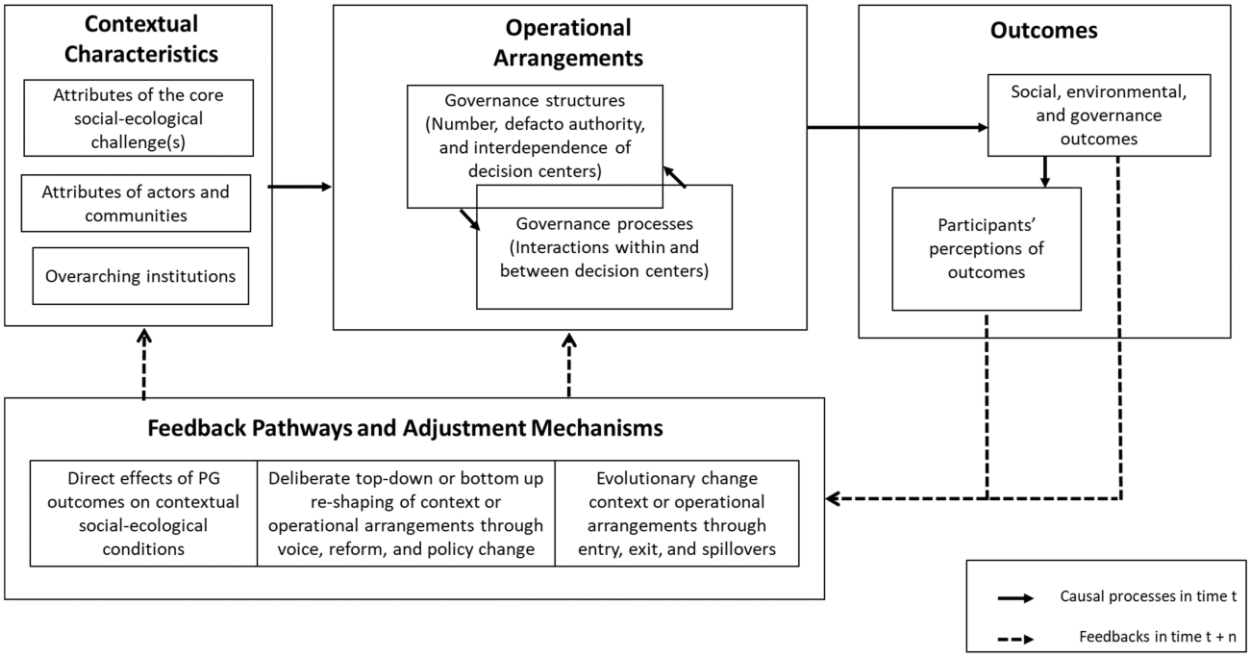

Figure 1. The COOF Analytical Framework (from Baldwin et al 2024, p. 335)

Rather than repeating here the full rationale and explanation of COOF and its components (which can be found in Baldwin et al 2024), we proceed directly to a description of how we applied the framework to our case study. Tables 1-5 (found at end of paper) were constructed from a large quantity of primary and secondary sources that we have pieced together to tell the evolving story of polycentric governance in the Chesapeake Bay region. Each table focuses on a specific era within the 40+-year history, beginning with the period leading up to the formation of the Bay's PG arrangements in Table 1. We define some eras as longer than others: the cutoff points for the time periods represent major milestones in the PG system's evolution. [Note: Future versions of this paper will include a brief history and background on the Bay. We apologize to readers who are not familiar with this case for not including it here.]

Each table is organized according to the first three categories provided by COOF: **Contextual Characteristics** (coded CX), **Operational Arrangements** (coded PG for polycentric governance/operational arrangements), and **Outcomes** (coded OC). The subcategories of C, O, and O identified in Baldwin and colleagues' diagram are used to further classify items: see Figure 1 in this paper. Each row of each table describes a constitutive element (a part or characteristic) of the Chesapeake Bay PG system. We sorted all elements according to the labels C, O, and O. For example, in Table 2, which covers the 1980-86 period, we identify the establishment of the voluntary federal-state partnership known as the Chesapeake Bay Agreement (CBA) as a structural element of the Bay's PG system, *the* defining structural element, in fact. It therefore gets its own row in the table under the PG Structure subcategory [PG_STR] of Operational Arrangements. We describe the CBA very briefly in the "System Element" column (the main column in every table). The whole row captures important dimensions of that element of the system.

The tables treat the fourth component of COOF differently. F is for **Feedback Pathways and Adjustment Mechanisms**, a vitally important set of processes that define any PG system as a complex adaptive system. Instead of adding headings for F and its subcategories with rows underneath, like we do for C, O, and O, the tables try to capture the idea of feedback and adjustment (F) more dynamically as a flow of influences into and out of each row. We do this using two columns in the tables—one before and

one after "System Element" to represent the direction of influence. The first feedback-related column is labeled "Antecedents": this column records variables we see as potentially important predecessors to the element represented by each row. "Antecedents" are the formative inflows to each row's element. Using the same example as above from Table 2, we trace the establishment of the Chesapeake Bay Agreement (CBA) to several contextual factors identified as initial conditions in Table 1. We record these predecessors or formative factors in the "Antecedents" column of Table 2 in the CBA row to signal their role as formative pathways that help explain the emergence of the CBA—how it came to be. It is very important to note that the "Antecedents" are not proven explanatory variables. They are the result of our careful examination of the case, but we have not tested them. Future efforts at large scale modeling of PG evolution might endeavor to do so. In fact, the antecedents could be viewed as hypotheses about the dynamics of emergence within this or potentially any PG system. In each table the "Antecedents?" column label includes a question mark to signal the speculative nature of these observations.

Each table also contains a second feedback-related column for recording pathways of influence pointing to the future. The "Implications for PG" column records our speculative thoughts about how a particular "System Element" might shape the trajectory of the PG system going forward. Like "Antecedents," "Implications for PG" are also untested and could be treated as hypotheses about the possible flow-on effects from a specific system element to other parts of the PG system. Those column labels also end in a question mark for that reason.

The structure of the tables aims to capture the full benefits of the multi-dimensional COOF framework in a two-dimensional space. Vertically each table contains a category of elements associated with C, O, and O. For the F category, each row is meant to read left to right as a mini flow diagram depicting dynamic feedback forces, starting with the emergence and formation of a specific system part or feature (note the arrow from "Antecedents" to "System Element") and then the expected impact of that part or feature on the system's subsequent development (note the arrow from "System Element" to "Implications for PG").

3. How It Worked: Initial Observations

The utility of the COOF framework is especially clear when applied to a longitudinal analysis such as this one. The breadth of COOF enables researchers to ask big questions such as the following.

1. Normative/conceptual questions
    a. Is it possible to imagine a governance arrangement that can direct our core governance institutions to address significant collective action problems?
    b. If so, how would such arrangements cope with the fundamental limitations of our basic institutional architecture and its deeply embedded power imbalances?
    c. Among the imaginable set of governance arrangements that meet these criteria, are they all polycentric to some degree?
2. Descriptive and explanatory questions
    a. How do such governance arrangements emerge in practice?
        i. Can we identify the factors that tend to enable their emergence and shape their evolution over time?
        ii. Can we identify the obstacles to their emergence and resilience over time?
    b. Why do these governance arrangements take different forms in different contexts?
3. Typology questions
    a. What are the different forms of PG found in the world? How shall we classify them?
4. Evaluative questions
    a. How have various forms of these governance arrangements performed vis a vis desired ecological, social, economic, cultural, etc. outcomes?
    b. How shall we decide which outcomes to measure performance against?

c. In the absence of counterfactuals for any case, how can we judge its performance (Lubell, Gerlak & Heikkila 2012)?
d. Assuming adequate answers to questions 4b&c, can we identify system features that are more adaptive vs. maladaptive across cases?

This paper reports progress to date on our preliminary efforts to tackle the descriptive and explanatory questions (#2 above) in the case of the Chesapeake Bay's PG developments to date.

In applying COOF, we found the first component—Context—to be an especially powerful tool for understanding the push and pull of enabling conditions and obstacles to PG emergence and development. The Context variables continually remind the researcher that PG systems nearly always rely on constituent institutions (the decision-making centers) to do the necessary work. PG structures may exercise varying degrees of authority (sticks and/or carrots) over the decision-making centers, but in many cases, that authority is highly constrained. Effectiveness thus depends on persuasion, which requires a delicate balance of pressure and support.

The degree and type of pressure and support needed to create a coherent PG arrangement in turn depends on the types of shared problems plaguing the decision-making centers and the extent to which they truly are shared (Contextual Subcomponent 1 – attributes of the SES challenges), the characteristics of the actors and organizations who are "running" those decision-making centers formally and informally (Contextual Subcomponent 2 – attributes of actors and communities), and the collective choice rules in which those actors and organizations function (Contextual Subcomponent 3 – overarching institutions).

Among the five tables summarizing our data collection so far, Table 1 contains the most content—largest number of rows—associated with Context and its subcomponent. And it is worth noting that Table 1's contextual variables continue to be relevant across all five tables. In other words, the initial enabling and inhibiting conditions for emergence of the PG system continued to exert a push-pull influence over the system's evolution across the 40-year period. We are enthusiasts for the inclusion of C in COOF.

We found the Operational Arrangements component (the first O in COOF) the most unwieldy of the 4 components, simply because it covers such a mind-bogglingly large potential swath of organizational structures and actor behaviors, functions, and processes. We found the structure-process distinction helpful, and we had an easier time identifying system elements that belong under structure compared with process. With more opportunities to apply this component, we expect decisions about what to include in which bucket will become easier.

As you can see in Tables 1-5, we have only scratched the surface in terms of information about Outcomes (the second O in COOF). Noted in the tables are open questions in need of attention regarding how to define and measure some of the key outcomes, including governance capacity and political representation.

Re Feedback Pathways and Adjustment Mechanisms (the F in COOF), we initially struggled with applying this until we decided to treat it as a flow rather than a stock. When we added the Antecedents and Implications columns and started identifying these factors for each System Element (row) in our tables, we appreciated the opportunity to think more systematically about the ways in which each system element can be viewed as the product of previous forces (looking backwards) and as a potential stimulus for subsequent PG developments (looking ahead).

The following sections describe five themes that emerge from preliminary analysis of our first round of data collection represented in Tables 1-5.

4. Interjurisdictional Externalities and Uneven Distribution of Costs and Benefits

The factors we included in the first contextual subcomponent of Context—**Attributes of the Core Social-ecological Challenge(s) [CX_PROB]**—describe the fundamental problem in the Bay as a classic case of inter-jurisdictional externalities (see Table 1). The Bay itself is roughly 200 miles long, but its watershed extends across 64,000 square miles spread among six states. Byproducts of activities undertaken throughout the watershed flow into the region's 150 tributaries, which represent more than 100,000 stream miles, all of which eventually converge on the Bay. The watershed's 14:1 land-to-water ratio is the largest of any coastal water body in the world and helps explain why actions on land are so vitally important to the Bay's health. Much of the Bay is very shallow, which helps explain the 14:1 ratio and the Bay's sensitivity to inputs.

With a watershed that includes all or part of six states, the Bay's central challenge is analogous to that of adjacent municipalities seeking to internalize problems of "unfavorable spillovers or externalities" in the classic article by V. Ostrom, Tiebout, and Warren (1961) (hereafter OTW, following Baldwin et al). The horizontal relationships in the OTW setting involve cities, towns, and counties, with vertical relationships to state governments. In the analogous case of a watershed-regional setting like the Bay case, the horizontal relationships involve states primarily, with vertical relationships to the federal government.

In theory, inter-jurisdictional spillover problems can be solved through cooperative arrangements among the jurisdictions involved, and many such cases have been observed. OTW (p. 838) point out, however, that such arrangements are more likely to work "when joint activities produce a greater return to all parties concerned" (benefits exceed costs) and when the size of the payoffs is similar among the centers:

> "Concerted action by the various units of government in a metropolitan area is easier to organize when costs and benefits are fairly uniformly distributed throughout the area. … More difficult problems for the polycentric system arise when the benefits and the costs are not uniformly distributed. Communities may differ in their perceptions of the benefits they receive from the provision of a common public good. In turn, a community may be unwilling to 'pay its fair share' for providing that good simply because its demands for provision are less than in neighboring communities" (OTW, p. 840).

Unfortunately, a second contextual feature of the Bay region—the unevenness of state interests in the Bay—puts it directly into OTW's "more difficult" category of polycentric problems. At one end of this spectrum, the states of Maryland and Virginia, which border the Bay, have very substantial economic interests associated with fishing, shipping, recreation, and other industries, as well as other interests associated with the many communities whose identities are defined by their proximity to the Bay. The other states in the watershed (Pennsylvania, Delaware, New York, and West Virginia) have different amounts of indirect interest in the Bay's health. Further complicating matters, each state's contributions to the Bay's decline are far from proportional to their interests in the Bay. The borders of the headwater states do not touch the Bay, and yet they send significant loads of pollutants to the Bay via tributaries. This is especially true of Pennsylvania due to the mighty Susquehanna River, which contributes fully half of the Bay's entire freshwater input; two-thirds of the Susquehanna's 444 miles of length run through Pennsylvania.

The problem of maldistribution of costs and benefits, with downstream populations suffering the effects of upstream activities, is hardly new or unique to the Bay, of course. Unfortunately, the familiarity of the problem does not make it easier to solve.

These two central contextual features of the Chesapeake Bay SES—inter-jurisdictional externalities and non-uniformity of interests—define its central collective action problem. Such contextual characteristics

are central to understanding the challenge facing any PG system that might emerge in this context: how to internalize large-scale inter-jurisdictional externalities without recourse to a full federal takeover of the region's environmental governance. (Such a takeover is not a practical alternative to PG, of course, but it is theoretically relevant.)

Note: The CX_PROB section of Table 1 focuses on the attributes of the Bay's collective action problem rather than the indicators of ecosystem degradation. The degraded condition of the Bay and its connection to regional settlement and economic development patterns has been thoroughly described elsewhere and is assumed here.

5. Ordinary Politics

The second contextual subcomponent of the COOF—**Attributes of Actors and Communities [CX_POLS]**—enabled us to capture the political realities (POLS) that further complicate efforts at PG cooperation and coordination in the Bay watershed. Political realities are central to understanding PG emergence because many, if not most, of the actors in these situations are calculating the costs and benefits of polycentric participation and cooperation in terms of *political* costs and benefits. Elected officials especially are at least partly motivated by what they perceive as the net effect of PG activity on their ability to stay in office.

In EGF terms, these are the primary games being played by actors within their own decision-making centers, and they shape the types of secondary games we observe being played between the centers in the forums that constitute the PG system's structures. As an example of nested games, consider the fact that elected officials' reasons for wanting to stay in office may vary (the primary game). The ability of PG entrepreneurs and caretakers to persuade elected officials to continue participating in PG (the secondary game) will be greater when the elected officials are motivated to stay in office by a desire to solve important problems. Current scholarship applying game theory to polycentric games (some of it features at this conference) offers to provide additional insights about these types of interacting games and how they influence each other.

When OTW (p. 831) describe decision-making centers within a polycentric system voluntarily "taking each other into account" (that now-famous phrase) and thus functioning as a true "'system'" (OTW put the word "system" in quotation marks), they locate this distinctively polycentric activity solidly in the context of ordinary municipal politics due to the imperative of unanimity. In their words,

> "a variety of informal arrangements may be available for negotiating basic policies among local government agencies in a metropolitan area. … These arrangements work effectively *only so long as substantial unanimity can be reached, for formal implementation of such decisions must be ratified by each of the appropriate official agencies* (OTW, p. 841, emphasis added).

Unanimity, which requires separate ratification within each decision-making center, seems highly unlikely when the centers have diverse interests. In this context, "Negotiation among independent agencies allows the use of a veto against any unacceptable position" (OTW, p. 842). In the Bay case, each state's veto point will be heavily influenced, if not determined, by the balance of interest-group and other relevant pressures within the state at the time. This paper's tables, Table 1 especially, attempt to capture as many of these political forces as possible. Some political forces count as Contextual Characteristics, such as fundamental power imbalances and national trends in interest group dynamics. These are the primary games for most actors. We categorize other political forces—the ones that appear to operate as secondary games, as Operational Arrangements within the PG system (PG Processes).

Fundamental facts in this sphere include the inherent power imbalance between competing groups with conflicting interests in the Bay. One important dimension of many collective action problems involves the different types of costs and benefits facing different groups (Olson 1965). With respect to restoring the Bay, many of the needed controls would impose concentrated economic costs on identifiable groups in the short term. Some of these costs may involve lost opportunities—for new urban or suburban developments, for example—compared to potential levels of development in the absence of the control. Developers, farmers, municipalities, and others constitute the identifiable groups with respect to these concentrated costs/lost opportunities. Public choice theorists have observed that groups facing the unwelcome prospect of concentrated costs have strong motivation to organize to block policies that would impose these costs. These groups thus enter the game of influence politics with a leg up [PG_PROC].

By contrast, Bay restoration efforts, if effective (note the "if"), would generate economic benefits for a large, diffuse public in addition to some identifiable groups, such as fishers and recreational users of the Bay. Unlike the costs and lost opportunities associated with pollution control measures and other activity restrictions, which tend to occur almost immediately, most of these benefits would take years to manifest. According to public choice theory, groups for whom promised benefits are diffuse, uncertain, and/or delayed have less motivation to organize to support the relevant policies than their opponents have to block change. This dynamic makes diffuse beneficiaries harder to organize into interest groups, especially when the diffuse benefits are promised in the more distant future. Pro-environmental groups suffer precisely these natural disadvantages in the arena of interest-group politics, according to this formulation, because they mostly represent the interests of the larger public, including future generations [PG_PROC].

Within this context of asymmetric organizing capacity, patterns of interaction between policymakers and interest group representatives often follow somewhat fixed patterns based on shared ideology and background, flow of campaign contributions, participation in advocacy coalitions, and sheer proximity of actors, which includes attending the same events over and over and other avenues of repeated exposure to some views more than others. Jacob Hacker and Paul Pierson (2012) trace the emergence of "winner-take-all politics" in the U.S. starting in the mid-1970s when large corporations and small businesses made the decision to organize more professionally and fight harder against social and regulatory trends they saw as threatening their interests. Their strategy included not only more lobbying and campaign contributions, but also more concerted pressure on rulemaking processes within executive branch agencies and inserting themselves wherever possible in all three branches of government and at all levels.

This type of contextual macro-trend has important implications for PG emergence and evolution. PG entrepreneurs and caretakers must compete with long-standing patterns of interest group influence as they attempt to focus the attention of decision-making units on issues of shared concern. The more overlap between the PG agenda and the priorities of key interest groups within the decision-making centers (state and federal), the easier will be the job of the PG leaders. In the Bay case, this secondary game of negotiation among the states depends heavily on the content of each state principal's veto points because those veto point set non-negotiable boundaries around the potency of any unanimous agreement. Each state principal's veto points, in turn, will be shaped at least in part by that principal's home state pattern of interest group dynamics. Degree of overlap between the Bay restoration agenda, state interest groups' agenda, and the state principals' veto points is certain to vary from state to state and from one time period to another within states as governors, legislators, and other key leaders come and go.

It is important to note that the types of power imbalances we discuss here and include in the tables are never wholly determinative of policy outputs. Non-industry groups prevail more often than one might expect in policymaking. Nonetheless, the reality of Hacker & Pierson's (2012) insight is a fundamental contextual factor in all U.S. settings, which makes it a key issue for anyone designing any PG arrangement in this country.

6. Cross-Scale Intervention: Appeal to Central Authorities

Across the 40-year span of Chesapeake Bay PG, one external source of pressure on state politics appears to have played an outsized role: cross-scale intervention in the form of threats—and eventually, action—by the federal government (EPA) to exercise its Clean Water Act oversight power. As OTW (p. 842) anticipated, within voluntary polycentric arrangements operating as true systems, "Agreement must be negotiated within the limits of the various veto positions if the alternative of recourse to an external authority at a higher level of political jurisdiction is to be avoided." OTW's (p. 837) "criterion of local self-determination" articulates the importance of "[c]ommitments to local consent and local control," aka "home rule" in the U.S., which is closely related to the EU principle of "subsidiarity." PG systems are thus characterized by a fundamental and irreducible tension between the benefits of subordinating state differences to achieve shared goals, on one hand, and the benefits of maintaining local control to deliver the specific mix of public goods demanded by the residents of each state:

> "Appeal to central authorities runs the risk of placing greater control over local metro affairs in agencies such as the state legislature, while at the same time reducing the capability of local govts for dealing with their problems in the local context" (OTW, p. 841).

Tables 1-5 describe how this tension played out over the history of PG in the Chesapeake Bay. In the Bay, as in many other collaborative watershed partnerships around the country, the "[a]ppeal to central authorities" most of the time originated outside the formal structure of the PG system. In the Bay, however, it took more than a decade for these external pressures to begin asserting themselves. Table 2 notes how environmental groups in the 1980s generally embraced a norm of cooperation in keeping with the overall voluntary spirit of the CBA. This norm constituted a mostly friendly game of watch, cajole, gather data, and wait. Pressure placed on states and federal agencies tended to be gentle.

Litigation begins to enter the Bay story toward the end of the 1980s when downstream local jurisdictions in Maryland successfully sued over inadequate enforcement of pollution limits, as mentioned in Table 2. Moving into the era covered by Table 3, an important point of national context was the increased use of lawsuits by environmental organizations across the U.S. in the 1990s to force EPA to exercise its concurrent enforcement authority under the Clean Water Act (CWA). The national trend toward CWA litigation reached maturity in the Bay region starting in 1999 (Table 3) and picked up pace in the early 2000s (Table 4) as coalitions of regional NGOs, often led by the Chesapeake Bay Foundation (CBF), sued the EPA for not pushing states harder to comply with CWA requirements. These lawsuits represented a significant change in the nature of the game being played by civil society players and the responses required by government players, as represented by rows under the PG Processes subcomponent of Operating Arrangements in the tables.

Table 5 records relatively recent developments in the litigation game as opponents of vigorous EPA enforcement began to fight back against the environmental groups' litigation strategy with their own lawsuits. Notable among these was a suit brought by the American Farm Bureau and its Pennsylvania affiliate (and later joined by several agricultural trade association) against the EPA. That suit alleged that the EPA's 2010 pollution control measures specifying Total Maximum Daily Loads (TMDLs) for key pollutants exceeded the agency's statutory authority. Equally notable was the decision by key environmental groups to join this suit on the side of the defendant to support the EPA's position.

The 2010 TMDLs may be viewed as the most significant federal advancement toward Bay restoration since the great flurry of institutional creation in 1983-84 (CBA, CEC, CBMP, CBP). The environmental NGOs had fought hard in 1999 and into the 2000s to pressure EPA to issue the TMDLs. They were not going to see their hard work overturned by the Farm Bureau suit. Also, now that the EPA was doing the right thing, in their view, the environmental organizations were intent on showing their full support for the

EPA. This episode illustrates how alliances can shift within a PG system as players pursue different types of games in the PG setting.

7. Reflexivity and Cooperative Federalism

The litigation story told in the previous section offers a vivid example of the types of reflexive processes emphasized in the EGF. In the Bay case, the take-away is that bottom-up campaigns by public-interest advocacy groups may be needed to force higher levels of government (in this case, the EPA) to exert top-down pressure (in this case, on states). In addition, those bottom-up campaigns are likely to include lawsuits, which, if decided in favor of plaintiffs, then induce a cascade of top-down activity from the courts to the executive branch agencies and from the agencies to the states. OTW's "appeal to central authorities" turns out to be a very complex set of interacting processes, at least in some cases.

One additional contextual factor from Table 1 deserves a mention in the Bay litigation story: cooperative federalism. It resides under the third subcomponent of Context—**Overarching Institutions [CX_ARCH].**

All the standard Politics-101 features of the U.S. system must be included under this third contextual sub-category, including the three branches, separation of powers, checks and balances, and the statutory basis of agency authority (all of which apply to the state and the federal levels). Table 1 includes these basic system elements plus the highly relevant dual sovereignty that characterizes the U.S.'s distinctive approach to federalism generally.

More specifically, Table 1 includes a row for the principle of "cooperative federalism" as an overarching institution because it specifies the structural division of responsibility between states and the federal government in the environmental policy sphere. According to this principle, under federal environmental statutes that specify shared responsibility states are meant to function as primary day-to-day implementers of federal policies and primary enforcers of federal laws, with the EPA's main role being one of oversight, which includes communicating regularly with state officials to avoid surprises, supplying state environmental agencies with the guidance and technical assistance needed to perform their roles, and reviewing state actions. In addition, the principle of cooperative federalism in this context emphasizes the EPA's ultimate statutory responsibility for fairly and effectively enforcing federal requirements and deterring noncompliance with federal laws. This "concurrent enforcement authority" means that, "[i]f a state partner is not taking timely or appropriate action to address threats to public health and the environment, EPA has the authority and responsibility to take direct action."[1]

Taking a 40-year perspective reveals how the application of the above principles shifted over time. The previous paragraph's description of shared responsibility is drawn from a 2023 EPA memorandum by EPA's current Administrator Michael Reagan, which reaffirms the "1984 Memorandum on EPA Policy on Oversight of State Delegated Environmental Programs" issued by Administrator William Ruckleshaus. It is also worth noting that the 2023 Memorandum rescinded and replaced a 2018 Memorandum from Acting Administrator Andrew Wheeler titled "Principles and Best Practices for Oversight of Federal Environmental Programs Implemented by States and Tribes," which had created the potential for weaker interpretations of EPA's concurrent enforcement authority. These memo wars offer a valuable reminder that even basic structures associated with allocation of basic responsibilities are subject to differences in interpretation through different political and ideological lenses.

[1] Quoted on p. 4 of the Memorandum of Feb. 17, 2023 from EPA Administrator Michael S. Regan to EPA officials with subject line: "Principles and Best Practices for Oversight of State Implementation and Enforcement of Federal Environmental Laws."

In the Bay case, a major theme of the first 25-30 years was general reluctance by the EPA to use their concurrent enforcement authority to penalize or pre-empt states that were dragging their heels on pollution control. Although a source of great frustration for anyone concerned about the increasing pace of damage to the Bay over this period, the EPA's position is understandable in light of the earlier quote from OTW (p. 842) about veto points: In a polycentric system, "[a]greement must be negotiated within the limits of the various veto positions if the alternative of recourse to an external authority at a higher level of political jurisdiction is to be avoided." Actors at the higher level of political jurisdiction (in our case, the EPA) who recognize this dynamic will understand the potential consequences of exercising their pre-emptive authority. If the states are motivated to keep negotiating by the hope of avoiding federal action, then the fact of federal action may induce states to exercise their veto power and exit the forum, thereby killing any chance of agreement.

Using the language of negotiation, we can translate this to say that bargaining within a voluntary PG system like the CBA is constrained by the ever-present threat that one or more of the key players may choose to defect rather than continue negotiating. When a system depends on unanimity, as discussed earlier, a veto essentially counts as a defection, which at a minimum brings negotiation to a standstill, and at worst, may signal a shrinking or even collapse of the PG structure.

In practice, we should note that the EPA's issuance of the Bay-wide TMDL did not cause defections, shrinkage, or collapse of the CBA and related institutions. Many interest groups disagreed with the move, and, as noted and recorded in the tables, some groups sued and appealed their case all the way to the Supreme Court. But only one state joined that case as a plaintiff, and the core institutions of Chesapeake Bay PG carried on. SCOTUS did not take up the opportunity to hear the case: They allowed the lower court's ruling in favor of the EPA to stand.

8. Professionalism and Institutional Momentum

In voluntary PG systems that require unanimous agreement on shared action, when the threat of recourse to a higher jurisdictional authority is weak, we expect weak agreements and weak actions to result. Under these conditions, key actors within states can set relatively low veto thresholds to protect their political options, which leads to lowest common denominator policy outputs such as vague commitments, specific targets with no penalties for missing them, and/or targets with loopholes and exemptions that allow politically powerful interests to avoid costly disruptions to business-as-usual.

Unfortunately, that characterization fits a lot of the activity undertaken by the states under the CBA and CBP (Layzer and Renfret 2023). Tables 1-5 note examples of both weak policymaking and weak enforcement by Bay partner states, and additional examples will be added as we continue collecting and sorting data. Among the many frustrations people express about Bay restoration, continued reliance on the good will of farmers to adopt best management practices (BMP) is high on the list for critics. One critic summarized the weaknesses of the CBA wryly: "beneath current events lay decades of 'collaborative' effort, principally by the watershed states, to avert federalization of a steadily expanding problem" (Colburn 2016, p. 678)—a useful reminder that actors may just as easily choose to collaborate to block progress as to advance progress (and that progress itself is in the eye of the beholder).

At the same time, notable achievements deserve acclaim. These include the ban on phosphate detergent, improvements in sewage treatment, various fishing moratoria, the focus on tributaries, and various efforts related to green infrastructure and smart growth. Experiments with tradable credits yielded helpful information even if they did not advance the goals of pollution control. Even the much-maligned BMPs have generated useful data: "voluntary, 'collaborative' measures have been applied longer in the Chesapeake than any other ecosystem-wide restoration program in the world" (Colburn 2016, p. 678).

In addition, large and growing numbers of civil society groups and local government bodies have participated in Agreement-related events. And although the issuance of the Bay-wide TMDLs did not put enough pressure on the partner states soon enough to ensure victory as measured by the 2025 targets (which are now being reviewed and renegotiated), the fact of TMDLs themselves counts as a major achievement. The TMDLs provide a foundation for further progress in the next phase of PG development for the Bay.

Moving from weaker to stronger action in a voluntary arrangement seems to require outside pressure. In the case of the Bay, as noted, higher levels of government have traditionally been cautious about exercising authority in ways that might scare off the state partners. Thus, the direction of influence has been from civil society to higher levels of government via the courts, resulting in higher levels of government eventually exercising more authority over states.

In addition to pressure from civil society for faster progress, our analysis indicates an important role for individual officials and networks of experts working inside and outside government to find innovative ways of pursuing policy goals. Of special note are efforts by the Obama Administration to develop new, collaborative ways of working closely with states in the TMDL drafting process. According to one legal analysis (Colburn 2016, p. 677), the process they invented offers “an emergent model of intergovernmental administration tailored to address our largest-scale environmental problems.”

The innovations associated with the Chesapeake Bay TMDL appear to confirm the potential of talented, motivated officials to advance polycentric governance by applying what OTW (p. 842) call "[p]rofessional administrative standards." George Frederickson (1999) has made a similar point in a similarly polycentric metropolitan context. Our observation about expertise and professionalism may be further analyzed as a possible example of the impact of epistemic communities (per Haas 1992) and/or advocacy coalitions (per Sabatier 1988) on the policy process if it can be determined whether the individuals responsible for the TMDL process innovations were members of, and influenced by, larger networks of specialists who share core beliefs and a commitment to best practices.

Finally, the impact of institutional momentum may be worth examining as an additional explanation for the emergence and longevity of this constellation of CB PG institutions. Once structures are set up, we know people are often reluctant to dismantle them. Even opponents may not want to be known as the people who killed X, Y, or Z organization or initiative. Also, new policies and new organizations quickly acquire fans and super-fans willing to go to bat for them, and some become important symbols of progress to their supporters, even if the new policy or new organization’s actual impacts are mixed or weak. This appears to have been the story of the CBA to date. There were enough achievements to keep it in play and, evidently, enough perceived tangible or intangible benefits to the partner states to maintain membership and avoid defection (probably more intangible benefits overall). Correspondingly, the disappointment that has accompanied each missed set of target deadlines has not translated into a high enough cumulative political deficit to cause defections. We do not know where the threshold for CBA survival lies. Addressing that question requires comparisons between historical PG arrangements that have survived and those that have collapsed.

9. Further Work

This paper is more a progress report than a paper. We appreciate your reading it through to the end and welcome any and all feedback. We have more work to do to fill out Tables 1-5 and more work to do to identify patterns of evolution across the eras. We look forward to becoming more expert users of COOF as this research continues and reporting further results from this ongoing case study.

Table 1. Application of COOF to the Initial Conditions for Chesapeake Bay Polycentric Governance

PRE-1980 PERIOD: AD HOC MANAGEMENT (not yet governance) OF THE CHESAPEAKE BAY WATERSHED		
COOF Variable	**System Element** →	**Implications for PG?**
CONTEXTUAL CHARACTERISTICS		
Attributes of the core social-ecological challenge(s) [CX_PROB]	Large-scale, **inter-jurisdictional externalities across watershed**: nitrogen, phosphorous, silt and others	Creates asymmetry of interests among actors in different parts of watershed, leading to lop-sided bargaining situations. PG is needed to internalize inter-jurisdictional externalities.
	Large number of activities contribute to problem: (over)fishing, dredging for navigation, farming, forest harvesting and clearing for development, wetlands destruction, dam construction, suburban development (lawns and impervious surfaces), stormwater mismanagement, inadequate wastewater treatment, etc.	Controlling or influencing all these activities would require participation by many govt departments, which indicates need for PG. Potential for inadvertently creating perverse incentives is high due to complex interconnections between polluting activities, which indicates need for careful coordination.
	Hard to trace **nonpoint-source pollutants**, including airborne sources, to specific polluters. These pollutants comprise a large portion of total loads.	Obstacle to applying "polluter pays" principle when internalizing externalities
	SES subject to **large swings in ecological indicators** following large storms.	Hard to predict future ecological states
	Rapid **population growth** creates significant **development pressures.** Development stresses Bay ecosystem along every dimension.	Very hard for any governance system to mount a large enough response to match these resource pressures
(*Likely obstacles to PG emergence; **Likely enabling conditions)		
Attributes of actors and communities [CX_POLS]	***States vary in degree of economic dependence on the Bay**: MD & VA have the most.	Creates asymmetry of interests among actors in different parts of watershed, leading to lop-sided bargaining situations.
	***States vary in mix/balance of political attitudes** toward environment and relative power of business/agriculture vs. environmental interests. These patterns shift over time with political realignments.	May complicate efforts to reach consensus among states.

	*Bay restoration efforts will impose **concentrated economic losses +/or costs on identifiable groups** in **short term**, compared to status quo (i.e., developers, farmers, municipalities, etc.).	Groups with concentrated interests have strong motivation to organize to block policies that would impose these costs, per the theory of collective action dilemmas.
	*If effective, Bay restoration efforts will generate **economic benefits** for a large, diffuse public in **medium-long term** (in addition to some identifiable groups).	Groups facing diffuse, uncertain, and/or delayed benefits have little motivation to organize to support the relevant policies. This makes them hard to organize into interest groups.
	***Patterns of interaction between policymakers and interest group representatives** often follow somewhat fixed patterns based on shared ideology and background, flow of campaign contributions, participation in advocacy coalitions, and sheer proximity (attending same events; repeated exposure to some views more than others).	PG structures must compete with these long-standing patterns of influence as they attempt to focus the attention of decision-making units on issues of shared concern. The more overlap between the PG agenda and the priorities of key interest groups, the easier will be the job of the PG leaders.
	National setting includes **increasing strength and sophistication of environmental movement following successes of the 1970s.	Raises awareness of threats to Bay and may buoy chances of forceful environmental protection outputs (policies and enforcement initiatives)
	*National setting includes **more sophisticated organizational efforts by business community** in backlash against 1960s/70s regulations and social changes. This trend started in mid-70s and built greater momentum during Reagan era (Hacker and Pierson 2012).	Reduces chances of forceful environmental protection outputs (policies and enforcement initiatives). Although interest group spending does not fully determine policy outputs, business community can often outspend environmental groups on issues of top concern to them.
	National setting includes **growing popularity of voluntary and collaborative models of environmental protection.	Increases motivation to use voluntary and collaborative mechanisms in any new collaborative management scheme.
	National setting includes **growing popularity of more systemic and science-based approaches, including ecosystem-based management (EBM) and adaptive management (AM).	Scientific findings have potential to influence future PG developments.
	National setting includes steadily growing **role of scientific community in environmental policymaking. Scientists have keen interest in modeling the Bay as a whole, complex, adaptive ecosystem.	Early funding of Chesapeake Bay PG initiatives included substantial sums for scientific modeling of Bay.

	****? Media** plays an important role in flow of information and discourse about Bay issues. Mainstream and social media outlets and individual journalists count as actors.	Media influence is difficult to measure. If backroom deals tend to benefit powerful economic interests, then greater transparency within the system may strengthen Bay restoration initiatives and propel states toward more cooperation. But this scenario depends on high-quality journalism, which cannot always be assumed.
Overarching institutions [CX_ARCH]	Overarching institutions as defined by U.S. Constitution establish collective choice rules for the executive, legislative, and judicial branches. Core institutions have **no explicit capacity for governance at watershed scale**.	Additional formal or informal institutions may be needed.
	Relevant **federal environmental statutes** articulate statutory goals and establish agency authority to implement policies and enforce the laws: Clean Water Act (CWA) and Coastal Zone Management Act (CZMA)	Rulemaking and enforcement tools authorized by existing federal statutes influence degree of pressure feds can place on other actors to reduce harmful activities.
	Federal executive rulemaking must follow requirements of the **Administrative Procedures Act**.	When PG actors appeal to higher levels of authority to act, they agree to the associated process constraints.
	Collective choice rules create an easier path for some policies compared to others. For example, legislative bodies with **super-majority requirements** (like the U.S. Senate's filibuster rule) make passing new legislation difficult, which favors status quo policy.	The EGF mentions path dependency as a reality of the policy process within PG systems. Collective choice rules that create obstacles to policy change work with path dependency to entrench the status quo.
	State constitutions establish collective choice rules for the executive, legislative, and judicial branches. Varies by state, of course.	State actions/outputs are expected to vary significantly based on each state's politics + degree of economic dependence on Bay. This makes coordinated action more difficult.
	Major **state statutes** establish additional collective choice rules, for example regarding processes of public engagement in rulemaking, as well as overarching operational rules regarding statutory authority of state agencies to act—when, where, and how. Varies by state, of course.	Rulemaking and enforcement tools authorized by existing state statutes make it easier for states to take immediate action. Variation in authority across states is an obstacle to coordinated action.

	Structure of federalism (**dual sovereignty** and 10th amendment to US Constitution) + stated norm of "**cooperative federalism**"	Concept of cooperative federalism is widely criticized as unrealistic given natural tendency for states to (1) compete with each other for jobs, industries, and other assets and (2) to resist federal guidance or intervention when it is inconvenient (Bullman-Pozen and Gerkin 2009). Designers of PG need to be realistic about these long-standing patterns of institutional interaction.
	1984 Ruckleshaus Memorandum re EPA Policy on Oversight of State Delegated Environmental Programs: **States are designated primary implementers and enforcers** of relevant federal enviro laws and EPA regs. **EPA oversees these efforts while also retaining concurrent enforcement authority**. Regional EPA offices have primary responsibility for oversight of state implementation and enforcement. A recent internal EPA memo (Feb. 17, 2023) reaffirmed this distribution of responsibilities, under the banner of "cooperative federalism."	In practice, regional offices may vary in their eagerness to step in when states under-perform. Reluctance to exert vigorous oversight weakens the cross-scale component of the PG system because states get the message that they can be sluggish about enforcement without consequences. How much cross-level pressure is the right amount within a PG?
	Courts play a key role because lawsuits are one of the standard tools of environmental enforcement and oversight in the U.S.	Litigation becomes a very important factor in the evolution of Bay PG in the 1990s and 2000s as civil society groups put pressure on the EPA to put pressure on the states.
	Govt agencies at all levels produce a vast quantity of **regular reports** on their activities and the conditions of the spheres in which they operate. Content of reports may be mandated by law and may change over time as data collection methods, etc. advance.	Provision of information can influence elite +/or public opinion in ways that shape governance outputs at local, state, +/or federal levels. Information is also one input to bargaining within PG.
	Rules in place and rules in use by **federal agencies whose activities affect the Bay**	Federal agencies vary in level of interest in/priority placed on Bay.

OPERATIONAL ARRANGEMENTS		
Polycentric governance structures [PG_STR]	States have established various voluntary, membership-based **forums for information sharing and collaboration** over the years, e.g., National Governors Association (NGA, 1908), National Conference of State Legislatures (NCSL, 1975), National Association of State Budget Officers (NASBO, c 1950).	Such forums enable flow of information and may establish various types of social capital and trust useful for specific collaborations. They are settings where new ideas can be seeded and developed.
	Additional **ad hoc forums** are established from time to time to address specific shared concerns.	
Polycentric governance processes (i.e., games) [PG_PROC]	State politics and policymaking operate **autonomously** from each other and from the federal government **except** when states choose to work together (such as when attorneys general join forces to sue the federal government) and when states negotiate bilaterally with federal agencies such as the EPA around shared implementation of federal policies.	State actions/outputs are expected to vary significantly based on each state's politics + degree of economic dependence on Bay
	Individuals inside or outside government can step into roles as **policy entrepreneurs or policy brokers** to advance new policy and management solutions. They must then compete for the attention of the key decision makers.	This phenomenon, and its results, are hard to predict. Policy entrepreneurs and policy brokers who know how to build coalitions around shared issues can have an outsized influence on PG success.
	Processes of **policy diffusion** between states may cause new policy and management solutions to spread (Oliveira et al 2023).	This phenomenon depends on the relative motivations of the various states to find solutions to the problems identified. Effective policy entrepreneurs and brokers can advance diffusion.
	Interest-group pressure in favor of environmental cleanup will come from lobbying, public awareness campaigns, and other political activities by environmental activists, the fishing industry, recreational users, or other stakeholder groups interested in the Bay's ecological status. This is a core component of **politics-as-usual** within the states (the decision-making units of the PG system).	Groups united around fighting concentrated costs or winning concentrated benefits have natural advantages over groups united around diffuse costs or benefits. Pro-environmental groups thus have natural disadvantages because they mostly represent the interests of the larger public, including future generations.

Interest-group pressure to limit costs and restrictions associated with environmental cleanup will come from lobbying and other political activities of agriculture, urban development, and business groups, etc. This is a core component of **politics-as-usual** within the states (the decision-making units of the PG system).	These groups often exert considerable leverage within state political systems because they are well-funded. Also, job growth and maintenance of the state's tax base are often top priorities for governors and state legislatures, regardless of party affiliation.
Outputs of **state-politics-as usual** are shaped by the balance of power among sectoral interests and the net effect of various forces exerting pressure. Politics as usual = constant jockeying among competing interests for attention from governors, state legislatures, state agencies, and relevant local bodies.	Business/farmer dominance may lead to weak environmental efforts, but balance of power at any point in time may realign in response to unpredictable focusing events and shifts in public opinion.
Top-down pressure in favor of environmental cleanup may come from the threat of federal regulation. This is one form of cross-scale intervention: "Appeal to central authorities" (OTW, p. 842). In a nice example of reflexive processes, bottom-up campaigns by advocacy groups may be needed to force higher levels of government to exercise their authority to exert top-down pressure.	There is an inherent tension between the value of a voluntary state approach and the need for federal intervention if states fall short. States may choose to act on their own if the threat of central govt intervention is real enough.
Pressure in either or both directions may come from **litigation**. Lawsuits brought by activist groups and/or user groups, etc. can force or block policy change.	Litigation is one element of politics-as-usual. Results will depend on legal arguments + how judges interpret the law and exercise judicial discretion. Litigation played a very significant role in Bay PG especially in the 1990s and 2000s.
Pressure for effective action may come from **networks of experts,** sometimes called **epistemic communities** per Haas (1992), composed of specialists inside + outside government who share core beliefs and a commitment to best practices. They may work within +/or across states and levels of government to advance "[p]rofessional administrative standards" (OTW, p. 842). Some may work alongside relevant interest groups within **advocacy coalitions**, per Sabatier's formulation.	Impacts of these actors' activities can be difficult to measure and predict. See Frederickson's (1999) observations on the role of cross-jurisdictional networks of experts in a metropolitan context similar to OTW.

	All the above pressures can be brought to bear on actors not only at the individual state level, but also in multi-state forums.	Outputs of multi-state bargaining are shaped by each state's internal politics + the relative strength of external pressures.
OUTCOMES		
Ecosystem health [OC_ECO]	Multiple indicators of stress were identified in the decades leading up to the CBWA. Note 1978 study by joint MD-VA Chesapeake Bay Legislative Advisory Commission + Congressionally funded 5-year study sponsored by US Sen. Charles Mathias (MD), which led to 1983 EPA Report.	Scientific reports sometimes play an important role in setting the policy agenda and creating momentum for new PG arrangements.
Governance capacity [OC_ABLE]	How to define and measure this?	"Capacity" in part refers to the PG system's ability to effectively internalize interjurisdictional externalities within the watershed and thereby sustain the production of public goods associated with the overall health of the Bay.
All relevant interests represented [OC_REP]	OTW's (p. 836) "criterion of political representation" requires "inclusion of the appropriate political interests" within a decision-making arrangement, whether PG or contained in a single jurisdiction. Appropriate interests include those affected directly and indirectly by the consequences of the decisions being made.	Political representation is very difficult to achieve in practice due to the inevitable imbalance in organizing capacity between groups facing direct (concentrated) vs. indirect (diffuse) costs or benefits, as noted above.
Repertoire of policy options [OC_OPT]	Successful governance systems encourage innovative policy solutions (e.g., regulatory +/or market-based schemes, etc.) as well as governance techniques (e.g., new channels for public engagement, etc.).	Effective PG will promote innovation and the diffusion of promising new ideas among states and localities.

Table 2. Application of COOF to 1980-86 Developments in Chesapeake Bay PG

1980-86: EXPLOSION OF INSTITUTIONAL STRUCTURES			
COOF Variable	**Antecedents?** →	**System Element** →	**Implications for PG?**
CONTEXTUAL CHARACTERISTICS			
Core SES challenge(s) [CX_PROB]	Large-scale and wide-spread inter-jurisdictional externalities (same as in ad hoc governance period)		1983 EPA Report highlights systemic problems and raises awareness.
Actors and communities [CX_POLS]	States have highly varying levels of direct interest in the Bay. Costs and benefits of remediation are unevenly distributed between states and actors/interests within states (same as in ad hoc governance period).		
Overarching institutions [CX_ARCH]	Overarching institutions lack capacity for governance at watershed scale (same as in ad hoc governance period).		Additional formal or informal institutions appear to be needed.
	Elevated awareness of threats [CX_PROB]	Congress passes Atlantic Striped Bass Conservation Act (1984)	Evidence of federal policymaking capacity
OPERATIONAL ARRANGEMENTS			
Polycentric governance structures [PG_STR]	Elevated awareness of threats [CX_PROB] + Expectation that states will take lead on CWA implementation [CX_ARCH] + National popularity of voluntary, collaborative, and systemic and science-based approaches [CX_POLS]	Chesapeake Bay Commission est. 1980 - originally bistate (MD + VA); PA joins 1985	May be seen as the event that launched PG in the Bay region. Effectiveness will depend on governance processes (below) and state politics.
		1983 Conference titled "Choices for the Chesapeake: An Action Agenda" culminates in CBA (next row).	Offers example of a temporary forum with significant outputs.

		1st Chesapeake Bay Agreement (CBA), signed in 1983, is a voluntary partnership between EPA, DC, MD, PA, VA.	Although it is only one-page, CBA represents the key PG milestone for the Bay. Effectiveness of the Agreement will depend on governance processes (below) and state politics.
		Chesapeake Executive Council (CEC) est. 1983 w/ members: EPA Administrator + chair of Chesapeake Bay Commission + cabinet secretaries of MD, VA (changes to governors in 1987) + DC mayor	CEC structure sets up forum for actors to build social capital.
		Federal CBP Office created 1984 per original Agreement, with coordinating ("liaison") role only. Codified in 1987 in Sec. 117 of CWA.	Effect of Federal CBP Office on states likely to be weak.
		Chesapeake Bay Monitoring Program (CBMP) est. 1984: includes states + feds + 10 research institutes	Effectiveness will depend on quality and timeliness of data + political appetite for information.
		CBMP begins issuing annual "State of the Chesapeake Bay" reports.	Information about Bay health is an important driver of PG developments in future.
		Chesapeake Bay Citizens Monitoring Program est. 1985: tasks willing citizens with collecting local water quality samples	Effectiveness will depend on quality and timeliness of data + political appetite for information.
Polycentric governance processes (i.e., games) [PG_PROC]	National popularity of voluntary, collaborative approaches [CX_POLS]	CBA is purely voluntary. No sanctions for lack of action by partners. Note contrast with federally led environmental achievements of previous 15-20 years.	Potential for performative participation rather than genuine problem-solving
		Twice yearly meetings of Bay partners established in Agreement.	Effective use of this new forum will depend on willingness of partners to have meaningful discussions and push beyond the window dressing.
		States bargain with each other to arrive at shared goals and commitments.	May generate least-common-denominator agreements (including goals and targets) due to asymmetric interests.
		Main advocacy groups embrace collaborative approach, choose to be patient.	Reduces pressure on states to perform, but could improve social capital between actors.

	State politics-as-usual [PG_PROC]	Practice of not implementing state policies vigorously goes largely unchallenged. Example of MD's Critical Area Law: "[D]evelopers quickly found ways to capitalize on the vagueness in the law" (Layzer & Renfret 2024, p. 463).	Reduces potential for state effectiveness.
		Practice of creating loopholes in regs for agriculture and forestry industries goes largely unchallenged.	Reduces states' ability to control runoff because ag and forestry are major sources.
	Courts [CX_ARCH] + Increasing strength and sophistication of environmental groups [CX_POLS]	Downriver counties in MD sue to impose stricter controls on upriver counties. Suit settled in 1981 in favor of plaintiffs.	Begins to establish a role for litigation in this policy subsystem.
OUTCOMES			
Ecosystem health [OC_ECO]	Phosphate detergent ban + striped bass moratoria considered highly successful interventions. Better sewage treatment helped water clarity and sea grasses.		
Governance capacity [OC_ABLE]	Phosphate detergent ban demonstrated cooperative behavior between states. 3D models of the Bay initially developed and refined.		
All relevant interests represented [OC_REP]	TBD		
Repertoire of policy options [OC_OPT]	MD (1985-89) + VA (1989) place moratorium on striped bass harvesting. MD, DC, VA, PA ban phosphate detergent. State cost-sharing introduced for upgrading local wastewater treatment. Significant progress at Blue Plains plant in DC. Farmers encourage to adopt best mgt practices, but weak ag regs.		

Table 3. Application of COOF to 1987-99 Developments in Chesapeake Bay PG

1987-99: TRYING TO MAKE VOLUNTARY APPROACHES WORK			
COOF Variable	**Antecedents?** →	**System Element** →	**Implications for PG?**
CONTEXTUAL CHARACTERISTICS			
Core SES challenge(s) [CX_PROB]	Trend began earlier and intensified in 1990s. [CX_PROB]	Steadily increasing pollution from poultry manure and dairy industry	States will need to exert pressure on powerful political interests to address this problem at appropriate scale.
Actors and communities [CX_POLS]	Increasing strength and sophistication of environmental groups [POLS]	TMDLs become a focus of activity for enviro groups throughout the US, who file a raft of lawsuits against EPA to try to speed the process of issuing TMDLs across the country.	Litigation threat makes it harder for EPA to continue its prevailing "wait-and-see" approach with states that are dragging their feet on TMDL processes.
Overarching institutions [CX_ARCH]	All	Section 117 re Chesapeake Bay added to CWA 1987.	Codification in law adds to perception of CBP's status as a long-term force for PG progress in the region. This could cast doubt on opponents' arguments that CBP is a passing fad to be ignored.
OPERATIONAL ARRANGEMENTS			
Polycentric governance structures [PG_STR]	Growing confidence based on 1983-86 structural achievements.	1987 Agreement sets first numeric goals for reducing "controllable loads" of N and P.	Evidence of partners' willingness to continue this "experiment" and even increase efforts
	1987 Agreement creates momentum (previous row).	VA Chesapeake Bay Preservation Act 1988	Agriculture and forestry exempted, thereby reducing effectiveness significantly.
	1991 Nutrient Reduction Reevaluation identified need to (1) expand efforts to tributaries and (2) address nonpoint sources in agricultural and urban areas more effectively. [PG_STR-INFO]	1992 amendments to 1987 Agreement: Watershed divided into 10 major tributaries; enhanced monitoring announced; submerged aquatic vegetation (SAV) added as metric.	Further evidence of PG creating space for action by partners

	General momentum toward state actions	State NPDES permit system	Effort is to be noted, but effects were modest. Continued focus on voluntary measures strengthens norm of tolerating weak state controls.
	General momentum toward state actions	Voluntary nutrient reduction programs introduced at state level by 1999. Best management practices (BMPs) emphasized. Citizen groups work with farmers to promote BMPs.	Inter-state policy diffusion is notable. Heavy resistance from CAFOs (Contained Animal Feeding Operations) also notable. Initial programs not well funded or prioritized.
	Role of scientific community + Appetite for information within policy subsystem [CX_POLS] + Norms of regular reporting from agencies [CX_ARCH]	CBF begins its "State of the Bay" reporting program with 1998 report. Annual reports tracking progress of remediation efforts issued 1998-2008, with biannual reports thereafter.	Demonstrates role of civil society in overseeing PG effectiveness.
Polycentric governance processes (i.e., games) [PG_PROC]	National popularity of voluntary, collaborative approaches [CX_POLS]	Alliance for the Chesapeake Bay (NGO) organizes roundtable meetings leading up to 1987 Agreement under EPA grant $. Meetings are open to public. Public comments invited.	More than 500 citizens attend meetings, indicating strong public interest. Discussed key issues with state and federal legislators.
	Politics-as-usual	Conflicting reports from states and media sources re progress	Risk that people will stop trusting the data, which would reflect poorly on CBA's approach.
	Courts as forum [CX_ARCH] + Increasing strength and sophistication of enviro groups [CX_POLS] + Enviro groups losing patience with voluntary approach and pace of change [CX_POLS]	Enviro groups sue EPA in 1999 for failing to require VA to develop TMDL for tidal waters on the federal list of impaired waters.	Consent decree sets 2010 deadline for VA to develop the TMDL and mandates EPA to do so by 2011 if VA misses its deadline.

OUTCOMES	
Ecosystem health [OC_ECO]	Nearly all the Bay's tidal areas added to federal list of impaired waters. Massive nutrient loading after Hurricane Fran - no nutrient decreases compared to 1970s.
Governance capacity [OC_ABLE]	Questions begin re 3D computer models: models lag behind monitoring data, suggest false progress.
All relevant interests represented [OC_REP]	How to specify?
Repertoire of policy options [OC_OPT]	Mostly voluntary models; note emphasis on BMPs.

Table 4. Application of COOF to 2000-2008 Developments in Chesapeake Bay PG

2000-08: CIVIL SOCIETY LOSING PATIENCE			
COOF Variable	**Antecedents?** →	**System Element** →	**Implications for PG?**
CONTEXTUAL CHARACTERISTICS			
Core SES challenge(s) [CX_PROB]	Large-scale and wide-spread inter-jurisdictional externalities: This is an ongoing feature of the PG situation. Can PG internalize these externalities?		
Actors and communities [CX_POLS]	States will always have highly varying levels of direct interest in the Bay. Costs and benefits of remediation are unevenly distributed between states and actors/interests within states. This is also an ongoing feature of the situation.		
Overarching institutions [CX_ARCH]	Reminder: Overarching institutions lack explicit capacity for governance at watershed scale.		
OPERATIONAL ARRANGEMENTS			
Polycentric governance structures [PG_STR]	VA TMDL lawsuit (1999) provides impetus.	Chesapeake 2000 Agreement signed with goal of removing tidal waters from the federal list of impaired waters by 2010. Includes 102 restoration-related goals and a commitment to ecosystem-based fisheries management.	The Chesapeake Bay model of collaborative watershed management is ambitious and flawed, but partners are not giving up.
		Headwaters partners (DE, NY, WV) join 2000 Agreement.	Significant boost to PG
	Momentum from 2000 Agreement	Six states in 2005 agree to limit N + P via sewage plant permitting process.	Examples of progress, however small, help keep the initiative moving slowly forward.
	Note impetus of lawsuits.	EPA in 2007 restarts work on TMDL for whole Bay, including allocation of targets to sewage plants, stormwater systems, and farms.	Ultimately leads to major achievement in 2010.
	Pressure to generate accurate reporting	CBP begins issuing annual "Bay Barometer" reports in 2008.	Key role for information continues.

	Effective awareness raising	National stimulus bill authorizes $878m to Clean Water State Revolving Fund for six Ch Bay states.	Federal funding is vital given the fundamental collective action problem (temptation for states to free-ride) at the heart of this system.
Polycentric governance processes (i.e., games) [PG_PROC]	Sierra Club and CBF lawsuits provide impetus.	EPA commences its TMDL process in early 2000s based on Watershed Improvement Plans (WIPs) and revised plans (based on EPA feedback) submitted by states.	Completed in 2010.
	Role of media + Role of scientific community + Administrative politics	Washington Post in 2003 begins covering overly optimistic progress announcements from CBP. CBP officials admit to succumbing to temptation to overstate achievements to justify program funding.	Problem of accuracy and reliability of data from various sources, including computer models, becomes a constant source of tension re Chesapeake Bay governance.
	Environmental groups losing patience with voluntary approaches and pace of action.	CBF in 2003 calls for "binding legal framework," including firmer deadlines and better regulation and oversight by EPA.	Helps propel progress in 2010s.
		CBF in 2004 sues EPA for not withdrawing permits from sewage plants with high N releases	Litigation plays a very large role.
		Waterkeepers Alliance (NGO) in 2004 sets up offices to monitor key tributaries.	Identity of key civil society actors shifts over time.
		Outside groups release "Chesapeake Bay Action Plan" calling for tougher regulations and a "heavier hand"	Note polycentric coordination among activist groups.
OUTCOMES			
Ecosystem health [OC_ECO]	Continued disappointing results; underwater grasses diminished; not on track to meet 2010 targets.		
Governance capacity [OC_ABLE]	How to specify?		

All relevant interests represented [OC_REP]	How to specify?
Repertoire of policy options [OC_OPT]	MD flush tax 2004 + Increased funding for sewage plant upgrades in VA, PA 2004 + Local govts experimenting with green infrastructure + Introduction of tradable N credits whereby developers seeking new sewage plants buy credits from farmers using BMPs (VA in 2006, PA in 2007)

Table 5. Application of COOF to 2009-2024 Developments in Chesapeake Bay PG

2009-24: MORE CROSS-LEVEL FEDERAL INVOLVEMENT			
COOF Variable	**Antecedents?** →	**System Element** →	**Implications for PG?**
CONTEXTUAL CHARACTERISTICS			
Core SES challenge(s) [CX_PROB]	Large-scale and wide-spread inter-jurisdictional externalities: This is an ongoing feature of the PG situation. Can PG internalize these externalities?		
Actors and communities [CX_POLS]	States will always have highly varying levels of direct interest in the Bay. Costs and benefits of remediation are unevenly distributed between states and actors/interests within states. This is also an ongoing feature of the situation.		
Overarching institutions [CX_ARCH]	Reminder: Overarching institutions lack explicit capacity for governance at watershed scale.		
OPERATIONAL ARRANGEMENTS			
Polycentric governance structures [PG_STR]	Change in administrations is a key factor + Pressure from NGOs, including lawsuits. Note greater effort to innovate in application of federal statutory authority - motivated by many years of waiting for purely voluntary approaches to payoff.	Obama Executive Order 13508 declares Bay a "national treasure" and creates federal leadership committee to create long-term coordinated strategy.	Shot in the arm for CBP and a signal of federal intention to become more active in Bay.
		CEC in 2009 postpones targets from 2010 to 2025 and sets 2-year goals to ensure constant oversight. States recommit to restoring Bay.	
		EPA in Dec 2009 announces plan to punish states for not meeting goals.	
		Obama Administration in 2010 releases vision for restoration by 2025, following CEC's 2009 announcement, with $20m increase for CBP.	

		Landmark TMDL issued in Dec 2010 with limits for point- and nonpoint-source N, P, and sediment for 92 over-polluted segments of the Bay. Together with Phase I WIPs by states and DC, these docs constitute the Chesapeake Clean Water Blueprint.	
		New stormwater rules issued in 2011	Maintaining momentum forward
		In 2014 Bay partner states and EPA sign 4th Chesapeake Bay Agreement, which sets new 2025 date for pollution reduction targets. Name is changed to Chesapeake Bay Watershed Agreement.	
		New CAFO rules issued in 2014	
		New Clean Air Act regs relevant to Bay issued in 2020	
Polycentric governance processes (i.e., games) [PG_PROC]	Role of civil society expands throughout history of CBP.	NGOs in 2009 organize letter and petition campaign to put pressure on Obama Administration. They gather 19,000 signatures calling for penalties for "bad actors" in Bay.	Advocacy groups have a repertoire of actions available - it's not all litigation. Their role in PG system is vital and multi-faceted.
	Advocacy groups continue the fight. [CX_POLS]	CBF and partners sue EPA in 2009 on grounds that it is legally required under the CWA to establish TMDL for whole Bay. Suit settled in 2010 with historic binding agreement requiring EPA to take specific actions by specific dates aimed at removing all parts of Bay from the federal list of impaired waters.	Settlement (2010) requires more aggressive action by EPA, thereby setting new norm of federal intervention in Bay. Strengthens the cross-level component of this PG model.
	Administrative Procedures Act [CX_ARCH]	Process of promulgating Bay TMDL includes public comment process that generated 14,000 comments + 18 public meetings with 2500 attendees.	PG processes must be guided by overarching institutional rules, like the Administrative Procedures Act.

	Backlash against TMDL: Agriculture community fights back against TMDL victory for environmental forces.	In 2011 (2 weeks after issuance of Bay TMDL in Dec 2010), American Farm Bureau Federation and PA Farm Bureau sue EPA on grounds that TMDL exceeds the agency's authority. Six additional agricultural trade associations + the National Association of Home Builders join the suit soon after.	If courts were to strike down the Chesapeake Clean Water Blueprint process in this or any future case, the role of the federal govt in the Chesapeake Bay would be rolled back. How would PG system adjust?
	Advocacy groups continue the battle by joining suit in support of EPA.	Six environmental groups, led by CBF, file motion in defense of EPA in Farm Bureau suit. Court in 2013 rules in favor of EPA and rejects all arguments by the Farm Bureau and partners and affirms the EPA's authority to work with states to set pollution limits based on science for the Bay.	Decision contributes to legitimacy of this PG model and the increasing importance of the cross-level role for EPA.
		Farm Bureau appeals the ruling to Circuit Court in 2013, with support from 21 state attorneys general. Circuit Court rules in favor of EPA.	Decision contributes to legitimacy of this PG model and the increasing importance of the cross-level role for EPA.
		Farm Bureau appeals to SCOTUS. SCOTUS declines to hear the case. Lower court's decision in favor of EPA holds.	Decision contributes to legitimacy of this PG model and the increasing importance of the cross-level role for EPA.
	Continued reluctance by EPA to exercise its authority + Continued foot-dragging by states, especially PA.	In 2020, CBF, the Maryland Watermen's Association, one of MD's counties, and an individual farmer-conservationist from VA file suit alleging failure by the EPA to comply with the Clean Water Act and the CBA, especially in Pennsylvania. Attorneys general of DC, MD, and VA file a parallel suit.	Momentum of the 2000 lawsuits continues.
		In 2023, parties to the above suit settle out of court. Settlement includes agreement by EPA to increase enforcement of rules on agricultural operations in Pennsylvania, with a focus on the 7 counties that are the biggest polluters, as well as pursuing new efforts to control stormwater runoff.	

	Disappointment re not meeting 2025 targets + Concerns about public and media reaction	As of 2024, all parties are in discussions about how to address next phase. Much bargaining to be done.	Will PG systems need to be modified to address shortfalls in progress re targets? And if so, how?
OUTCOMES			
Ecosystem health [OC_ECO]	Targets will not be met in 2025 as promised in 2010.		
Governance capacity [OC_ABLE]	How to specify?		
All relevant interests represented [OC_REP]	How to specify?		
Repertoire of policy options [OC_OPT]	Increased focus in this era on more forceful federal role, but note continued reliance on voluntary measures such as BMPs.		

References

Baldwin, Elizabeth, Andreas Thiel, Michael McGinnis, and Elke Kellner. 2024. "Empirical Research on Polycentric Governance: Critical Gaps and a Framework for Studying Long-Term Change." *Policy Studies Journal* 52 (2): 319–48. https://doi.org/10.1111/psj.12518.

Berardo, Ramiro, and Mark Lubell. 2019. "The Ecology of Games as a Theory of Polycentricity: Recent Advances and Future Challenges." *Policy Studies Journal* 47 (1): 6–26. https://doi.org/10.1111/psj.12313.

Biddle, Jennifer C., and Karen J. Baehler. 2019. "Breaking Bad: When Does Polycentricity Lead to Maladaptation Rather than Adaptation?" *Environmental Policy and Governance* 29 (5): 344–59. https://doi.org/10.1002/eet.1864.

Bulman-Pozen, Jessica & Heather K. Gerkin. 2009. "Uncooperative Federalism," 118 *Yale Law Journal* 1256.

Carlisle, Keith, and Rebecca L. Gruby. 2019. "Polycentric Systems of Governance: A Theoretical Model for the Commons." *Policy Studies Journal* 47 (4): 927–52. https://doi.org/10.1111/psj.12212.

Colburn, Jamison E. 2016. "Coercing Collaboration: The Chesapeake Bay Experience." 40 *William and Mary Environmental Law and Policy Review* 677.

Cole, Daniel H., Graham Epstein, and Michael D. McGinnis. 2019. "The Utility of Combining the IAD and SES Frameworks" 13 (1): 244. https://doi.org/10.18352/ijc.864.

Frederickson, H.G. 1999. "The 1999 John Gaus Award Lecture: The Repositioning of American Public Administration." *PS: Political Science & Politics 32*(4): 701–712.

Haas, Peter M. 1992. "Introduction: epistemic communities and international policy coordination". *International Organization* 46 (1): 1–35. doi:10.1017/S0020818300001442.

Hacker, Jacob S. and Paul Pierson. 2012. *Winner-Take-All Politics*. Simon & Schuster

Layzer, Judith R. and Sarah Renfret. 2023. *The Environmental Case: Translating Values into Policy* (6th edition). CQ Press.

Lubell, Mark, Andrea Gerlak & Tanya Heikkila. 2012. "Chapter 5: Calfed and Collaborative Watershed Management: Success Despite Failure?" In Jeroen Frank Warner, Arwin van Buuren, and Jurian Edelenbos, eds. *Making Space for the River: Governance Experiences with Multifunctional River Flood Management in the US and Europe*. IWA Publishing.

McGinnis, Michael D. 2020. *Updated Guide to IAD and the Language of the Ostrom Workshop: A Simplified Overview of a Complex Framework for the Analysis of Institutions and their Development.* http://php.indiana.edu/~mcginnis/iad_guide.pdf

Olson, Mancur. 1965. *The Logic of Collective Action: Public Goods and the Theory of Groups*.

Ostrom, Elinor. 2010. "The Institutional Analysis and Development Framework and the Commons." 95 *Cornell Law Review* 807.

Ostrom, Vincent, Charles M. Tiebout, and Robert Warren. 1961. “The Organization of Government in Metropolitan Areas: A Theoretical Inquiry.” *American Political Science Review* 55 (4): 831–42. https://doi.org/10.2307/1952530.

Sabatier, Paul A. 1988. “An Advocacy Coalition Framework of Policy Change and the Role of Policy-Oriented Learning Therein.” *Policy Sciences* 21 (2): 129–68. https://doi.org/10.1007/BF00136406.

Steinzor, Rena & Shana Campbell Jones. 2013. “Collaborating to Nowhere: The Imperative of Government Accountability for Restoring the Chesapeake Bay.” 4 *George Washington Journal of Energy & Environmental Law* 51.

Weible, Christopher. 2023. *Theories of the Policy Process* (5th edition). Routledge.