Applying Policy Process Theories to Environmental Governance Research: Themes and New Directions

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Policy scholars have effectively leveraged policy process models, theories, and frameworks to respond to a variety of important environmental questions. For example, how do environmental issues arrive on the agendas of policymakers? What factors contribute to environmental policy change? What are the designs and effects of institutions (e.g., policies or cultural norms) on environmental governance? In this review, we survey the field of policy process scholarship, focusing on environmental governance, with three objectives. The first objective is to catalog the policy process models, theories, and frameworks most often featured in studies of environmental governance. The second is to capture the methodological choices commonly employed in the application of these models, theories, and frameworks in environmental domains. The third is to identify how these approaches deal with issues central to environmental governance research, including time, space, and policy scale. We aim to identify trends and strategies for integrating key considerations of scale into empirical policy process scholarship.

KEY WORDS: environmental governance, policy process theory, scale

政策学者已有效利用政策过程模型、理论和框架回应一系列重要环境问题。比如，环境问题如何出现在政策制定者的议程之上？哪些因素促进环境政策变化？制度（例如政策或文化规范）设计有哪些，它对环境治理产生了什么作用？在这篇文章中，作者调查了政策过程学术领域，聚焦于环境治理。作者有三个调查目标。第一个目标是对环境治理研究中最常涉及的政策过程模型、理论和框架进行分类整理。第二个目标是获取在应用这些模型、理论和框架时最常使用的方法选择。第三个目标是识别这些方法如何应对环境治理研究的中心问题，包括时间、空间和政策范围。笔者致力识别出用于将关键考量融入实证政策过程学术的趋势和策略。

关键词: 环境治理, 政策过程理论, 范围

Los expertos en políticas han aprovechado de manera efectiva los modelos, teorías y marcos de procesos de políticas para responder a una variedad de preguntas ambientales importantes. Por ejemplo, ¿cómo llegan los temas ambientales a las agendas de los responsables políticos? ¿Qué factores contribuyen al cambio de la política ambiental? ¿Cuáles son los diseños y efectos de las instituciones (por ejemplo, políticas o normas culturales) en la gobernanza ambiental? En esta revisión, examinamos el campo de la beca de procesos de políticas, centrado en la gobernanza ambiental, con tres objetivos. El primer objetivo es catalogar los modelos de procesos de políticas, las teorías y los marcos que se presentan con

mayor frecuencia en los estudios de gobernanza ambiental. El segundo es capturar las elecciones metodológicas comúnmente empleadas en la aplicación de estos modelos, teorías y marcos en dominios ambientales. La tercera es identificar cómo estos enfoques abordan los temas centrales para la investigación de la gobernanza ambiental, incluidos el tiempo, el espacio y la escala de políticas. Nuestro objetivo es identificar tendencias y estrategias para integrar consideraciones clave de escala en la investigación empírica del proceso de políticas.

Introduction

Environmental governance research has proliferated over the past four decades. Governance denotes efforts by government, private, and civil society actors to guide society toward desirable social and environmental outcomes using diverse strategies (e.g., regulation, competition, collaboration) (Baker, 2014). Scholars interested in environmental governance have typically focused on the diversity of actors and institutions that shape environmental outcomes at multiple scales (Fahey & Pralle, 2016; Lemos & Agrawal, 2006). Governance research has emphasized questions pertaining to decentralization, globalization, market-based instruments, and cross-scale governance (Lemos & Agrawal, 2006). In a review of the environmental policy research from 2012 to 2015, "governance" was the most common theme (Fahey & Pralle, 2016).

In this study, we approach environmental governance from the standpoint of policy process theory, as central to understanding governance dynamics. Weible and Sabatier (2017, p. 2) define the policy process as a series of system-bound interactions that "occur over time between public policies and surrounding actors, events, contexts, and outcomes." Efforts to understand these interactions have produced several well-established policy process models, theories, and frameworks. We are interested in the application of these theories[1] for the purpose of diagnosing, and ideally rectifying, complex and multidimensional social and environmental ills. To that end, we ask: *How have scholars studying environmental governance through the lens of policy process theories addressed issues of spatial, temporal, and policy scales?*

Scale is of special attention to environmental governance researchers since environmental dilemmas and attempts to address them occur on multiple levels across space (e.g., local to global, different types of political jurisdictions) and time (past, present, future) (Ostrom, 2005; Ostrom & Cox, 2010). Policy interactions are often conceptualized as dynamics at the micro- (individual), meso- (group, community, networks), and macro- (system) policy scales. Policy scale is a core construct undergirding policy process theories investigating policy formulation and change. Here, we aim to document the diversity in policy, spatial, and temporal scales in environmental governance policy process studies, motivated by the lack of systematic investigation of the extent and methods through which environmental governance scholars are addressing scale. Inconsistent or interchangeable use of the terms

"scale" and "level," and lack of uniform conceptual definitions of scale, obscure comparability and knowledge accumulation (Young, 2002). If we ignore or poorly define scale dimensions of governance dilemmas, we create blind spots that prevent us from understanding and appropriately diagnosing solutions.

Policy Process Theories

Next, we briefly describe the policy theories on which we focus. They are based on well-established theories discussed in the third and fourth editions of Weible and Sabatier's *Theories of the Policy Process* (Sabatier & Weible, 2014; Weible & Sabatier, 2017). This text constitutes the most comprehensive and regularly updated reference on policy process theory and research. We additionally consider two recent frameworks that have received empirical applications, but are not yet part of this text, the Institutional Collective Action and Ecology of Games Frameworks.

The Advocacy Coalition Framework (ACF) theorizes about groups of policy stakeholders who have common policy beliefs and engage in nontrivial coordination to influence policy change (Sabatier, 2011). According to the ACF, these advocacy coalitions expend resources to encourage policy change or stability that aligns with their interests. The Multiple Streams Framework (MSF) aims to explain policy agenda setting, viewing it as primarily influenced by the confluence of factors affiliated with three streams: the politics stream, policy stream, and problem stream (Zahariadis, 2007). Policy entrepreneurs are vested stakeholders who strategically engage with the streams to open or seize windows of opportunities to advance their favored solutions.

The Punctuated Equilibrium Theory (PET) explains a commonly observed trend in the policy process: once policies are adopted, they typically experience long periods of minor change and only periodically undergo major revisions. Factors theorized to contribute to policy stasis include information processing constraints, incremental decision making, and policy monopolies (Jones & Baumgartner, 2005). Innovation and Diffusion Models (IDM) seek to explain jurisdictions' adoption of new policies and programs. Innovation models focus on factors internal to an adopting jurisdiction, while diffusion models investigate the order and pace by which new policies and programs spread across jurisdictions (Berry & Berry, 2017).

The Social Construction and Policy Design Theory (SCT) focuses on how groups in society that vary in levels of power and societal approbation are treated through policy design and related implications for citizen participation. A key tenet of SCT is that policymakers strategically leverage policy design to assign benefits to groups that are positively constructed (i.e., possess high power and societal approval), and burdens to negatively constructed groups (Ingram, Schneider, & DeLeon, 2007). The Policy Feedback Theory (PFT) examines how policies influence the attitudes and behaviors of policy stakeholders and the public, and thereby subsequently affect policymaking and political processes (Mettler & Sorelle, 2017). The Narrative Policy Framework (NPF) investigates the role of narratives in the policy process by identifying structural features common to most narratives in policymaking, and

theorizing about when narratives are likely to occur and how they map to policy outcomes (McBeth, Jones, & Shanahan, 2014).

Several additional theories emphasize collective action dilemmas and the institutions used to govern them. The Institutional Analysis and Development (IAD) framework offers guidance on deciphering the design and evaluating the effects of institutions that govern decision making and behavior in collective action situations (Ostrom, 2005). The IAD was developed as part of an effort to understand the management of common-pool resources. As an extension of the IAD, the Social-Ecological Systems (SES) framework provides an elaborate description of variables relating to the governance and biophysical dimensions of collective action settings, and how they can interact to shape decision making, behavior, and outcomes therein (Ostrom, 2009). The Institutional Collective Action (ICA) framework offers an approach for identifying potential solutions to collective action dilemmas (e.g., externalities, diseconomies of scale) arising from fragmentation in decision-making authority among governmental units at the same or different levels (Feiock, 2013). In our analysis, articles using the IAD, SES, and ICA are classified under the IAD umbrella, encompassing theories of institutional rational choice more generally. Finally, the Ecology of Games (EOG) framework builds upon a sociological view of the policy process to examine how policy actors' relationships shape the strategies they employ (Lubell, 2013). It offers an approach for studying the design, outputs, and outcomes of collaborative policymaking venues with overlapping participants and issues.

Identifying and Coding Relevant Publications

This review entailed an analysis of peer-reviewed journal articles published 2015–18 that used at least one of the prominent policy process theories to study environmental governance. Words and phrases relating to each of the above-noted policy process theories were generated and served as keywords in Web of Science and Google Scholar searches. We focused on articles published between January 2015 and May 2018 to build on an earlier review of the literature (2012–15) by Fahey and Pralle (2016). This produced a total of 375 articles. Additionally, we conducted keyword searches in 29 political science, public administration, public policy, and environmental policy journals identified by Fahey and Pralle (2016) using the Web of Science's Journal Citation Report rankings. This yielded 139 publications (Table A1, Appendix A). After removing duplicates, doctoral theses, book chapters, books,[2] and conference papers, there were 280 codable articles.

From these, we identified as relevant articles that were: (i) empirical; (ii) peer-reviewed; (iii) about environmental or natural resource governance; (iv) preceded by an abstract or title containing one or more search terms; and (v) applying or developing at least one of the policy process theories, or including a key author citation associated with a theory (see Codebook, Appendix A). Articles that did not satisfy these conditions or did not have accessible English full texts were excluded. This left us with 185 articles to code and analyze.

Heeding Niles and Lubell's (2012) call for a "dialogue between theory and empirics," our codebook allowed us to identify key conceptual and methodological

dimensions of studies, including: theory, study design, hypotheses, type of data, environmental issue, unit of analysis, time dimension, geographic location, and jurisdiction. The last four categories operationalize key dimensions of scale in environmental governance research. Coding was conducted by three coders, trained in an iterated process that involved rounds of coding articles, comparing ratings, and discussing and revising the detailed codebook as necessary.[3] Two coders independently coded each article and the third coder served as an arbiter, making a final decision on any disagreements.

Results

Relevant articles were published in 85 different peer-reviewed journals (Appendix B), with the majority in policy- and environmental policy-focused outlets. The most well-established theories—IAD, ACF, MSF, and IDM—are also the most frequently used. Collectively, these approaches were employed in 76 percent of the articles we reviewed (141 of the 185). About 37 percent (69 of the 185) drew on the IAD, SES, or ICA, denoted in our results as IAD. This suggests a diverse research tradition that pays particular attention to the social rules and biophysical factors parameterizing the policy process.

Methodological Choices and Environmental Issues

The largest proportion of articles examined natural resource issues, defined as water, forests, fisheries, and wildlife (62 articles, 34 percent). Climate change concerns ranked second with 40 articles (22 percent), and sustainability-focused studies (e.g., recycling, green building, ride sharing) were third (29 articles, 16 percent). Energy was the topic of 21 articles (11 percent) followed by land use and ecosystem management (18 articles, 10 percent). The smallest proportion of articles explored environmental justice and/or pollution concerns (15 articles, 8 percent).

The trend of using qualitative over quantitative methods in environmental governance scholarship continues (see Fahey & Pralle, 2016), with roughly two-thirds of articles (119 of the 185) opting for qualitative approaches regardless of the type of the policy theory. An exception is the EOG framework: five of the eight EOG studies used quantitative methods. Mixed-methods (both quantitative and qualitative techniques) were most prevalent among studies using the IAD and ACF (Figure 1).

Single case studies were the most common study design regardless of the type of the environmental issue examined (117 articles, 63 percent) (Figure 2). Comparative case studies and mixed research designs were the next most popular study approaches (23 articles each), commonly used in conjunction with the IAD, ACF, IDM, and EOG frameworks. Rarer analytical approaches include large-N designs, social network studies, and experimental designs.

The largely qualitative investigations we observe are often associated with developing theory. Sixty-nine percent of the articles (128 of the 185) were coded as inductive, based on the absence of one or more explicit hypotheses; presence of explicit
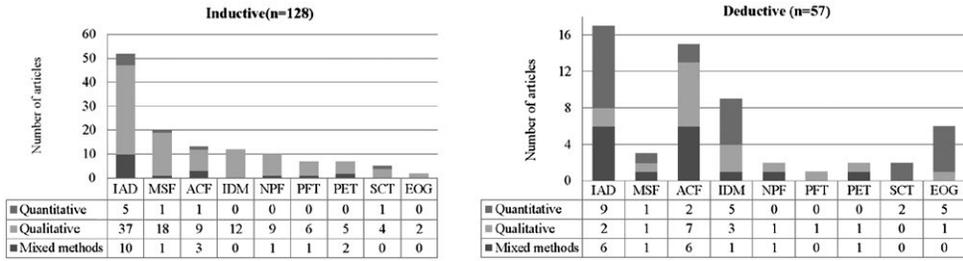
Figure 1. Theory by Type of Methods and Approach.

Inductive (n=128)	IAD	MSF	ACF	IDM	NPF	PFT	PET	SCT	EOG
■ Quantitative	5	1	1	0	0	0	0	1	0
■ Qualitative	37	18	9	12	9	6	5	4	2
■ Mixed methods	10	1	3	0	1	1	2	0	0

Deductive (n=57)	IAD	MSF	ACF	IDM	NPF	PFT	PET	SCT	EOG
■ Quantitative	9	1	2	5	0	0	0	2	5
■ Qualitative	2	1	7	3	1	1	1	0	1
■ Mixed methods	6	1	6	1	1	0	1	0	0

Note: Presence of explicitly identified hypotheses denotes a deductive approach and the absence, an inductive approach.

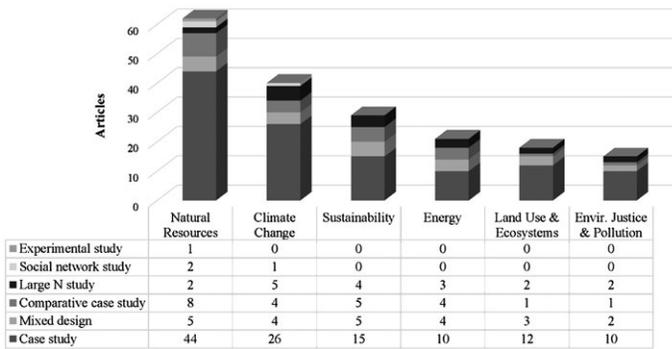**Figure 2.** Environmental Issue by Type of Study Design (*n* = 185).

	Natural Resources	Climate Change	Sustainability	Energy	Land Use & Ecosystems	Envir. Justice & Pollution
■ Experimental study	1	0	0	0	0	0
■ Social network study	2	1	0	0	0	0
■ Large N study	2	5	4	3	2	2
■ Comparative case study	8	4	5	4	1	1
■ Mixed design	5	4	5	4	3	2
■ Case study	44	26	15	10	12	10

Notes: Number of articles displayed in the table. Land Use (10 articles) and Ecosystems (8 articles) were combined for this summary due to low counts. See Codebook in Appendix A for examples of each environmental issue area.

hypotheses was taken as indicative of a deductive approach (Figure 1). Together, these results suggest that most scholars have not yet heeded calls for greater use of quantitative techniques to systematically test hypotheses across cases and contexts (e.g., Folmer & Johansson-Stenman, 2011; Lubell, Scholz, Berardo, & Robins, 2012). We caution that this result may instead indicate that some environmental governance questions are better answered by qualitative, case study-based research, and that scholars in this domain are focused on building context-sensitive theory.

Issues of Scale: Jurisdiction, Time, Geography, and Empirical Scope

We next explore how spatial scale (jurisdictional level, geographic location), temporal scale (time dimension of data), and policy scale (a study's unit of analysis) vary within each theoretical vein. We view scale considerations normatively in the sense that, all things equal, scholarship that investigates environmental issues across a range of scales is more desirable than a narrower literature. The ability of humans to devise solutions to novel dilemmas is in part a function of the range of institutional arrangements and policy solutions they can survey across and within

scales. With a richer knowledge base, scholars and stakeholders have a greater potential to combine and recombine insights in order to tackle new challenges and design solutions.

In the articles we examined, scholars explore environmental governance dilemmas at a diverse range of jurisdictional levels. Many studies focus on the national (47 articles) and local levels (39 articles) (Fig. A1, Appendix A). However, investigation of environmental concerns across time is more limited; only 48 of the 185 articles used over-time data. IAD and IDM studies used longitudinal data more often than ACF and MSF studies (Table 1). Some of these differences may be rooted in the nature of theories and proclivity to capitalize on existing data. The emphasis on over-time data is sensible for IAD studies because many investigate factors influencing the management of common-pool resources over time, using multiple methods (Blythe et al., 2017; Foster & Hope, 2016). Similarly, time plays an inherently central role in IDM studies (Arnold, Anh, & Long, 2018, Bromley-Trujillo, Butler, Poe, & Davis, 2016). It is more surprising that longitudinal data are less common in ACF studies because a central proposition of ACF is that policy change typically occurs over a decade or longer (Sabatier, 2011). The ACF and MSF articles reviewed tended to focus on a component of the theory in a snapshot in time, rather than investigating change over a period of time (Frisch-Aviram, Cohen, & Beeri, 2018; Palmer, 2015). Additionally, MSF and ACF studies employed more qualitative methods, while IAD and IDM studies relied on multiple methods and existing data. Notably, half of the longitudinal studies utilized existing data (24 of 48 articles), compared to a quarter of cross-sectional articles (34 of 137).

The majority of studies (152 articles) used existing data, such as public records, databases, and meeting minutes, alone or in combination with other sources. Most often these records came from local and national governments or sources at multiple jurisdictional levels. Environmental governance questions looking at more than one time period relied most often on national-level data (18 of 48 over-time articles). Over half of the articles (104) utilized multiple data sources. When articles used only one data collection method, interviews were the most common (used in 94 articles), followed by surveys (47), participant observation (18), and simulation/modeling (8 articles) (Fig. A2, Appendix A).

We examined the articles' primary unit of analysis to assess the diversity of foci. The entity to which the outcome of interest belonged was identified as that unit. For example, if a study examined the percent of a state's budget spent on environmental protection, the unit was the state. Units were classified as person, group, government entity; social artifact (e.g., policy, program, report, policy stasis); or multiple units (Figure 3). Social artifacts were the most commonly identified units of analysis (83 articles, nearly 45 percent), followed by government actors (38, 20 percent), groups (28, 15 percent), and people (20, 11 percent); 16 articles used more than one type of unit.

Consistent with the results of Fahey and Pralle (2016), we find that more than two-thirds of the articles focus on North American (76, 41 percent) and European concerns (39, 21 percent) (Figure 3). Asian environmental governance issues rank third in prevalence, addressed in 25 articles (13 percent). IAD articles have the

Table 1. Number of Articles by Time Scale and Jurisdictional Level for the Four Most Commonly Used Theories ($n = 141$)

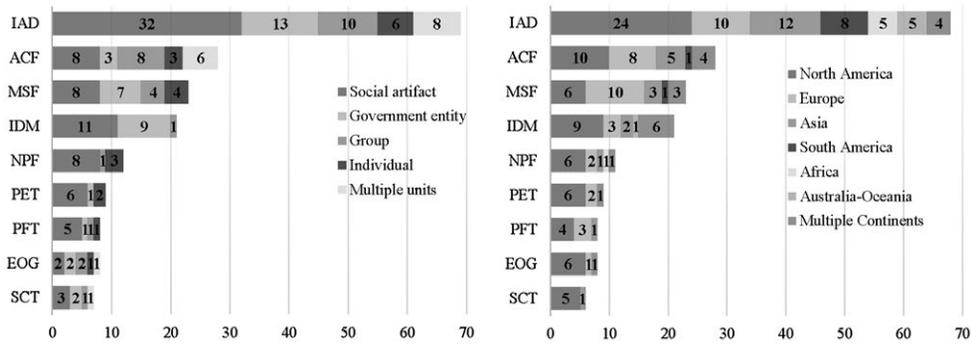|	IAD		ACF		MSF		IDM	
	Cross-sectional	Over-time	Cross-sectional	Over-time	Cross-sectional	Over-time	Cross-sectional	Over-time
Local	19	5	4	0	2	0	1	1
State	3	0	5	1	3	2	1	4
National	6	3	6	3	2	4	5	3
Regional	7	3	1	0	0	1	2	0
International	3	1	4	1	5	0	1	1
Multiple	14	5	3	0	4	0	1	1
Total	52	17	23	5	16	7	11	10

Figure 3. Number of Articles for Each Theory by Type of Unit of Analysis and Geographic Location.

most diverse geographic representation, possibly because of the prevalence of common-pool resource management challenges in the developing world and the concerted effort of the IAD's authors, Elinor and Vincent Ostrom, to engage scholars worldwide (Herzberg, 2015).

Finally, we summarize the diversity in *spatial, temporal, and policy scales* for each of the nine policy theories using an index of qualitative variation (IQV) (Table 2).[4] IQV ranges from zero to one, with higher scores indicating greater variation in the types of jurisdictions, geographic locations, time spans, and units of analysis among studies. IQV scores help us compare the degree to which studies using a specific policy theory examine environmental issues at diverse spatial, temporal, and policy scales.

MSF studies have the highest diversity (variation) in jurisdictional level: 96 percent of the maximum possible differences that can exist across the six jurisdictional levels (local, state, national, regional, international, multiple) are present in our sample of articles. ACF, IAD, and IDM studies have also examined governance questions at a diversity of jurisdictional levels. On the other hand, IAD studies have the greatest geographic variation, meaning that they have focused on governance dilemmas occurring in nearly all geographic areas for which we coded. This result is not particularly surprising given the international visibility of the IAD. ACF studies also

Table 2. Diversity in Spatial, Temporal, and Policy Scale Across Theories (*N* = 185)

Theory	Jurisdictional Level IQV	Geographic Scope IQV	Time Dimension IQV	Unit of Analysis IQV	*N*
IAD	0.91	0.93	0.74	0.57	69
ACF	0.94	0.86	0.59	0.61	28
MSF	0.96	0.82	0.85	0.58	23
IDM	0.91	0.82	1.00	0.43	21
NPF	0.85	0.82	0.75	0.39	12
PET	0.77	0.58	0.99	0.40	9
EOG	0.64	0.47	0.00	0.63	8
PFT	0.90	0.69	0.75	0.45	8
SCT	0.88	0.55	0.00	0.56	7

demonstrate substantial geographic diversity, due perhaps in part to the increasing uptake of ACF by European scholars (Jenkins-Smith, Nohrstedt, Weible, & Ingold, 2017). EOG and SCT studies demonstrate the least geographic diversity. This result for EOG may reflect the newness of the theory, and for SCT, its primary application in U.S. contexts (see Schneider, Ingram, & deLeon, 2014).

In our sample, the greatest diversity in temporal scale is for IDM and PET articles, and the lowest for EOG and SCT.[5] Since IDM diffusion studies examine the timing of policy movement, and PET explicitly focuses on the factors giving rise to policy stasis versus change over time, high IQV values for these theories are sensible. By contrast, EOG's focus on explaining the antecedents and consequences of policy actors' relationships has thus far been relatively time-agnostic. The low temporal diversity for SCT studies is somewhat surprising because feed-forward dynamics, whereby policy designs convey to stakeholders messages about their societal value and thereby shape the nature and likelihood of their subsequent political engagement, are a central component of SCT (Schneider et al., 2014). But this result may too be sensible given that a recent review found that the feed-forward dimension of SCT is understudied (Pierce et al., 2014).

To understand the policy scale at which recent scholarship has focused, we estimate it by the scale of an article's primary unit of analysis (individual, group, government entity, social artifact, or multiple units).[6] Notably, variations in policy scale in our data appear relatively low. The EOG and ACF, followed by the IAD, have the highest diversity in policy scale (Table 2). Studies utilizing these frameworks used all five categories of units of analysis. These results are explicable: the EOG theorizes about how policy actors engage across and within forums, such as stakeholder meetings, and the ACF theorizes about how individuals' beliefs affect their participation in advocacy coalitions and how those coalitions engage with government entities and other features of the policy process. The IAD is accommodating of and engages with a range of actor types. Studies utilizing the NPF and PET have the lowest diversity in policy scale, using only three types of units of analysis (with low counts); this may be because NPF studies have focused primarily on narratives deployed by coalitions and PET studies have traditionally focused on system-level dynamics.

Theoretical and Methodological Innovations

Next, we review several articles published in the last three years which integrate multiple theoretical approaches in their study of environmental governance, use innovative empirical or theoretical approaches, and reflect emerging trends in policy process or governance research.

Theoretical Integration and Innovation

Scholarship that integrates multiple theoretical perspectives is both advantageous and desirable for theory development and research. By identifying the commonalities and the complementarities across theories, scholars can "open windows of opportunity" to better understand and empirically investigate emerging

phenomena (e.g., networks, narratives, conflict). In fact, some of the most commonly used policy frameworks (ACF, IAD, MSF) effectively integrate models, constructs, or assumptions from other theoretical and disciplinary traditions (e.g., economics, psychology).

Boscarino (2016) draws on the ACF, NPF, and MSF to investigate what interest groups do when engaging in wars of words in the public arena. Although various policy theories are concerned with intergroup conflict over policy outcomes, when and how groups engage in frame contestation has been minimally empirically examined. Boscarino develops and tests a typology of frame contestation, examining energy advocacy by U.S. environmental nonprofits over three decades. Similarly, using over-time data, Aamodt and Stensdal (2017) bring together ACF and comparative politics approaches to understand climate change policy adoption in three developing nations. Climate coalitions advanced a climate policy agenda through confrontation in Brazil, cooperation in China, and complementary strategies in India (Aamodt & Stensdal, 2017).

Berardo, Olivier, and Lavers (2015) advance Ecology of Games (EOG) scholarship by examining how exogenous events can structure a complex governance system. They infuse the EOG framework with theorizing about focusing events and adaptive governance, and use this perspective to help explain the emergence and behavior of a new policy institution to guide fire response in Argentina. In a similar vein, Scott (2016) integrates theorizing on policy networks, collaborative governance, and EOG to examine how participation in government-sponsored collaborative management groups shapes inter-organizational ties. This paper also makes methodological contributions by using valued exponential random graph models (ERGM) to analyze tie intensity. Similarly, Jasny and Lubell (2015) use ERGM and related simulations to test Ecology of Games-founded, brokerage-related hypotheses about a two-mode water policy network, wherein organizations interact within and across policy venues.

Applying the ICA and policy diffusion theory (IDM), Yi, Feiock, and Berry (2017) examine the determinants of energy and climate change policy adoption. They find that economic development is linked to climate initiatives and that larger cities are more likely to adopt climate agreements. This work extends the ICA to account for economic and environmental policy co-benefits. Another contribution to innovation-diffusion research is Arnold et al.'s (2018) analysis of "policy expansion," an understudied phenomenon wherein jurisdictions rapidly adopt multiple measures tackling the same issue. In the context of municipal anti-fracking policy, they find that policy expansion is more likely when pressures for policymaking are not satisfied by an initial policy innovation and the innovation itself encourages lawmakers and stakeholders to revisit the issue.

Lastly, Barton and coauthors (2017) offer an interesting use of the IAD framework as an organizing schema for the functional attributes of policy designs in Costa Rica's Payment for Ecosystem Services initiative. The authors argue that the IAD framework's enumeration of types of "rules in use" offers a comprehensive language for identifying the interactions among economic, regulatory, and informational policy tools, thereby advancing "policy mix" research.

Innovative Empirical Approaches

In their study of nuclear power policy, Hegelich, Fraune, and Knollmann (2015) address two major challenges in empirically testing PET: statistically modeling punctuations and measuring attention. The authors utilize machine learning to identify policy attention-related variables, estimate the underlying distribution, and develop a statistical model of the U.S. federal research and development budget for nuclear power. Similarly, Hughes (2018) uses machine learning to code speeches in Congress to measure the political issue attention that could, per PET, lead to policy punctuations.

Al-Kohlani and Campbell (2016) empirically test the SCT's theoretical claims about the rank ordering of policy outcomes received by socially constructed target populations. They use socioeconomic, business, and crime data to examine air pollution exposure of societally favored but low-power Dependents (mothers, children); societally disfavored and low-power Deviants (criminals); societally disfavored but powerful Contenders (banks); and societally favored, high-power Advantaged (educated citizens, small businesses) groups. The results support some of SCT's theoretical claims.

Kammerman's (2018) research on local Swiss hydroelectric policy advances MSF research by using Qualitative Comparative Analysis to test MSF-derived propositions about policy stringency. Most studies using MSF do so qualitatively, while this methodology bridges the quantitative–qualitative gap. The author also models the levels of policy stringency, offering an improvement over MSF studies that typically attempt to explain only a binary adoption outcome.

Dressel, Ericsson, and Sandström (2018) apply Ostrom's SES framework in an innovative manner to understand the challenges to and solutions for moose management in Sweden. Their use of the framework is regional, quantitative, and spatially explicit, focusing on system dynamics, whereas most SES studies are case-comparative, qualitative, local, and/or focused on a specific action situation. Their principal component analysis reveals distinct subregions characterized by different combinations of the SES tier variables, and highlights the importance of geographically and spatially sensitive analytical strategies. Foster and Hope (2016) use the SES framework to understand payment dynamics surrounding community-financed rural water supply operations in Kenya. Their study is notable for its use of extensive quantitative data, leveraging decades of water committee records documenting more than 53,000 household payments for water from 571 hand pump locations, in addition to data from more than 3,000 household surveys.

Other exemplary empirical approaches included the use of hyperlink relationships and data from social media platforms. Elgin's (2015) study is part of a growing effort to use hyperlink relationships to represent real-world governance connections, leveraging the availability of large quantities of data on the web and the capacity of web-crawling technologies to mine them. Elgin (2015) tests and finds partial support for the ACF-rooted hypothesis that policy actors are more likely to form networks with actors that share their policy beliefs than with actors who do not. Using the NPF, Gupta, Ripberger, and Wehde (2018) conduct a large coding exercise of nuclear

energy stories that advocacy groups deploy via Twitter. They find support for framing techniques posited by NPF: winners constrain the policy debate by focusing on benefits and losers expand it by focusing on costs.

Emerging Trends

The last three years of environmental governance research illustrates a diversity of theoretical and empirical strategies, enriched by innovation and some emerging trends. Elgin (2015) tests a less widely used theory, the Political Analytical Capacity Framework, to explain how and under what conditions policy actors acquire and utilize information. Ingram, Ingram, and Lejano (2015) introduce a "narrative network approach" for understanding environmental governance that bridges the gap between network analysis and discursive policy scholarship. Similarly, scholars have offered the Discursive Agency Approach as an analytical heuristic to study agency from a discourse perspective (Leipold & Winkel, 2017), the Adaptive Venue Shopping Framework to examine how groups navigate multiple venues in pursuit of policy change (Ley & Weber, 2015), and the Policy Conflict Framework to guide empirical research on episodes of policy conflict (Weible & Heikkila, 2017).

There are also notable efforts to synthesize the contributions of policy process theories, including the edited book by Zohlnhöfer and Rüb (2016), which offers an empirical assessment of the strengths and weaknesses of MSF across national contexts and policy areas. A series of edited volumes by Cole and McGinnis (2015, 2017, 2015) summarize the contributions of Elinor Ostrom (architect of the IAD) and the Bloomington School of Political Economy in areas of resource governance, policy analysis, and policy application. Another trend is the appearance of policy-relevant scholarship in non-policy journals, such as works published in the *Journal of Cleaner Production* (Chandran, Hoppe, De Vries, & Georgiadou, 2015), *Scandinavian Journal of Forest Research* (Harrinkari, Katila, & Karppinen, 2017), *Journal of Risk Research* (Hunka, Meli, Palmqvist, Thorbek, & Forbes, 2015), *Voluntas* (Wong, 2016), and *BioScienc*e (Blair et al., 2017), among others.

We also see attempts to integrate multiple forms of scale. Angst and Hirschi (2017) use network analysis at multiple policy scales to understand how natural resource governance networks change over time in the case of Swiss landscape management. Kukkonen, Ylä-Anttila, and Broadbent (2017) apply Discourse Network Analysis to top U.S. newspaper stories to examine coalition policy beliefs and preferences in regard to climate change, both over time and across jurisdictional levels. Combing temporal, policy, and spatial scales, Wright, Andersson, Gibson, and Evans (2016) apply the IAD framework to analyze the ability of decentralization strategies to reduce deforestation.

Finally, there are increasing efforts to empirically explore environmental issues in China using policy process constructs. Drawing on the ICA, Yi and coauthors (2018) examine factors explaining the types of interjurisdictional agreements Chinese municipalities adopt to address transboundary environmental challenges. An unpublished study of sustainability in China uses panel data on 31 provincial

units (2003–12) to understand the public's role in bringing about regulatory change and greater environmental investment (Karuppusamy & Yuan, 2018).

Conclusion

Our review of environmental governance policy process studies published over the last three years finds that that the majority of research is case based, qualitative, and focused on North American and European environmental issues. Most studies are concerned with theory building rather than with testing explicit hypotheses. Natural resource management and climate change are the most common foci. Nearly all studies use existing data sources, though they may pair these with original data; more than half use multiple data sources. Most take as their primary unit of analysis social artifacts such as policies, programs, and rules.

Several lessons emerge from these findings. Environmental governance scholars today integrate diverse data sources, but these efforts remain limited to specific geographic contexts, issue areas, methodologies, and policy traditions. The trends identified in our review may reflect the prevalence of specific policy theoretic approaches across leading policy schools in the United States, resulting from either dominant policy process perspectives or the heritage of specific scholars. Our results indirectly reveal the distribution and dominance of policy theoretic approaches over the recent past, as well as the inherent emphases and choices by specific policy frameworks. Key drivers of environmental governance outcomes, such as social inequities, environmental justice, poverty, and economic structures, remain largely unaddressed on the periphery of empirical policy process scholarship. Other deficiencies in the current state of the literature relate to scale sensitivity and methodological innovations.

Our review particularly investigated the extent to which recent research spanned a range of spatial, temporal, and policy scales. Academic and policy communities are best served when researchers build and test theory within and across a range of political jurisdictions, geographic locales, time spans, and policy scales. Such comparative research, while challenging, can contribute to advances in environmental governance and policy scholarship, increasing the likelihood that scholars and practitioners are better equipped to tackle new concerns. Systematically testing hypotheses across cases and contexts requires a battery of strategies, including: replication, triangulation (use of multiple indicators and methods), consistent conceptualization and operationalization of policy constructs, and cross-cultural work by researchers from diverse backgrounds. Rigorous comparative work and theory advancement can also be aided by data sharing, pre-registration of hypotheses prior to empirical data collection, as well as interdisciplinary research teams that leverage experimental designs, over-time data, and novel methods.

Recent policy process research on environmental governance spans a range of jurisdictions, but there is a relative lack of longitudinal research, which is striking given that many theories purport to examine temporal dynamics. This is an important area for future study, particularly because understanding over-time dynamics allows more robust descriptions and explanations. Recent scholarship associated with many policy theories also lacks diversity in units of analysis (policy scale),

which could be a reflection of different research traditions or theoretical assumptions. We hope that by pointing out areas where policy process theories have been less broadly applied, environmental governance scholars will embrace the opportunity to move conceptually and empirically into new, more diverse domains.

Future environmental governance research can capitalize on efforts to integrate multiple theoretical and methodological approaches across scales. Novel methods (e.g., machine learning, web-crawling technologies) and increased access to large-N data sets, high-resolution imagery, and improved digital public records provide opportunities to expand our understanding of the actors and institutions shaping environmental outcomes. Geographically and spatially sensitive research can benefit from the application of remotely sensed data and spatial analysis. Adopting diverse approaches and advancing scholarship are the keys to building a robust literature, and perhaps more importantly, tackling the pressing environmental governance challenges of today and tomorrow.

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Notes

1. We use the term "theory" to refer to conceptual approaches for understanding the policy process; these approaches may be conventionally termed frameworks, theories, or models (Ostrom, 2005).

2. We were unable to review the books and book chapters within the time frame given for this review. There were fewer than 10 books; the most notable are mentioned in our discussion.

3. For instance, having identified only two articles applying the ICA, we integrated ICA with the other institutional theories under the IAD category.

4. $IQV_i = [1 − \sum p^2]*[(k/(k−1)]$, where i is the theory ($i = 1, … , 9$), p is the proportion of articles in each category, and k is the number of categories; for jurisdictional level $k = 6$ (see Table 1), for geographic scale $k = 7$ (Figure 3), for time $k = 2$ (Table 1), and for unit of analysis $k = 5$ (Figure 3).

5. The IQV values for time should be interpreted with caution as they are calculated using only two categories.

6. While the scale of a policy theory does not always align with the empirical units of analysis on which scholars focus, we expect a rough correspondence given the theoretical grounding of the articles.

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Appendix A

Table A1. List of Journals Used in the Process of Identifying Relevant Articles (adapted from Fahey & Pralle, 2016; impact factor and number of identified articles in parentheses)

Public Administration	Political Science	Public Policy	Environmental Policy
Journal of Public Administration Research and Theory (3.907, 11 articles)	American Political Science Review (3.316, 0 articles)	Policy Sciences (3.023, 22 articles)	Environmental Politics (2.695, 18 articles)
Governance (3.833, 1 article)	American Journal of Political Science (5.22, 1 article)	Journal of Policy Analysis and Management (3.444, 1 article)	Global Environmental Politics (3.237, 13 articles)
Public Administration Review (4.591, 0 articles)	Annual Review of Political Science (3.457, 0 articles)	Policy Studies Journal (2.83, 20 articles)	Climate Policy (3.832, 8 articles)
Regulation & Governance (2.735, 0 articles)	Political Geography (3.495, 0 articles)	Journal of European Public Policy (2.994, 4 articles)	Environmental Policy and Governance (1.268, 9 articles)
Public Administration (2.870, 1 article)	European Journal of Political Research (3.576, 0 articles)	Review of Policy Research (1.25, 18 articles)	Environment & Planning C–Government and Policy (1.864, 6 articles)
American Review of Public Administration (2.466, 0 articles)	Journal of Politics (2.255, 0 articles)	Science and Public Policy (1.368, 0 articles)	Journal of Environmental Policy and Planning (2.739, 3 articles)
Public Management Review (2.293, 0 articles)	Comparative Political Studies (2.919, 1 article)	Journal of Public Policy (0.920, 1 article)	
	British Journal of Political Science (3.326, 0 articles)		
	Political Behavior (1.877, 0 articles)		
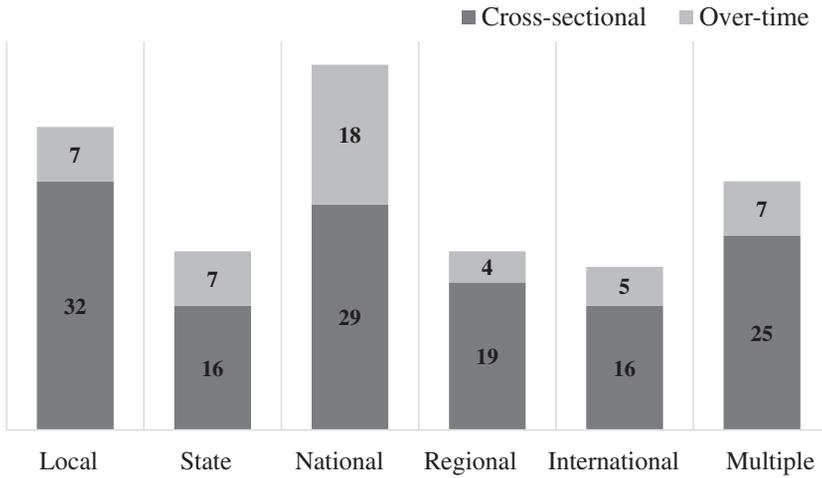
Fig. A1. Number of Articles by Jurisdictional Level and Time.

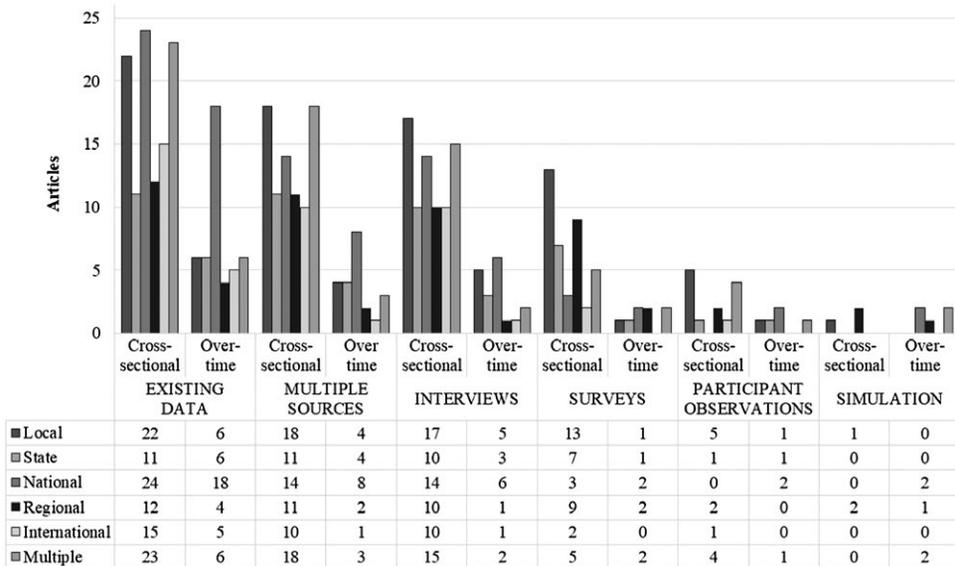|	Cross-sectional	Over-time	Cross-sectional	Over time	Cross-sectional	Over-time	Cross-sectional	Over-time	Cross-sectional	Over-time	Cross-sectional	Over-time
	EXISTING DATA		MULTIPLE SOURCES		INTERVIEWS		SURVEYS		PARTICIPANT OBSERVATIONS		SIMULATION	
Local	22	6	18	4	17	5	13	1	5	1	1	0
State	11	6	11	4	10	3	7	1	1	1	0	0
National	24	18	14	8	14	6	3	2	0	2	0	2
Regional	12	4	11	2	10	1	9	2	2	0	2	1
International	15	5	10	1	10	1	2	0	1	0	0	0
Multiple	23	6	18	3	15	2	5	2	4	1	0	2

Fig. A2. Type of Data Sources by Jurisdictional Level and Time (total exceeds 185 because an article could be coded both under existing data and multiple sources).

Codebook for 2019 PSJ Review
Rules for Article Searches and Inclusion (May–June 2018)
A keyword search was carried out over two months using Web of Science; Google Scholar; and in a targeted list of PS, PA, and PP journals. We used 10 policy process theories to develop a list of keyword phrases/words used in the searches. The majority theoretical approaches were based on Weible and Sabatier's *Theories of the Policy Process* (4th ed.). We added two additional, the Institutional Collective Action Framework and Ecology of Games Framework. The complete list is below:

1. Multiple Streams Framework (MSF)
2. Social Construction/Democratic Policy Design (SCT)
3. Policy Feedback Theory (PFT)
4. Advocacy Coalition Framework (ACF)
5. Narrative Policy Framework (NPF)
6. Punctuated Equilibrium Theory (PET)
7. Institutional Analysis and Development Framework (IAD)
8. Innovation and Diffusion Models in Policy Research (IDM)
9. Ecology of Games Framework (EOG)
10. Institutional Collective Action Framework (ICA)

Relevance: A document was identified as "relevant for inclusion and coding" if:

a) The abstract or title contained one of the keywords,

AND

b) The document was an **empirical, peer-reviewed article** (defined as data-driven article published in a peer-review journal; lit reviews are excluded),

AND

c) The issue area involved an environmental or natural resource governance issue,

AND

d) The article operationalized, tested, developed, and/or utilized _at least one of the policy process theories_ listed above, **OR** the article _included a key author citation_ as per the list below:

○ **MSF:** Kingdon, Zahariadis
○ **SCT:** Schneider, Ingram, DeLeon, Stone
○ **PFT:** Mettler, Pierson, Soss, SoRelle, Stone
○ **ACF:** Sabatier, Weible, Jenkins-Smith
○ **NPF:** Jones, McBeth, Shanahan
○ **PET:** Baumgartner, Jones, True
○ **IAD and SES:** Ostrom, Schlager, Cox, McGinnis
○ **IDM:** Berry and Berry, Mohr
○ **EOG:** Lubell
○ **ICA:** Feiock, Krause, Hawkins

2019 PSJ Review Codebook Guidelines
Please include the information asked for in each column. **Do not leave cells blank.** Notes are useful, particularly for articles we want to highlight in the body of the paper. Note articles that make a unique or especially interesting contribution to the literature (e.g., modifications or extensions of the framework/theory, unique methodological approach, or application) in the last columns (entries) of the codebook. The objective of this paper and coding activity is to understand how scholars applying policy process theories have, explicitly or implicitly, dealt with issues of time, space, and policy scale.

A. Identifiers. These guidelines provide instructions for coding the list of journal articles. Please enter your responses (codes) using this Google Form: https://goo.gl/

forms/RgTpkHHUSqfoxwQ73

When data are missing, code NA. *Please carefully read and follow the instructions.*

Document ID: ID number for each article (e.g., 1, 2, 3, ... N)

Name of Coder: Enter first name of coder.

Authors: Enter list of authors starting with **LAST NAME** of the first author on the list.

Title: Enter full title of article (if it is missing)

Year: Year published

Journal: Full name of journal

B. Policy process theory. **Keywords:** Enter the keyword under which the article was searched and selected for inclusion. This is the last column in the Excel file (Column J). Code under one of 10 theories: **MSF, SCT, PFT, ACF, NPF, PET, IAD, IDM, EOG**. For each abbreviation see list below:

1. Multiple Streams Framework (MSF)
2. Social Construction/Democratic Policy Design (SCT)
3. Policy Feedback Theory (PFT)
4. Advocacy Coalition Framework (ACF)
5. Narrative Policy Framework (NPF)
6. Punctuated Equilibrium Theory (PET)
7. Institutional Analysis and Development Framework (IAD) + Social-Ecological Systems (SES) + Institutional Collective Action (ICA)
8. Innovation and Diffusion Models in Policy Research (IDM)
9. Ecology of Games Framework (EOG)

MSF: Article applies or develops the Multiple Streams Framework. Code 1 for Yes, 0 for No. Title and/or abstract must include "multiple streams framework/ theory/model" or a reference to one of the key authors. See part A.2.e for a list of authors associated with each theory. (**1 = yes**, **0 = no**).

SCT: Article applies or develops SCT. Code 1 for Yes, 0 for No. Title and/or abstract must include "social construction" framework/theory/model or "democratic policy design." See also list of authors in part A.2.e. (**1 = yes**, **0 = no**).

PFT: Article applies or develops the PFT. Code 1 for Yes, 0 for No. Title or abstract must include "*policy feedback framework/theory/model.*" See also list of authors in part A.2.e. (**1 = yes**, **0 = no**).

ACF: Article applies or develops the Advocacy Coalition Framework. Code 1 for Yes, 0 for No. Title or abstract must include "advocacy coalition framework/ theory/model" or "democratic policy design." See also list of authors in part A.2.e. (**1 = yes**, **0 = no**).

NPF: Article applies or develops the Narrative Policy Framework. Code 1 for Yes, 0 for No. Title or abstract must include "narrative" but the keyword narrative **MUST** be connected also to the *Narrative Policy Framework*. See also list of authors in part A.2.e. (**1 = yes**, **0 = no**).

PET: Article applies or develops the Punctuated Equilibrium Framework. Code 1 for Yes, 0 for No. Title or abstract must include "punctuated equilibrium" framework/theory/model. See also list of authors in part A.2.e. (**1 = yes**, **0 = no**).

IAD: Article applies or develops the IAD, SES, or ICA Framework. Code 1 for Yes, 0 for No. Title or abstract must include "institutional analysis and development" or "institutional analysis and design," "framework/theory/model," and/or

"institutional grammar tool," and/or "social ecological systems" or SES. See also list of authors in part A.2.e. (**1 = yes, 0 = no**).

IDM: Article applies or develops the Innovation and Diffusion Model for policy design. Code 1 for Yes, 0 for No. Title or abstract must include "policy innovation" or "policy diffusion" or "policy adoption" framework/theory/model. See also list of authors in part A.2.e. (**1 = yes, 0 = no**).

EOG: Article applies or develops the Ecology of Games Framework. Code 1 for Yes, 0 for No. Title or abstract must include "Ecology of Games" framework/theory/model. See also list of authors in part A.2.e. (**1 = yes, 0 = no**).

Multiple Frameworks—Does the study use more than one theory/framework? If you checked more than one of the preceding boxes, code 1 = Yes; 0 = No

No Framework—Is there no explicit use of any of the frameworks in the TITLE, ABSTRACT, or BODY of the article? If yes, code 1; if no=0. If you did not check any of the preceding theory boxes, then note this here. NO EXPLICIT USE OF A THEORY/FRAMEWORK=1; Otherwise=0 (1 = yes, 0 = no)

Ideas from policy theory [*Code this question ONLY if you selected 1 for No Framework*]** Does the article use ideas or concepts from policy theory? Consult Table 1 in the codebook for concepts associated with each theory. If YES=1; if NO=0.

Notes—Enter any notes or comments you have about this article so far.

Relevance: (1 = yes, 0 = no). Does the article meet all of the conditions below:

a. The abstract or title contained one of the <u>keyword</u>s used in our search (see category Keyword coded earlier) **AND**

b. The document was an <u>empirical,</u> peer-reviewed article **AND**

c. The issue area involved an <u>environmental or natural resource governance issue</u> AND

d. The article operationalizes, tests, develops, and/or utilizes at least one of the policy process theories, **OR** includes a key author citation as per the list provided on page 1 of the codebook.

If yes to all subparts above, please code 1; otherwise code 0 (1 = yes, 0 = no).

IF YOU CODE 0, STOP CODING; THE FORM WILL SEND YOU TO THE SUBMIT PAGE. If you code 1, please continue coding

C. <u>Issue Area and Scale</u>. **Question:** Quote the author's stated research question. Code if the author explicitly identifies one or more research questions (e.g., our research question asks; we aim to; our objective is; we seek to...). If there is not an explicitly identified research question, please code NA.

Hypotheses: If the authors explicitly identify one or more hypotheses (e.g., we hypothesize/expect, test), please code 1. The hypothesis **does not** have to be related to the policy process theories. <u>Typically, hypothesis are located at the end of the Literature review, and prior to the Methods section.</u> Code 1 if there is an explicitly identified hypothesis, 0 otherwise. **(1 = yes; 0 = no)**

ENVIRONMENTAL ISSUE: Identify the primary environmental issue under investigation. Choose ONLY 1 category from the list below. For instance, if the study is about a cap-and-trade system for GHGs, select Climate Change; if it is about payments for ecosystem services in a forest community, select Ecosystems; if it is about hydraulic fracturing, select Energy. If there are potentially more than one issues, the rule of thumb is to identify the primary environmental medium or problem under study. Select from these categories:

1 = Natural Resources—including *WATER* **(**water use, allocation, irrigation,

rivers, lakes,wetlands, underground water, the oceans and seas, deltas and estuaries; water conservation; watershed; collaborative watershed groups; dams) *FORESTS* (use of forest resources, forest management, conservation, other); *FISHERIES & WILDLIFE* (including use and conservation of fisheries and wildlife, wildlife habitat conservation, biodiversity conservation).

2 = Land Use—including land conservation, agricultural land use, agricultural production/resources, rural landscapes; drylands, deserts; urban development; parks and recreation; national parks (if no specific resource uses are mentioned).

3 = Climate Change—including GHGs, climate adaptation, mitigation, cap-and-trade programs for carbon dioxide, carbon taxes, or other approaches for mitigating or adapting to the effects of climate change

4 = Energy—including clean or renewable energy; energy efficiency; energy sources; energy production, distribution, consumption; electricity grid; wind, solar, PV, hydro sources of energy generation; fracking or hydraulic fracturing; nuclear energy

5 = Ecosystems—including payments for ecosystem services (PES), ecosystem functions, ecosystem goods and services, ecosystem restoration; urban ecosystems. **NOTE**: If the study applies the SES framework, this DOES NOT necessarily suggest the environmental issue is Ecosystems. The framework could be applied to study fisheries, climate change, water, or forest management.

6 = Environmental Justice & Pollution—e.g., distributional issues related to the location of industrial facilities, power plants or other sources of air or water pollution, hazardous waste sites, landfills, nuclear facilities, and other air, water, or soil pollution. Examples also may include water contamination in Flint, Michigan; coal ash or chemical spills into rivers; pollution of underground water; exposure to hazardous substances; environmental risk, environmental racism, equity, or other distributional issues that may or may not be linked to pollution. This category also includes regulation of toxic substances and chemicals, such as lead, mercury, and DDTs.

7 = Sustainability—examples include educational programs for sustainable use of resources, recycling, reuse of materials, cradle-to-cradle management of waste; green buildings; LEED certification for green buildings/infrastructure; sustainable land use and management; waste and landfill management; population growth; sustainable communities via bike lanes, share rides, shared bicycle programs; electric cars, sustainable farming or agriculture, resilience, and vulnerability; natural disaster relief and recovery, flood management, risk management, or other sustainability practice).

8 = Other—If you select other, provide the type of resource or environmental issue in the text box.

Other (open-ended text box) Enter type of resource or environmental issue if you selected 8 above.

JURISDICTIONAL LEVEL—Identify the geographical bounds of the empirical analysis as it relates to the level of governance/government. For instance, if the study explores the implementation of a national policy at the state and local levels, but underlined empirically the analysis examines implementation at the state level only, code 2 = State. If the data analysis includes *both* state-level and local-level data, then code 6 = Multiple and identify the two levels using the binary variables that follow. Code *International* if the study empirically investigates international organizations

or global-level governance. If there is a discussion of regional programs (i.e., collaborations among states or cities/local governments), code REGIONAL. If the focus is on regional cooperation among nation states (e.g, NAFTA, the EU, multi-lateral environmental agreements), then code INTERNATIONAL.

1 = Local
2 = State
3 = Regional
4 = National
5 = International/Transnational
6 = Multiple
7 = NA/ Not identified
Level: LOCAL (1 = yes; 0 = no) Includes local government (town and county)
Level: STATE (1 = yes; 0 = no) Includes state-level government issues
Level: REGIONAL (1 = yes; 0 = no) Regional cooperation among cities, munici-palities, or states.
Level: NATIONAL (1 = yes; 0 = no) Includes nation state or national/federal level issues
Level: INTERNATIONAL/TRANSNATIONAL (1 = yes; 0 = no) (international/transnational issues, such as EU and NAFTA, multilateral environmental agreements)
Level: MULTIPLE (1 = yes, 0 = no)

D. Methods. **METHOD:** Identify the type of methods employed (quantitative, qualitative, or mixed methods). For an article to be quantitative, it must use numbers beyond description in the analysis. Qualitative work is empirical and does not rely on numbers. Mixed-methods combine elements of quantitative and qualitative methods. Where possible use the author's categorization of the analysis. Code only **1 = Quantitative, 2 = Qualitative, 3 = Mixed, or 4 = NA**. Do not leave blank; if not known, code NA.

STUDY DESIGN: If the article presents a case study, a comparative case study, a large N
Study, or a social network study. Coding categories: Case study; Comparative case study; Large N; Social networks; Experimental, Literature Review, Multiple, or Other. *IF you select MULTIPLE,* then identify the types of design in the binary questions below.

1 = Case study
2 = Comparative case study
3 = Large N study
4 = Social networks/network analysis
5 = Experimental study (including survey experiments)
6 = Mixed design
7 = Other
Case study (1 = yes; 0 = no) A focus on a specific case that is representative of a particular category of phenomena (e.g., the case of water pollution in Flint, Michigan).
Comparative case study or comparative analysis (typically small-n studies) (1 = yes; 0 = no)
Large N study (typically involves quantitative analysis) (1 = yes; 0 = no)

Social networks or network analysis (1 = yes; 0 = no) Must specifically mention networks, social networks, or network analysis.

Experiment (1 = yes; 0 = no) Must explicitly state that the study used an experimental design (e.g., an experimental survey, a lab or field experiment). Note that natural experiments are actually observational studies.

Other Enter a brief description of the study type in the notes section (e.g., meta-analysis)

DATA TYPE: Code the type of data collection mode used by the authors, as follows:

Survey, Interviews, Participant observation, Documents, Simulation, or Multiple. **See definitions and examples for each on the next page, before making your selection.** If you select MULTIPLE, then for the binary questions below, please select all types of data used by the authors.

1 = Survey
2 = Interviews
3 = Participant Observation
4 = Documents/Datasets
5 = Simulation
6 = Other
7 = Multiple

Survey: Code this on a binary scale, if the authors utilize survey data. **(1 = yes; 0 = no)**

Interviews: Code this on a binary scale, if the authors utilize *interviews or focus groups*.

(1 = yes; 0 = no)

Participant Observation: Participant observation is a data collection method typically used in qualitative research. Participant observation is the process enabling researchers to learn about the activities of the people under study in the natural setting through observing and/or participating in those activities (i.e., attending committee meetings, going out with fishermen while they fish, spending a day with a forest ranger to observe his duties/activities). Code 1 if the authors collected observational data by either directly or indirectly observing the study participants. Review the Methods section of the article if in doubt. It must explicitly state participant observation. **(1 = yes; 0 = no)**

Documents/Existing Data: Code this on a binary scale if the authors use public records, meeting minutes, archives, publicly available data or data sets (e.g., American Community Survey, EPA data, FAO data), or other publicly available documents. **(1 = yes; 0 = no)**

Simulation/Modeling: Code this on a binary scale if the authors utilize nonempirical data derived from a computer simulation or computer modeling. These approaches generate data based on a mathematical code or model and do not rely on real-world data. Again, review the Methods section if uncertain. Examples: agent-based modeling, Markov chain, population models, etc. This excludes regression models or quantitative/statistical analysis of survey data. Recall this is the type of DATA, not the type of ANALYSIS we are coding for **(1 = yes; 0 = no)**

UNIT OF ANALYSIS: Identify the study's primary unit of analysis. To identify the unit of analysis, first identify the outcome of interest or the dependent variable.

The entity to which the outcome belongs is the unit of analysis. For instance, if a study examines the decisions of municipal officials, the unit is an individual (municipal officials); if the study analyzes the reports of an environmental interest group, then the unit is a group (e.g., Sierra Club). If the study examines the percent of a state's budget spent on environmental protection, then the unit is the state (i.e., the budget belongs to the state). Consider also the option of multiple units of analysis, particularly if you coded earlier for the presence of multiple jurisdictional levels. Choose from these categories.

1 = Person

2 = Group (e.g., an interest group, a community, a coalition, a private firm)

3 = Government Entity (e.g., a state, a government agency, a nation state, a resource management agency)

4 = Social Artifact (e.g., a policy, a program, a rule, a report, demonstration, articles)

5 = Multiple units

6 = Other/NA (if other, please explain the notes section at the end of the form)

TIME: If the design is **Cross-sectional=0**; If **Longitudinal or Over-time =1**. If data were collected at only one time period, then it is a cross-sectional study. If data were collected at two or more points in time (e.g., in 2012 and 2014), or regularly over a period of time (e.g., every 5 years over a 25-year period), then this is a longitudinal study. If it is a literature review or conceptual paper (not an empirical paper), then you should not be coding it; it's not relevant.

CONTINENT: Identify and code the continent where the study site(s) is located. Use:

North America =1

Europe=2

Asia=3

Africa=4

South America=5

Australia-Oceania=6

Multiple=7 (if more than one continent is involved).

NA=8 (Code NA if there is no specific study site as in a simulation/modeling paper).

EXCEPTIONAL (yes/no): For the category "Exceptional," indicate whether you think the article should be highlighted in the body of the paper. Is this an article you really liked? (e.g., it had a unique take on either theory or methods). Please include articles that you believe make a unique or especially interesting contribution to the literature on environmental governance. This may include major modifications to a theory or exceptional methodologies or applications. **Code 1 = yes; 0 = no.**

Exceptional (why): For this category, indicate _why you feel this article should be highlighted_ or makes a unique contribution. Explain in a sentence or two why this article is exceptional.

Notes: Use this "Notes" category for any additional thoughts or considerations you wish to include. Notes are encouraged.

Appendix B

List of Journals for the 185 Relevant Articles
American Review of Canadian Studies
Applied Geography
Biodiversity and Conservation
BioScience
China Information
Climate Policy
Climate Risk Management
Conservation and Society
Ecological Applications
Ecological Economics
Ecological Indicators
Ecology and Society
Ecosystem services
Energy for Sustainable Development,
Energy Research & Social Science
Environment and Planning C: Government and Policy
Environment and Planning C: Politics and Space
Environmental and Planning Law Journal
Environmental Justice
Environmental Management
Environmental Modelling & Software
Environmental Policy and Governance
Environmental Politics
Environmental Science & Policy
European Policy Analysis
Food Policy
Forest policy and economics
Frontiers in Ecology and the Environment
Futures
GeoScape
Global Environmental Change
Global Environmental Politics
Governance
International Journal of the Commons
International Journal of Water Resources Development
Journal of Cleaner Production
Journal of Environmental Management
Journal of Environmental Planning and Management
Journal of Environmental Policy & Planning
Journal of European Public Policy
Journal of Flood Risk Management
Journal of Public Administration Research and Theory
Journal of Public Policy
Journal of Risk Research
Journal of Rural Studies

Journal of Sustainable Forestry 35(1)
Journal of the American Water Resources Association
Journal of the Southwest
Land Use Policy
Latin American Research Review
Marine Policy
Marine Resource Economics
Nonprofit and Voluntary Sector Quarterly
Philosophical Transactions of the Royal Society of London B: Biological Sciences
Policy Sciences
Policy Studies Journal
Proceedings of the National Academy of Sciences
Public Administration
Public Administration Quarterly
Public Administration Review
Public Management Review
Public Policy and Administration
Publius: The Journal of Federalism
Regional Environmental Change
Renewable and Sustainable Energy Reviews
Review of Policy Research
Scandinavian Journal of Forest Research
Science of The Total Environment
Social Networks
Society & Natural Resources
Sustainability
Systems Research and Behavioral Science
The American Review of Public Administration
Tourism Management
VOLUNTAS: International Journal of Voluntary and Nonprofit Organizations
Water Alternatives
West European Politics

Table C1. Key Concepts and Ideas by Theory (Source: Weible & Sabatier, 2017)—Use table below for coding category "IDEAS FROM POLICY THEORY"

Framework	Key Concepts
IDM	Policy innovation Policy diffusion
	Policy adoption
SCT	Policy design Social construction
PFT	Policy feedback Interest groups
PET	Incremental Policy change
	Policy monopoly
ACF	Coalitions Policy network
	Learning
	Conflict
	Values/beliefs
NPF	Narratives Frames/framing
IAD & SES & ICA	Institutions Collective action
	Social-ecological system
MSF	Agenda-setting Policy entrepreneurs
	Policy window
	Stream/ policy stream
EOG	Transaction costs