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Resilience of Legal Systems

Toward Adaptive Governance

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Introduction

Although there are numerous offerings, a good working definition of resilience as used in natural and social sciences, and appropriate for legal systems as well, is "the capacity of a system to experience shocks while retaining essentially the same function, structure, feedbacks, and therefore identity" (Walker et al., 2006, p. 14). This chapter explores how to contextualize these concepts for legal systems, recognizing that legal systems are situated within a vast co-evolving system of systems, and outlines a vision of new forms of governance that focus not only on how to design and manage the resilience of legal systems, but also on how legal systems can manage the resilience of other natural and social systems with which they co-evolve. With problems on a massive global scale looming large on the horizon, such as climate change and biodiversity loss, there is no more pressing set of challenges for legal system theory and practice in our time (Fischman, 2019).

Legal System Resilience: Of What, to What, and for What?

Translating the definition of resilience into legal systems research requires an understanding of the function, structure, feedbacks, and therefore identity of legal systems (the *of what*) and the kind of shocks they experience (the *to what*). Because legal systems both govern and co-evolve with other systems in large-scale complex social-ecological systems, they can

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contribute to, or diminish, the resilience of these other systems (Ruhl, 2011). Resilience in legal systems is, thus, often used to facilitate normative social purposes fulfilled through other social systems (the *for what*). In this section we chart out these three foundational questions of resilience theory as applied to law in general, and environmental law in particular.

Resilience of What?

The question of what it is about legal systems that could and should be resilient begs the question, What is a legal system? An easy response is that it is the system that creates, implements, and enforces formal rules governing society. This typology contains both the institutions tasked with creating and applying legal rules, as well as legal instruments, such as laws and regulations. But that answers very little for purposes of thinking of law as a *system* and what constitutes and contributes to its resilience. How does it behave? What are its boundaries? What is its input and output? Why does it sometimes fail? How will it look in one year? In 10 years? How should we use it to make change in some other aspect of social life? These are obvious questions, yet, of the tens of thousands of references to the legal system in legal literature, few authors say anything about it *as a system*. Even in the subset of this literature devoted to legal philosophy, little attention is given to the *system* half of the "legal system" (Ruhl & Katz, 2015). Furthermore, even when the system "half" of the law is studied, the analysis often proceeds on the assumption that law is a closed and self-referential system with fairly simple operating principles (Luhmann, 2004).

Going further, many legal scholars describe the legal system as complex without saying much about what *complex* means. So, for example, Conley (2007) claims that intellectual property rights law "has radically evolved since the nineteenth century when there was no structure, to the present where there are complex legal systems and rules in place" (p. 210). Other authors even go so far as to refer to "massively complex legal systems," suggesting that they "require a great deal of constituting" (Young, 2007, p. 417). As accurate as these statements may be, beyond conjoining "complex" and "legal system," they offer no insight into what makes a legal system *complex*. Although some legal scholars use the term *complexity* in discussing legal frameworks, the term often refers to nothing more than legal indeterminacy that is caused by the law regulating a complicated topic (e.g., multiple sectors of society) and expanding onto a wide vertical landscape ranging from the international to the local level (Kades, 1997). Despite these attempts to understand the complicated nature of legal systems, no scientific understanding of law's complexity has been forthcoming. Resilience thinking and the related field of complexity science—the study of complex adaptive systems—offer much insight in this regard.

Starting with complexity science, its key premise is that there is a difference between complexity in the sense of "complicatedness" and complexity in the sense of how a system is constructed and behaves. Few dispute that law is complicated; whether it is complex in this systems sense is another matter. Miller and Page (2007) explain the distinction, which goes to the essence of complexity science theory:

> In a complicated world, the various elements that make up the system maintain a degree of independence from one another. Thus, removing one such element

> (which reduces the level of complication) does not fundamentally alter the system's behavior apart from that which directly resulted from the piece that was removed. Complexity arises when the dependencies among the elements become important. In such a system, removing one such element destroys system behavior to an extent that goes well beyond what is embodied by the particular element that is removed. (p. 9)

The focus of complexity science is this kind of complexity found in systems "in which large networks of components with no central control and simple rules of operation give rise to complex collective behavior, sophisticated information processing, and adaptation via learning or evolution" (Mitchell, 2009, p. 13). Attributes of such systems include aspects of self-organization, network structure, emergence (the whole is different than the sum of its parts), feedback (both negative, which has a stabilizing effect, and positive, which has a destabilizing effect), the possibility of nonlinear behavior, contextualization (i.e., the application of the same approach in a different setting may not have the same results), and uncertainty (Mitchell, 2009).

Much of the work applying complexity science to legal systems has focused on mapping key concepts of complexity science onto legal systems (Ruhl & Katz, 2015). This work starts with the general definition of a complex adaptive system as previously mentioned: a large network of components with no central control and simple rules of operation giving rise to complex collective behavior, sophisticated information processing, and adaptation via learning or evolution. This framework is intuitive for anyone with training in law to map onto the legal system. The components of the legal system comprise a broad diversity of institutions—the organizations of people who make, interpret, and enforce laws—and of instruments—the laws, regulations, cases, and related legal content the institutions produce. These components are interconnected and interactive. Institutions are interconnected through structures and rules such as hierarchies of courts and legislative creation and oversight of agencies, and they interact in forums such as judicial trials, legislative hearings and debates, and agency rulemakings. The instruments are also interconnected through mechanisms such as code structures, and they interact through cross-references and other devices (Ruhl, Katz, & Bommarito, 2017).

The highly interconnected architecture of such a system drives the way it behaves over time (Ruhl & Katz, 2015). An agency adopts a rule, which prompts another agency to enforce a different rule, which leads to litigation before a judge, who issues an opinion overruled by a higher court, which prompts a legislature to enact a new statute, and so on. The institutional agents follow procedural and substantive rules, but there is no central controller pulling all the strings. There are hierarchies for various institutions (e.g., tiers of courts), yet there is no master agent controlling the *system*. Such systemic organization of law without a single master is one of the foundational elements of many legal systems, particularly those relying on a separation between the legislative, executive, and judicial branches. Through the separation of powers and other mechanisms, such as procedural safeguards, the rule of law seeks to secure a system in which no one institution would have all the keys to control the development of law (Dicey, 1979; Soininen, 2018; Thoma, 1978; Waldron, 2010). We recognize, of

course, that there are other forms of governance, such as those of authoritarian regimes, and that they too can exhibit complexity attributes.

There is now wide acceptance of the model of legal systems as complex adaptive systems (Murray, Webb, & Wheatley, 2019). This being the nature of legal systems, what about their resilience? Resilience of complex adaptive systems has become a large research agenda in many fields (Fraccascia, Giannoccaro, & Albino, 2018). Legal scholars have also long used terms like *resilient* and *resilience* to describe qualities of a legal system. A classic example is from Karl Llewellyn (1960), who observed that "an adequately resilient legal system can on occasion, or even almost regularly, absorb the particular trouble and resolve it each time into a new, usefully guiding, forward-looking felt standard-for-action or even rule-of-law" (p. 513). Although not articulating any formal theory of resilience, this and similar descriptions seem to mean what ecologists, social scientists, and complex systems researchers mean—that a resilient legal system enjoys consistency in overall behavioral structure notwithstanding continuous change of exogenous and endogenous conditions (Ruhl, 2011). Much as legal scholars have done for complexity science, therefore, how might we map the principles of resilience theory onto legal systems to better understand when they are and are not resilient?

Resilience theorists use the metaphor of a bowl and a ball rolling around its basin to illustrate key themes (Gunderson, 2000). The legal system, like any system, can be defined by its structure (e.g., division of powers between legislatures and courts) and processes (e.g., administrative decision procedures). Structure and process thus define the shape of the resilience "basin of attraction" and produce system behavior in the form of actual decisions of executives, legislatures, courts, and agencies, which is where the "ball" is in the bowl at any time. Different configurations of structure and processes—different basin shapes—can be expected to produce different behavioral outcomes in response to changes in internal and external conditions. How we design those configurations also matters for how the system stands up to changes of different quality and magnitude over time. Some configurations could rely on more rigid strategies—what resilience theorists call "engineering resilience" (Walker et al., 2006) or "static resilience" (Giannoccaro, Albino, & Nair, 2018)—to build a very efficient set of reliable structural and process components, whereas others could use the dynamic flexibility of "ecological resilience" strategies to build more capacity to adapt into the system (Cosens et al., 2017; Cosens, Gunderson, & Chaffin, 2018; Gunderson & Holling, 2002; Walker et al., 2006). Blends of these strategies can enhance "response diversity" so that the system is better prepared for new kinds of disturbances (Walker et al., 2006). These design choices take place at different scales and for different subsystems. What we call environmental law, for example, may be different in structure and process from criminal law, although they can share some legal systemic elements, such as the constitutional requirements regulating the organization of structure and processes.

Indeed, to a resilience theorist some features of a legal system surely would be interpreted as displaying strong versions of static engineering resilience strategies (Ruhl, 2011). The U.S. Constitution, for example, displays little tolerance for structural or process change. It was designed to be hard to alter in design and has proven so (Vile, 1994). Yet it is resilient. Its highly engineered structure and process design is so enduring that flips to new equilibrium states—the so-called constitutional moments—are quite rare (Sunstein, 1996). It has

proven capable of amendment in the face of major shifts in social values (i.e., the 13th, 14th, and 15th Amendments following the Civil War) and reinterpretation in the face of major shifts in social economic interaction (e.g., the New Deal in response to the industrial revolution and its impacts; Dorf & Sabel, 1998), setting a high threshold for change.

By contrast, common law legal systems, which allow for the incremental development of law through case-by-case judicial opinion, offer an example of dynamic ecological resilience, in the sense they are designed with a highly dispersed structure of courts throughout the nation, all working to craft doctrine under a loose set of process rules (Ruhl, 2011). Response diversity is high, as multiple courts from different states may be working on the same new problem to arrive at a spectrum of doctrinal results. The result is a high capacity for swings in behavior in response to changing conditions without altering the system's basic structure and process design. Outcomes can move responsively to new knowledge and changed conditions, sometimes dramatically so and other times over long periods of judicial tinkering, without the system's structure and process design changing. For example, at one time the U.S. Supreme Court declared wetlands to be common law nuisances, whereas courts today have ruled the draining or filling of a wetland to constitute a nuisance (Blumm & Ruhl, 2010). The common law of nuisance has responded to the modern science of wetland ecology and changed public perceptions to make a complete 180-degree turn on the status of wetlands (Nagle, 2008), but by no means would anyone consider the common law of nuisance to have been restructured as a system to make this shift in doctrine.

Similar incremental developments are also a feature of civil law systems governed mostly through statutes. To take one example, construction of rivers for hydropower was deemed crucial from a societal perspective in 20th-century Finland, but after the arrival and formalization of ecological water quality requirements stemming from the EU, especially small-scale hydropower has been deemed societally unsustainable. Despite this, hydropower operations still enjoy strong legal protection through constitutional protection of private property, but the change in the EU legal framework has started an incremental change toward securing ecological flows in the Finnish rivers (Soininen, Belinskij, Vainikka, & Huuskonen, 2019).

It is important in this respect to distinguish between resilience of the legal system's underlying structure and processes and the stability of the substantive content of law—that is, the lifespan and durability of particular decisions by executives, legislatures, courts, and agencies. A legal system relying heavily on ecosystem resilience strategies, for example, is likely to experience flux in the substantive legal content it produces. The ball rolls far from equilibrium in such systems. There may be many reasons, however, to prefer greater stability in the substantive content of the law, finding a balance between flexibility and rigidity in legal processes (Craig et al., 2017, 2018).

This point warrants unpacking legal system resilience into two dimensions—the institutional and the instrumental. Institutional resilience pertains to the actors in the legal system and the processes they use to create and enforce laws, whereas instrumental resilience pertains to the resilience of those substantive laws. Resilience of one is not predetermined by the resilience of the other. For example, although the recent volatility of executive institutions around the world may suggest an erosion of institutional resilience, presidents and prime

ministers often find it can be quite difficult to impose similar instability on the instruments over which they have authority, such as agency regulations, due to institutional resilience elsewhere in the system. On the other hand, a highly resilient institutional structure, such as an authoritarian regime, might be so powerful as to be in a position to change legal instruments on a whim.

These possibilities lead directly to the important observation that whether a legal system is or is not resilient—institutionally, instrumentally, or in both domains—implies nothing about the system normatively (Fischman, 2019). Resilience is an emergent property of a social system, but it does not make the system "good" or "bad"—that is for society to decide. To be sure, resilience might itself be desirable and considered normatively a good quality to promote in a legal system. But the presence or absence of resilience in a legal system alone does not entitle the system to any particular normative status. What modern society might consider a discredited legal system—feudalism, for example—might nonetheless be resilient (as it was for centuries). Even today, despotic rulers establish and perpetuate resilient legal systems to support their reign.

At the same time, the normative underpinnings of the legal system (e.g. rule of law and separation of powers) can affect what kind of and how much resilience the system has (functions, basins of attraction, etc.). So law's resilience is affected by normative decisions regarding the system design (e.g., the constitution), but resilience itself is a descriptive concept once the normative foundations are put in place.

Indeed, to the extent resilience is a desired quality, it may nevertheless pose trade-offs with other normative goals of a legal system (Ruhl, 2011). It may be possible to have too much resilience. If, for example, a legal system is highly resilient in the engineering sense, but it is producing outcomes that are no longer normatively acceptable to society, its resilience is a problem, not a virtue (Gunderson, Garmestani, Rizzardi, Ruhl, & Light, 2014). In such cases an extreme external disturbance or internally initiated reformation of the system may be needed to escape from the highly resilient but undesirable regime. The persistence and ultimate demise of the legal system once supporting American slavery offers an example—it took a national civil war to begin the dismantling.

In summary, resilience of legal systems at a very general level can be defined the same as it is for other social systems—broadly speaking, it is the ability of the legal institutions and the legal instruments they produce to experience shocks while retaining essentially the same function, structure, feedbacks, and therefore identity. This property exists in countless interacting legal systems operating across horizontal scales (e.g., the interactions between substates within a national system) and vertical scales (e.g., the interactions between global, regional, national, and subnational systems). To return to the original question of this section—What is a legal system?—we thus define it as a complex adaptive system comprised of numerous interacting and even nested systems of international law, regional law (e.g. the EU), as well as national and subnational systems (i.e., a system of systems), all of which exhibit varying degrees of resilience.

Because legal systems play an important role in shaping and fulfilling social norms, one must be careful to consider that legal system resilience as defined may not be a good force in society. Where it is working well on behalf of society, legal system resilience is a positive

effect to be promoted and protected; where it is not, perhaps it must be overcome to facilitate legal system transformation. Both of those possibilities raise the question, Resilience to what?

Resilience to What?

The next time you take a peaceful hike through a forest, stop for a moment and consider that you are in the middle of a war zone. Species within the ecosystem are engaged in cooperative and competitive behaviors, and the system as a whole must manage natural disturbances such as floods and droughts and human disturbances such as pollution and habitat destruction. It is no wonder that ecosystems are identified as classic examples of complex adaptive systems (Levin, 2000).

Legal systems also experience disturbances from internal and external forces. Take environmental law for example. Internally, some political actors advocate for massive revision of the system, such as repealing major statutes or privatizing public lands (for examples, see Lazarus, 2004). Although calibration of regulatory impact has always been a central debate within environmental law, such radical proposals can be seen as viable threats to system resilience. Likewise, external disturbances abound from other social systems, such as financial system collapse threatening budgets of agencies implementing and enforcing environmental regulation (Nash, Ruhl, & Salzman, 2017). At the extreme, warfare, climate change, and mass human migration can have deleterious effects on the environment and environmental law. There are also legal constraints that provide resistance at the expense of adaptive capacity, thereby diminishing system resilience, such as strong property rights regimes that exist in some nations, the United States being a glaring example. In short, legal systems like environmental law can be thought of as much like natural ecosystems, constantly working out conflicts in internal dynamics while battling off threats from outside. The difference, of course, is that legal systems are entirely the invention of, and controlled by, humans. Legal systems have normative purposes chosen by society, leading to the third fundamental resilience question: for what purpose is legal system resilience intended?

Resilience for What?

What is the legal system's role in society? Generally speaking, the purpose of legal systems is to provide a stable and equitable framework for attaining normative goals in the overall social-ecological system. To do so, legal systems interact with other social systems in such a way as to provide a stable platform for their operation (e.g., so that the financial system can function over time), but in many cases also attempt to steer those other systems toward socially desired goals (e.g., to promote greater social justice in the healthcare system). Depending on society's normative choices, in some cases the relationship between legal and other social systems is positive and in others it is antagonistic—legal systems generally promote the healthcare system and fight criminal networks. Generally, legal theorists have defined what constitutes a "good" legal system as one exhibiting and promoting legitimacy, accountability, and justice (Cosens et al., 2017, 2018). As Lon Fuller (1969) famously articulated, this would entail (a) denial of ad hoc (purely contextual) decisions, (b) public promulgation of laws, (c) denial of retroactive legislation, (d) clarity of laws, (e) denial of

contradictory rules, (f) laws that do not require actions beyond the capabilities of the affected parties, (g) nonfrequent changes to the legal system, and (h) legal norms that are implemented and enforced as they are announced. In societies that value these attributes, legal system resilience is both built upon and promotes them (Cosens et al., 2017, 2018).

It is important in this respect to distinguish between resilience of the legal system and resilience of other natural and social systems the law is aimed at addressing. Environmental law, for example, might focus on how law can promote resilience of ecosystems, and banking law might focus on how to make the financial system more resilient, but that is not the same as asking how to design resilience in law. Nor does it necessarily follow that if law is successfully designed to be resilient that it will promote (or undermine) the resilience of any other social system.

These design choices, moreover, operate at multiple scales within and across the vast domain of the legal system. Resilience theory does not posit that a system as complex as law is entirely one kind of "bowl." Rather, it is more a set of landscapes over which we find engineering and ecological resilience strategies mixing in different blends to form topographies of various contours depending on where in the system we look. Some resilience theorists refer to this multiscalar complex of topographies as a panarchy. Allen and Holling (2010) explain:

> For resilience theory, it is critical to understand the scales of interest and the scale of analysis because one level of a panarchy may collapse and cascade to lower levels, but the system as a whole may be maintained. . . . Resilience is a property that can exist at any scale in a panarchy. A given level may not be very resilient, but the larger system may be. (p. 3)

Environmental law, for example, has many facets, not all of which use the same blend of resilience strategies. Environmental law in turn is nestled with many other fields of regulation in the larger scale system of administrative law, which in turn is embedded within a system of constitutional law, each with its own resilience landscape. Similarly, in common law nations, administrative law operates alongside the common law, which likely has different resilience properties. Thus, administrative law uses checks on agency process to allow delegation from a legislative body and a degree of flexibility in expert implantation, whereas common law involves a slow evolution of substantive law through an incremental process of judges and litigants learning by doing. In civil law systems, such a learning by doing mechanism might function through courts informing the legislature of a regulatory failure, and the legislature making the required adjustments, provided there is the political will to do so. The legal system, therefore, has many potential equilibrium states at many different scales, each with its own set of resilience attributes. One component of the larger system—to use an all too real recent example, the financial law system—may fail, but the legal system as a whole may continue to prove resilient.

It follows that the possibility of "flips" from one system state to another—which implies that the resilience strategies associated with the prior state did not ultimately resist change—are not necessarily undesirable in legal (or other) systems. If resilience of natural

ecosystems or stability of legal decisions is our priority, it might be law's structure and process that have to shift to a new system state when change threatens those values. For example, if one were to trace the history of the environmental law system in the United States, an unmistakable transition occurred in the 1970s as statutory regimes supplanted common law regimes as the dominant system structure (Lazarus, 2004). And EU environmental law has undertaken a shift from rule-based statutory regulation to goal-based legislative frameworks with market-based instruments and self-regulation complementing formal regulation (Langlet & Mahmoudi, 2016). These were in many ways planned flips to a new equilibrium state, a process known in resilience theory as *transformability*, the "capacity to create a fundamentally new system when ecological, economic, or social (including political) conditions make the existing system untenable . . . [by] creating new stability landscapes" (Walker et al., 2006, p. 7). One of the facets of resilience theory thus focuses on how to manage systems that have multiple equilibrium states and how to flip between them under certain conditions (Gunderson & Holling, 2002).

Properties of Resilient Legal Systems: A Case Study of Modern Environmental Law

Given that we can define resilience and identify its operation in many social systems including law, an obvious question follows: "What is it that allows these systems to sustain such productive, aggregate patterns through so much change?" (Miller & Page, 2007, p. 28). A starting point is to unpack the engineering/ecology resilience distinction into a more refined typology of attributes. For example, in their deep examination of resilience in complex systems, Alderson and Doyle (2010) explain that five key features of a system contribute to the capacity to endure through surrounding change:

> *Reliability* involves robustness to component failures. *Efficiency* is robustness to resource scarcity. *Scalability* is robustness to changes to the size and complexity of the system as a whole. *Modularity* is robustness to structured component rearrangements. *Evolvability* is robustness of lineages to changes on long time scales. (p. 840; italics in original)

Of these five qualities, reliability and efficiency appear most in keeping with engineering resilience strategies, whereas scalability, modularity, and evolvability match up more closely with ecological robustness (Gunderson & Holling, 2002; Anderies, Janssen, & Ostrom, 2004). As such, it is likely that trade-offs will be encountered and force difficult decisions about system design. A system that is highly efficient in using scarce resources, for example, might as a consequence have less response diversity because of lower reliability in important system components (Alderson & Doyle, 2010). A recurrent system design question, therefore, is how to balance these properties, which, as previously observed, is driven in large part by the normative decisions a society has made regarding its goals for the legal system (Ruhl, 2011).

Modern environmental law offers many examples of how these properties both contribute to legal system resilience but must be balanced. Although institutions and instruments aimed at regulating human behavior toward the environment, such as laws protecting parks, have been in place in many nations for over a century, the highly articulated architecture of modern environmental law, relying on dozens of legislative acts, administrative agencies and their regulations, and judicial oversight dates back no more than a few decades in most nations (Lazarus, 2004). The core purpose of this style of environmental law is to regulate how humans treat the environment. The two principal goals are to protect what we care about in the environment itself (species, ecosystems, wetlands) and to protect human health and welfare given our dependency on the environment (antipollution, waste controls). This is a tall order. For one thing, the environment itself is a massive complex adaptive system in its own right. And there are multiple social systems, including other legal systems, acting in ways that promote or undermine the environment's resilience and which environmental law must therefore engage. Trade-offs are inevitable, as the real or imagined jobs-versus-environment debate has persisted for decades as an example. In short, environmental law as a legal system is embedded in a massive and monstrously complex social-ecological-technological system. Managing its reliability, efficiency, scalability, modularity, and evolvability is a full-time job for a large army of policymakers and practitioners.

Reliability

Modern environmental law systems consist of many institutions and instruments. Reliability means that when one of these components fails, the system as a whole does not substantially diminish in resilience. Of course, failure is often in the eyes of the beholder—some people consider the environmental law system to have failed because it regulates too much and others, because it regulates too little. Either way, in most nations that moved to the modern environmental law model beginning in the 1970s, the system remains largely intact despite many component failures along the way. In the United States, for example, every one of the suite of federal statutes enacted in the 1970s—the Clean Water Act, Endangered Species Act, Clean Air Act, National Environmental Policy Act, and a host of others—remains in place today, if not augmented through amendments over time.

Despite what Lazarus (2004) describes as a pathological series of pendulum swings in American politics, bashing environmental law in one direction, then building it back up in the other, and so on, the system has persisted. To a large extent this can be attributed to structural checks-and-balances features found in many legal systems, where shared authority reduces the propensity for any one institution, such as the executive, to move too far in one direction without other institutions, such as the judiciary, weighing in. Legitimacy and accountability of governing authorities also must necessarily factor into the type of resilience the system can deploy in this regard, promoting the ecological resilience underpinning reliability.

To be sure, the modern environmental law system has failed many times and at many places. But it is mostly a success story. Many rivers are cleaner, the air is healthier in many places, contaminated sites have been remediated, species have been protected, the loss of wetlands has been stemmed in many nations, and so on. The modern environmental law

system is, in other words, largely intact and working in many nations. There are, of course, many pockets of the world where this is not the case, and the international legal system faces many environmental challenges at the global scale, such as climate change, loss of biodiversity, and massive plastics pollution in the oceans. The environmental law agenda is far from completed, and faces some problems of unprecedented scale and intensity, but the environmental law system has demonstrated immense reliability to component failure over time.

Efficiency

In most nations, the modern environmental law system ramped up quickly and without overriding attention to efficiency. This was out of necessity—the environment was in dire shape and getting worse, so strong regulatory measures were needed. The U.S. Endangered Species Act is a prime example, as it requires species to be designated for protection without regard to economic impact. The Finnish Nature Conservation Act portrays similar characteristics. It was also the case that environmental law began by relying heavily on administrative agencies to promulgate and enforce strong regulations, which itself demanded large staffs and significant expenditures.

Over time, however, environmental law systems have introduced more efficiency-conscious instruments. Many regulatory programs must at least conduct cost–benefit and technological feasibility analyses (Revesz, 1999; Hahn & Sunstein, 2002) or at least contain legal provisions to exempt certain societally desired activities from inefficient regulation. Moreover, modern regulatory programs have brought to the fore an array of new forms of instruments, such as cap-and-trade pollution programs and habitat offset banking, which rely on market forces and self-regulation to produce more efficient system operation (Esty, 2019; Gunningham & Grabosky, 1999).

Institutional efficiency is also a factor. Budgets for environmental agencies have been held static or reduced in many nations, driving a "more for less" scarcity of resources that has forced agencies to be more efficient (Nash et al., 2017). There is intense debate over how far to go in this direction but enhancing efficiency of administration and efficiency of outcome has been an unmistakable trend in modern environmental law systems, particularly in comparison to their earliest forms.

Scalability

Modern environmental law includes many mechanisms to promote robustness to changes to the size and complexity of the system as a whole. The air pollution problem, for example, operates at many scales from local to global, and environmental law systems have scaled accordingly. Some air pollutants are regulated for their local impacts as well as for their nationwide ambient impacts, and laws like the U.S. Clean Air Act include different mechanisms for each. Environmental law systems have also massively scaled in scope without falling apart, particularly as new environmental problems arise. The EU's environmental law system, for example, did not exist 50 years ago but today is considered one of the most expansive, complex, and intensive regulatory interventions found in law (Langlet & Mahmoudi, 2016). A multitude of other bilateral and regional treaties exists to manage environmental issues such as water regimes and trade (de Chazournes, 2013). On the other hand, environmental law has

had less success maintaining viability at global scales. There are some success stories, such as the reduction of ozone precursor chemicals, but less traction has been gained on problems like climate change and ocean plastics pollution. There are many reasons for this beyond the capacity of environmental law systems, but it does appear that scalability becomes a severe problem for environmental law once it moves beyond regional scales.

Modularity

Environmental law's robustness to structured component rearrangements has varied largely due to broader background governance structures of relevant jurisdictions. For example, in theory at least, the federalist structure of nations like the United States allows one level of authority to step in to address a regulatory problem when other levels do not. One argument for a strong federal role in U.S. environmental law was to counter the perceived race to the bottom by states as they prioritized economic development (Lazarus, 2004), which has also been a justification given for the development of robust EU level law in Europe (Langlet & Mahmoudi, 2016). On the other hand, U.S. states like California and Oregon have often outpaced the federal government in pursuing environmental protection through their environmental law systems. There are also oftentimes multiple agencies and other entities working across the same level of authority, with overlapping and complementary roles (Freeman & Rossi, 2011; Salzman & Ruhl, 2010). This system of systems has built extensive modularity in the United States and other federalist environmental law systems employing the same kind of cooperative federalism. Modularity also allows for smaller scale experimentation, which is less risky in the face of uncertainty than large scale (as well as easier to adjust if it proves wrong). One criticism of the strong federal role in environmental law is that it does not provide sufficient space for local innovation, even when designed as so-called cooperative federalism. More centralized systems may trade off modularity in favor of efficiency or scalability, as keeping the cooperative federalism model running imposes redundancies and coordination costs.

Evolvability

As previously noted, modern environmental law is in many ways an evolutionary story, tracing its roots back over a century in many nations. It is as well an ongoing system of evolution, as new institutions and instruments appear, and some disappear, over time to adjust to new challenges and calibrate to new ways of governing. The 1970s saw the statutory revolution in the United States and the creation of the EU's system, and both have since incorporated new techniques, such as market-based approaches and goal-based framework regulation, and taken on new problems such as climate change. Some even argue that environmental law is undergoing yet another evolutionary era as private environmental governance structures such as supply chain management present potential gains on environmental quality that would be difficult to realize using only public governance mechanisms (Vandenbergh & Gilligan, 2017). Yet, there is growing concern that the type of wicked problems operating at global scales, such as climate change and biodiversity loss, are moving at so rapid a pace that environmental law may not have the adaptive capacity to keep up.

Future Research Pathways for Resilient Legal Systems: The Adaptive Governance Frame

The rise of complexity science and resilience thinking as serious and influential disciplines has helped put meat on the bones of the claim that legal systems are complex and resilient, and resilience thinking's analytical framework for studying social-ecological systems situates legal systems within the larger system of systems (Fischman, 2019). Future application of resilience thinking to legal systems, therefore, must start with the recognition that law is but one mechanism of governance within large-scale social-ecological systems (Drahos & Krygier, 2017; Gunningham & Grabosky, 1999). Legal system resilience might obstruct overall governance resilience, such as by crowding out or prohibiting innovative private actor solutions or by suppressing progressive cultural norms. Or legal system resilience may be absolutely necessary to serve social goals, in which case the challenge of balancing reliability, efficiency, scalability, modularity, and evolvability will be ever present. Ultimately, though, most policy decisions require at least some legal framing, so legal system resilience is rarely not a concern (Black, 2012). Choices about legal system resilience—how much of it to have and how to achieve that goal—are thus part of a broader governance regime facing questions like these across many social systems (Frohlich, Jacobson, Fidelman, & Smith, 2018; Lebal, Anderies, Campbell, & Hatfield-Dodds, 2006; Sellberg, Ryan, Borgstrom, Norstrom, & Peterson, 2018).

Reflecting this awareness, in recent years legal system resilience has been taken up as part of a more comprehensive research agenda focused on adaptive law to support adaptive governance. Adaptive law refers to the design of legal systems, institutions, and instruments intended to facilitate flexibility, resilience, and dynamism in the management of complex social-ecological systems. It has emerged in theoretical literature and practical implementation largely as a response to perceived inadequacies of conventional regulatory law, particularly law governing environmental and natural resources management.

Conventional regulatory regimes, often referred to as the command-and-control approach, rely on centralized regulatory institutions, rigid rules and standards, permitting programs demanding extensive front-end assessment of an action's impact, extensive postdecision litigation, and limited opportunity at the back end for administrative adjustment of those decisions (Craig & Ruhl, 2014). While credit is due to such approaches for the immense progress they have achieved in improving environmental and natural resources conditions (Lazarus, 2004), there is a growing perception among scientists and policymakers that the major challenges on the horizon, such as climate change, biodiversity degradation, and widespread ecological disturbance, are so complex, evolving, interconnected, and large in scale that different governance approaches are needed. Recognizing that social and ecological systems are linked in a system-of-systems dynamic, legal theorists and practitioners of adaptive law embrace law as part of social-ecological systems. Legal regimes must therefore not only consider the complex adaptive qualities of social-ecological systems, but also must themselves achieve appropriate resilience and adaptive capacity.

Broadly speaking, adaptive law is one component of the mesolayer fitting between adaptive governance at the macrolevel and adaptive management decision-making at the

microlevel. Adaptive governance integrates adaptive law, and adaptive law integrates adaptive management. To understand adaptive law, therefore, requires some attention to the concepts of adaptive governance and adaptive management, their historical development, and their relation to adaptive law in theory and practice.

Adaptive governance has been defined as "governance that allows emergence of collective action capable of facilitating adaptation to change and surprise as well as the capacity itself to evolve" (Cosens et al., 2018, p. 6). Governance is composed not only of government institutions but also of private and other social actors influencing social-ecological system policy through markets and other social networks (Chaffin, Gosnell, & Cosens, 2014; Vandenbergh & Gilligan, 2017). Adaptive governance focuses on increasing cross-scale interactions and social networks among stakeholders within the governance system (Frohlich et al., 2018; Karpouzoglou, Dewulf, & Clark, 2016). Adaptive governance encourages matching the scales of government and nongovernmental authorities to the scales of the social-ecological system being governed by employing multiple units of power, operating at multiple scales, to create partially redundant and overlapping public and private authorities to act. This polycentric structure enables decision-making to operate closer to the social or environmental issue demanding an action, by increasing local authority management capacity while retaining networks across horizontal, vertical, and diagonal dimensions within the network of governance actors. As such, the polycentric model can actually enhance modularity, scalability, and efficiency at the same time, since it is not only highly inefficient to create a formal entity at the scale of every problem, in the face of uncertainty, it is impossible to do so. Thus, through the self-organization of responding networks the scaled response must emerge rather than be designed.

Adaptive law facilitates adaptive governance. Although there are other mesoscale components necessary to achieve the promise of adaptive governance, such as social norms and financial capital, law in both its private and public forms is central to operationalizing adaptive governance. Adaptive law searches for arrangements of legal institutions and instruments, operating in public, private, and hybrid spheres, that optimize the opportunities for adaptive capacity at macroscales of social-ecological system management.

Adaptive law traces its roots to critiques of conventional command-and-control regulatory models, emerging in the 1980s, that advocated greater reliance on market-based and information-based instruments, such as habitat credit banking, pollution cap-and-trade programs, and pollution emission disclosures (Stewart, 2001). These so-called next-generation approaches, however, were intended primarily to *reduce* the need for expert administrative decision-making at microscales by leveraging the dynamic forces of market mechanisms and information disclosure (Bevir, 2012; Craig & Ruhl, 2014; Dorf & Sabel, 1998). Statutes and regulations established the market and information disclosure regimes, which were broadly overseen by administrative authorities, but turned over ultimate decision-making in the field to market transactions and the reputational and network impacts of information disclosure.

By the mid-1990s, it had become increasingly apparent that even these innovations in decision-making, while producing some very positive outcomes, were not up to the task of supporting adaptive governance of complex social-ecological systems or increasingly complex, globalized social systems in general (Dorf & Sabel, 1998). The coupled concepts of

goals-based ecosystem management and its decision-making methodology of adaptive management became a focus for theoretical design and practical implementation for these large scale social-ecological system management challenges (Williams & Brown, 2014). Contrary to the market and information mechanisms, adaptive management *increases* the decision-making engagement of expert agencies; but also, contrary to the command-and-control approach, does so in a way that encourages a learning-by-doing culture by allowing agencies responsible for social-ecological system management to set goals, test hypotheses, implement planned actions, monitor results, and adjust approaches without undergoing the heavy procedural burdens of conventional regulatory regimes (Craig & Ruhl, 2014).

Adaptive management principles were quickly embraced by resource management agencies around the globe (Frohlich et al., 2018; Williams & Brown, 2012). At the same time, increasing concern over the global-scale impacts of climate change, biodiversity degradation, and large-scale ecological impairment led to greater attention for building more robust social-ecological system resilience and adaptive capacity. Efforts to implement adaptive management within the traditional technocratic framework failed in application to large-scale systems including the Florida Everglades (Gunderson et al., 2014) and the Columbia River (Lee, 1999; Volkman & McConnaha, 1993). Legal scholars began to focus on the governance regime in which adaptive management of complex social-ecological systems might work (Cosens et al., 2018; Cosens & Gunderson, 2018). Whereas adaptive management focuses on *instrument* design for decision-making at the microscale, this new movement focused on *governance* design to promote adaptive capacity at the macroscale of social-ecological system management more broadly. Early manifestations, sometimes referred to by legal scholars as the "new governance" movement, emphasized polycentric, redundant, interdisciplinary governance institutions, as well as reliance on flexible regulatory instruments including adaptive management and market and information based instruments and increased public–private interaction (Cosens et al., 2018). Over time, other research disciplines including political science, sociology, ecological economics, and natural resources management began emphasizing adaptation and resilience as qualities of governance necessary to manage complex social-ecological system. They referred to this new configuration of institutional design and capacity as adaptive governance, which is generally the more accepted term today for new governance that includes flexibility and learning by doing (Chaffin et al., 2014).

Although achieving adaptive governance does not necessitate employing adaptive management and employing adaptive management does not guarantee achieving adaptive governance, most theorists and practitioners suggest that the two are reinforcing and should go hand in hand (Folke, Hahn, Olsson, & Norberg, 2005). What sits between and connects them at the mesoscale includes, principally, legal systems such as environmental law. Environmental law can support adaptive governance and utilizes adaptive management to do so. Yet, it had grown increasing apparent by the early 2000s that environmental law, after decades of command-and-control regime implementation, had become deeply embedded with the rigid attributes of conventional resource management law, as previously described, and was an obstacle to both implementing adaptive management and facilitating adaptive governance. In particular, conventional resource management regimes traditionally have relied on siloed authorities conducting purportedly comprehensive predecision impact assessment

and subjecting those authorities' decision processes to extensive opportunity for public intervention and probing postdecision judicial review (Bevir, 2012; Dorf & Sabel, 1998; Soininen et al., 2019). Although each of these design features responds to central goals of good governance, such as transparency, legitimacy, and accountability, each also impedes the flexibility and dynamism needed for both adaptive governance and adaptive management.

Growing increasingly aware of this inherent tension, legal, policy, and resource management scholars and practitioners have begun forging new ground in legal theory aimed toward achieving more adaptive forms of law intended on the one hand to robustly support adaptive social-ecological system governance and embrace adaptive management's iterative decision-making style, but on the other hand not to undermine the goals of transparency, legitimacy, and accountability (Cosens, 2013; Craig et al., 2017; DeCaro, Chaffin, Schlager, Garmestani, & Ruhl, 2017; Soininen & Platjouw, 2019). It is a balancing act, but one that is unavoidable. As previously noted, the premise of adaptive governance is that social-ecological systems are complex adaptive systems in which legal systems are embedded and co-evolving. The challenge for design of adaptive law therefore is to take the complex adaptive qualities of a social-ecological system into account while also taking into account that the legal system is embedded in these social-ecological systems and thus itself is a complex adaptive system.

Responding to that challenge, the building literature on adaptive law identifies several key features of what defines adaptive law and how to build it out in robust, durable forms. Adaptive law involves iterative processes that stimulate monitoring and evaluation of social-ecological systems to identify changes and/or generate new knowledge that can inform adjustments in both governance and management systems, including opportunities for legal reform (i.e., the adjustment of the legal regime of the entities involved). Importantly, it is widely agreed that there is no set formula for achieving adaptive law or that there is some optimal set of institutions and instruments that will necessarily be the most adaptive. Rather, theorists have proposed, and practitioners have tested, a broad array of strategies. What constitutes adaptive law, in other words, is an ever-evolving work in progress. Nevertheless, some core goals and principles have emerged in adaptive law theory and practice.

Synthesizing these concepts with resilience thinking, Cosens et al. (2017) identify the three governance aspects manifested through law and unpack the qualities that distinguish adaptive law from conventional regulatory models. *Structure* has to do with the way in which governance institutions are constructed, interconnected, and operationalized through law. Adaptive law promotes structure that is polycentric, integrated, and persistent. *Capacity* speaks to the resources and authority of governance to adapt. Adaptive law that is resilient promotes adaptive and participatory capacity. Lastly, *process* involves how the structure exercises its capacity. Adaptive law promotes process that is legitimate, just, problem-solving, reflective, dispute resolving, and balanced between stability and flexibility. The latter quality—the optimal trade-off between stability and flexibility that produces neither too much rigidity nor too much room for arbitrary decision-making—is perhaps the one that will be most vexing for legal theorists and practitioners to design and implement (Craig et al., 2017; Craig & Ruhl, 2014; Frohlich et al., 2018). Substantive weighing and balancing of norms, combined

with procedural safeguards such as the administrative and judicial reason-giving requirement, have been proposed as partial solutions to this problem (Soininen, 2016).

Needless to say, forging adaptive governance theory is a work in progress, and applying it in real-world contexts will no doubt run into many barriers (Sharma-Wallace, Velarde, & Wreford, 2018). But the growing consensus among governance theorists is that conventional governance systems are simply not well-equipped to manage the kinds of problems facing complex social-ecological systems around the globe. Problems such as climate change, biodiversity loss, and water scarcity will test the resilience of social-ecological systems, which in turn will test the resilience of legal systems. Just as any other natural or social system must build adaptive capacity to manifest resilience, so too will a new model of adaptive law be needed, and soon.

Conclusion

Resilience thinking has profound implications for law and its capacity to support adaptive governance. Law is a complex adaptive system comprised of institutions and instruments at multiple levels ranging from international to local and regulating most aspects of human activity, either directly or indirectly. But law does not do so from outside other social systems; rather, it co-evolves with them in a system-of-systems network. As a system within a system, law has resilience features that can be characterized along the lines of general resilience theory: it exhibits properties of reliability, efficiency, scalability, modularity, and evolvability. One of law's main functions is to govern human activity so that the resilience of other systems (ecosystems, markets, cities etc.) can be managed effectively, efficiently, and legitimately. Hence, law is inherently a case multisystemic resilience—we must manage legal system resilience to manage resilience of other social systems. Adaptive governance is a theoretical framework and a set of principles for managing the resilience of systems to societally desired ends. Legal system resilience, managed properly, produces the adaptive law needed to support adaptive governance.

To be sure, these are broad and lofty principles. They chart a new direction in governance theory and practice, one aimed at bringing law in tune with the complex adaptive system qualities of social-ecological systems and of law itself. The challenges to social-ecological system resilience around the globe, on the near and distant horizons, demand nothing less of law and its resilience.

Key Messages

1. Law is a complex adaptive system comprised of institutions and instruments at multiple levels ranging from international to local and regulating most aspects of human activity either directly or indirectly.
2. As a system, law has resilience features that can be characterized along the lines of general resilience theory: (a) reliability, (b) efficiency, (c) scalability, (d) modularity, and (e) evolvability.

3. One of law's main functions is to govern human activity so that the resilience of other systems (ecosystems, markets, cities, etc.) can be managed effectively, efficiently, and legitimately.
4. Adaptive governance is a theoretical framework and a set of principles for managing the resilience of systems for socially desirable ends.

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