Uncommon Approaches to Commons Problems: Nested Governance Commons and Climate Change[†] [‡]

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Natural capital resources crucial to combatting climate change are potentially subject to tragic overconsumption absent a requisite degree of vertical government regulation of resource appropriators and/or horizontal collective action among resource appropriators. In federal systems, these vertical and horizontal approaches may (or may not) take place in any one of four scales—local, state, national, and global—"nested" one within another. Prior research has described how natural capital in federal systems of government, though privatized and/or subject to government regulation, may nonetheless remain in a tragic plight due to the allocation of governance authority in federal systems—an allocation that may or may not legally entrench the commons dynamic. This Article builds on that research to present a clearer picture of the complexity of natural capital resource commons and does so by first deconstructing the nested commons scales and describing for the first time a number of legal authority and political action scenarios that may either resolve natural capital commons dilemmas or facilitate commons tragedies within the scales of a federal governance structure. The Article then details the "divergent" vertical regulatory and horizontal collective action approaches to managing climate-crucial natural capital within each scale. The Article concludes by pointing toward future scholarship exploring how these "divergent" approaches within scales can become "convergent" by taking into account both legal constraints that may exist on vertical regulation across scales as well as geopolitical circumstances positively or negatively impacting political action within scales. This convergent approach encourages the proper management of natural capital resources by more fully accounting for the complexities of the federal governance commons.

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† This Article is dedicated to the memory and scholarship of Elinor Ostrom, who inspired this work and many others during her long and impactful career.

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Introduction and Theoretical Content

Commons resources are at risk of being tragically over-consumed absent some mechanism to adjust the potential self-interested rationality of commons users. Scholars have thoroughly analyzed three primary mechanisms that may be used to rein in the potential rationality of commons appropriators: (1) government regulation, (2) private property rights, and (3) the "successful collective action" model developed by 2009 Nobel Prize winner Elinor Ostrom. These mechanisms are implemented in a variety of ways. Some natural resources are subject almost exclusively to a private property rights solution, while others are owned or managed exclusively by the government. Other resources are both privatized and subject to government oversight in their management. Yet others may constitute the purest form of a commons, subject neither to private property rights nor government regulation, being managed directly by a common pool of users.

While appropriators of resources may certainly self-regulate and act against rational self-interest by altruistically managing the resources over which they maintain control in a sustainable manner, appropriators often act in their rational self-interest in the absence of a suitable degree of higher-level government intervention ("vertical coordination") or purposeful, coordinated collective action with other horizontally situated actors (what we also refer to throughout this Article as "self-coordination").[1] Such is the case in the United States for many types of resources—or what we also refer to here as "natural capital"—that act as either significant carbon sources or sinks and are therefore crucial to regulating climate change. Many of these resources, even if privatized, are not managed pursuant to a cooperative self-coordinated strategy and may not be subject to government regulatory inputs designed to achieve the objectives of much needed climate change policy.

Whether it be forests, terrestrial or coastal wetlands, or agricultural resources, a wide range of management approaches may be implemented—or perhaps more frequently *not* implemented—both horizontally within levels of government (global, national, state, or local) or among private property owners, and vertically across levels of government and private properties. These approaches may have potentially tragic consequences for natural capital crucial to regulating climate change. Assume, for example, that state governments are actors appropriating natural capital on one scale of governance—the "national scale."[2] The federal government currently maintains no direct inputs into the management of 60% of U.S. forests, which are privately owned and subject almost exclusively to state regulatory authority. This represents the *vertical component* in which a higher level of government, the federal government, manages (or fails to manage) natural capital by regulating resource appropriation within state jurisdictions, situated one scale down. Simultaneously, state governments' forest management policies are all over the board on their level of regulatory stringency. While some states maintain fairly stringent forest management standards, others, particularly in the Southeast, maintain none at all. This represents the *horizontal component* in which actors appropriating natural capital on the same scale manage (or fail to manage) natural capital through collective action. This description presents a classic tragedy of the commons problem, whereby a number of actors (here, the fifty state

1. Throughout this Article we use the phrases "horizontal collective action" and "horizontal self-coordination" interchangeably.

2. Throughout this Article, we refer to local, state, and national governments as "appropriating" resources similar to herders on an open pasture. We do not mean that they are necessarily engaged in direct appropriation, though that may certainly be the case. Rather, these governments most often facilitate private appropriation activities through the stringency (or lack thereof) of their rules for natural capital appropriation.

governments) may act as rational herders and appropriate resources from a single resource system (forests within the United States), with many states doing so without instituting appropriate mechanisms of resource management. It is perhaps no surprise, then, that the U.S. Forest Service projects that urbanization and other factors will remove 13% of all southeastern forests over the next fifty years, not only creating a significant source of carbon but also removing a crucial carbon sink.[3]

While this example analyzing one scale of governance helps illustrate the classic tragedy of the commons scenario, natural capital resources like U.S. forests are subject to a far more complex commons phenomenon than the classic case—a complexity that arises out of a *three-dimensional* vertically and horizontally integrated resource management arrangement that is exemplified by a federal governance structure. Indeed, descriptions of commons resources and solutions for their management are often oversimplified. In the United States, given that there is very little natural capital subject to a pure common-pool arrangement, the resource management challenge is often framed, somewhat two-dimensionally, as about striking the appropriate balance between the two extremes of private property and government regulation, or about preserving the values of private property ownership in balance with the values that natural capital provides to the public at large.

One problem with this limited inquiry is that it presumes that once private property rights, government regulation, or both, are in place for managing natural capital, the commons dilemma has disappeared. This presumption is based on the belief that while there were once resources open to all and subject to tragic overconsumption, now those resources are either privatized or regulated, thereby eliminating the commons or associated tragedy. In reality, as described in recent scholarship,[4] the commons dilemma has not disappeared. Rather, both the entities labeled commons herders and the scale of the resource system to which they maintain access have simply shifted.

To see this more clearly, consider an illustration based upon key aspects of commons scholarship. Commons analysis is typically framed in the context of resource "appropriators" appropriating "resource units" of natural capital from a "resource system."[5]

The "scales" that we refer to in this Article contain "resource systems" that are geographically bounded by national, state, or local

3. DAVID N. WEAR & JOHN G. GREIS, U.S. FOREST SERV., THE SOUTHERN FOREST FUTURES PROJECT: SUMMARY REPORT 26–31, 35 (2011).

4. *See generally* Blake Hudson, *Federal Constitutions: The Keystone of Nested Commons Governance*, 63 ALA. L. REV. 1007 (2012); Jonathan Rosenbloom, *New Day at the Pool: State Preemption, Common Pool Resources, and Non-Place Based Municipal Collaborations*, 36 HARV. ENVTL. L. REV. 445 (2012).

5. *See infra* notes 14–17.

jurisdictional boundaries. In a federal system of government, there are several scales to which commons analysis may be applied. There is the national scale in which the national resource system is embedded, the state scale in which fifty distinct state resource systems are embedded, and the local scale in which thousands of local government resource systems and private property resource systems are embedded. Furthermore, each of these resource systems is embedded within the ultimate scale, the global resource system. As we adjust our focus from one type of resource system on one scale to another resource system on another scale, it is necessary to adopt a new perspective on both the entities considered herders on the commons and the common pool of natural capital to which these herders maintain access.

For example, on the national scale, states are the herders who may (or may not) horizontally coordinate their appropriation of resource units of natural capital from the national resource system, or whose appropriation may (or may not) be subject to vertical coordination by the federal government. Yet in shifting to the state scale, we see that local governments are the herders who may (or may not) horizontally coordinate their appropriation of resource units of natural capital from the state resource system, or whose appropriation may (or may not) be subject to vertical coordination by the state government (which is now the vertical actor rather than the horizontal actor, as on the national scale). Shifting scales allows us to see that in the absence of horizontal self-coordination or vertical regulatory coordination by a higher level of government, private property owners may act as herders on local commons, local governments as herders on the state commons, state governments as herders on the national commons, and national governments as herders on the global commons.

Another problem presented by the limited inquiry, most relevant for the purposes of this Article, is that it seemingly assumes that the interplay between appropriators, the commons, and associated resources is relatively identical regardless of (1) the scale on which the vertical or horizontal management approaches are implemented and (2) geopolitical and jurisdictional differences found among resource systems located on the same scale. The limited inquiry is again two-dimensional, oversimplifying both the vertical and the horizontal approaches to commons resource management. This oversimplification fails to fully account for legal differences in the various scales that affect the viability of vertical or horizontal management approaches across scales and also fails to take into account geopolitical differences that may arise among similarly situated horizontal actors that can affect their choice of horizontal versus vertical approaches.

Stated differently, there are two important components that together constitute a third dimension of federal governance commons

analysis. The first component is what we term "geolegal" differences across scales of governance.[6] These come in the form of legal constraints placed on either higher-level governmental entities that prevent vertical regulation or on higher- or lower-level entities that prevent them from taking successful horizontal collective action for resource management. These constraints may arise out of either constitutional or legislative restrictions—such as limitations on the federal government under Commerce Clause analysis or preemption of local government regulatory authority by state governments. The second component comes in the form of geopolitical differences horizontally across jurisdictions, whereby vertical or horizontal approaches to commons management may be more or less viable depending on the political circumstances in similarly situated horizontal regions.

The limited analysis would conclude that the government within *a single scale* vertically regulates to avoid the commons dilemma (the first dimension) or that actors horizontally coordinate in a way that avoids the commons dilemma (the second dimension), and that both horizontal and vertical action are equally viable as applied to, and take place in a uniform manner across, that single scale, thus ignoring geolegal constraints and geopolitical differences across and within scales (the third dimension). In fact, a federal system of government contains multiple two-dimensional (vertical-horizontal) scales stacked one on top of another, or "nested" one within another. So private property owners may horizontally coordinate with each other or be subject to higher levels of governmental authority, as may local governments, state governments, and even national governments. Furthermore, the multiple, two-dimensional scales of government are embedded in a three-dimensional structure created by distinct geolegal constraints vertically and horizontally across scales and geopolitical circumstances horizontally across jurisdictions. The geolegal and geopolitical environments being different across scales may influence how the herders view and interact with their respective commons and with each other.

By way of illustration and looking at the state scale in isolation, the limited analysis would simply consider whether the State of Alabama vertically regulates private forest management (the first dimension) or

6. Highlighting "geolegal" differences simply recognizes that vertical regulation and horizontal collective action do not take place in the same way within different scales due to different legal environments. For example, the federal government may be restrained from regulating some activities at the state and local levels because those powers are reserved to states under the Tenth Amendment. This is a geolegal difference from vertical regulation at the state level, where the same constitutional provision does allow the state to vertically regulate lower-level scales regarding that subject matter. "Geolegal" also encapsulates different legal circumstances across horizontal jurisdictions. For example, there are good arguments that the federal government may vertically regulate certain aspects of subnational forest management under the Commerce Clause, whereas the Canadian federal government clearly may not under the Canadian Constitution.

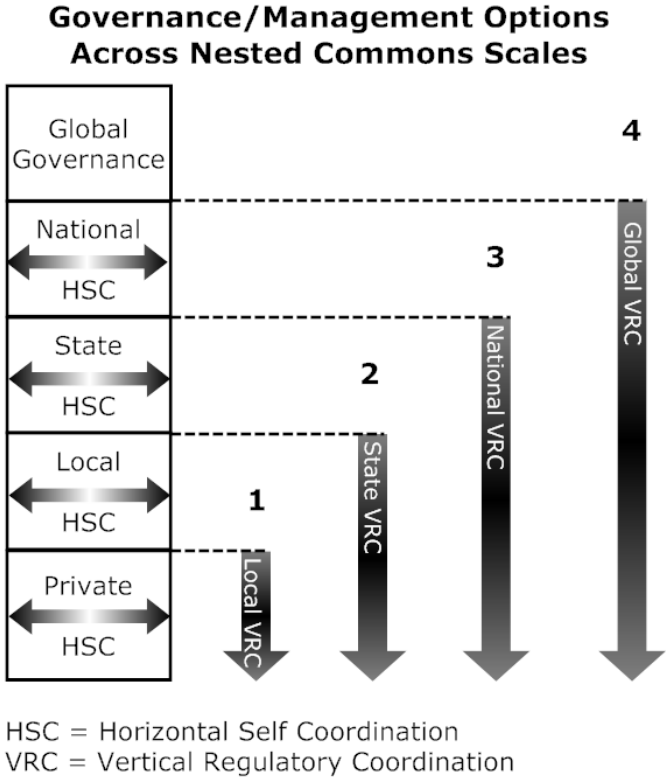
private foresters in Alabama horizontally coordinate their forest management activities (the second dimension), or some combination of the two, to avoid the commons dilemma. This two-dimensional analysis, however, ignores the fact that different scales might also maintain regulatory inputs into forest management, such as the federal government or Alabama's many local governments. Yet the viability of these regulatory inputs may be quite variable. The federal government, for example, may be subject to constitutional constraints on its authority to regulate private forests in Alabama under Commerce Clause analysis. Similarly, some states may legislatively preempt local governments from setting their own forest management standards in lieu of or supplemental to state mandates, while Alabama may encourage such supplemental regulation. Furthermore, the two-dimensional analysis overlooks the fact that a different balance of vertical regulation or horizontal collective action may manifest within the state scale in different regions of the United States. A vertical private forest management approach may be more likely, for example, in Oregon than in Alabama. In the same way, a vertical regulatory approach to regulating land-use planning related to urban growth boundaries might be more appropriate in the Pacific Northwest, since geopolitics makes such an approach more viable, whereas geopolitical considerations make a vertical regulatory approach far less viable in the southeastern United States.

Rather than grappling with this three-dimensional complexity, solutions to the primary problems associated with resource management are often framed as limitations on a readily identifiable number and type of externalities that may spill over jurisdictional boundaries with uniform geopolitical characteristics to create isolated environmental harms. Yet avoiding commons tragedies in the federal governance structure in which private property rights and government regulation are embedded will often require an adjustment of horizontal and vertical relationships among relevant actors within a single scale—the first and second dimensions—and consideration of the geolegal impacts stemming from multiple scales nested one within another and the geopolitical differences across horizontal scales—the third dimension. When scholars focus too acutely on the variety of externalities that exist even in the presence of private property rights or government regulation, the magnitude of the tragedy of the commons attributes of the problem is diminished.

Ultimately, the limited, two-dimensional vertical/horizontal analysis prevalent in current law and policy debates both overlooks the commons attributes of federal systems and ignores the fact that the federal system of government results in *multiple* two-dimensional vertical and horizontal relationships nested one within another that may influence the commons dynamic. It fails to holistically account for the many government scales vertically that may establish rules of resource management for private

properties or lower levels of government. Similarly, such analysis fails to account for the ways in which multiple actors on different scales (private property owners or various levels of government) may work simultaneously with other actors on the same plane to tackle commons challenges at each scale, and how their efforts may interact with vertically scaled governments. Once these considerations are fully integrated into commons analysis, we see that depending upon the relationship between private property rights and government regulation on any one scale, commons tragedies may yet occur for natural capital absent an adjustment in the relationship between the *multiple*, two-dimensional scales where horizontal coordination or vertical regulation may occur—again, nested one within another as depicted in Figure 1. The resource management challenge is anything but a two-dimensional balance within single scales of governance.

FIGURE 1



Importantly, the three-dimensional horizontal and vertical interactions themselves, particularly in a federal system of government, can act as what may be termed a "nested governance commons" within

which natural resource commons are embedded. Within each horizontal scale, the rules of resource management allowed by the governance framework (what we refer to here as "legal authority") and the resource management actions actually undertaken at that level (what we refer to here as "political action") interplay with the natural environment to provide a complete picture of the complexity of the commons, as herders may appropriate natural capital from each commons scale and across scales with tragic consequences. In the absence of a higher level of government maintaining legal authority or exercising political action to regulate, or in the absence of legal authority or political action to horizontally coordinate with each other, private property owners may act as herders within local government commons, local governments may act as herders within state commons, states may act as herders within national commons, and nations may act as herders within the global commons. The overlay of segmented vertical jurisdictions and vertical regulatory authority over a myriad of individual horizontal jurisdictions creates a nested commons that is especially salient within federal systems of government, like the United States, where regulatory governance jurisdictions are legally divided both horizontally and vertically.

This Article builds on and merges prior research by each of the Authors, further refining an examination of the complexity and operation of this three-dimensional nested governance commons within which natural capital is managed. It offers a more precise, theoretical conception of commons solutions addressing the nested federal system commons. This Article begins to deconstruct the three dimensions by looking primarily at the first two dimensions described above: horizontal versus vertical mechanisms for managing natural capital commons within successive, nested scales. (The further complexities provided by the third, geolegal-geopolitical dimension will be the focus of future scholarship building on this Article.)

Part I provides a basic background on the tragedy of the commons and the resources at which the various mechanisms of commons management have traditionally been directed, including traditional natural capital crucial to climate regulation. This Part next examines federal systems of government within which natural resource commons are embedded as a nested governance commons, which in turn may be considered a "new commons" resource in the commons lexicon. Part II next attempts to "de-nest" the nested federal governance commons within which natural resource commons are embedded. This Part dissects the cross section at which the natural resource commons and nested governance commons meet, and how commons problems may either arise or be resolved in the presence of a variety of scenarios depending upon the presence of government legal authority, governmental political action, or both, within each scale.

Part III then provides tangible examples exemplifying the divergent (or uncommon)[7] approaches that may be implemented within each individual, isolated scale to avoid tragedies for natural capital crucial to combatting climate change—namely horizontal self-coordination within the scale or vertical regulatory coordination by the governmental entity the next scale up. Part III's discussion lays the foundation for future research exploring a convergent (or common) approach to addressing commons problems. Analysis of a convergent approach to tackling commons problems necessarily takes into account the various complexities arising at the vertical/horizontal intersection of natural capital commons in the context of the third dimension discussed above—the legal and political differences across vertical and horizontal jurisdictions in the United States—which lends itself to a more nuanced analysis.

I. COMMONS RESOURCES AND MANAGEMENT

A. TRAGEDY OF THE COMMONS

Garrett Hardin's oft-cited[8] *Tragedy of the Commons*[9] has had a profound impact on the shape and structure of environmental policy. In particular, Hardin's article has proven to be the genesis of a body of commons scholarship that has since evolved to inform key aspects of law and policy, economics, political science, and a variety of other fields.

The *Tragedy of the Commons* describes a field open to herders of cattle, each of whom is grazing in the pasture. This "commons" is "open access," with each relevant actor on the commons (or pasture) maintaining the right to use the "commons resource" (or grass) as much as possible and with no ability to exclude other actors from doing so. In the *Tragedy of the Commons*, the open nature of the commons allows each herder to make a "rational" calculation to continually add cattle to the herder's respective herd in an effort to maximize personal economic gain. Though each herder gains the entire benefit of each additional animal, the negative cost of overgrazing is spread among all herders—while the commons is open to all, the system of natural capital present upon it is closed and limited. The tragedy occurs when each herder determines that it is always in the herder's best interest to add more cattle, since individual returns will always far outweigh individual costs. Eventually, without some

7. We do not use the term "uncommon" here to mean low frequency or rarity, but rather to indicate that the two approaches we highlight—vertical regulatory coordination and horizontal self-coordination—have nothing in common with each other, being on opposite ends of the commons solution spectrum.

8. *See* KARLSON "CHARLIE" HARGROVES & MICHAEL H. SMITH, THE NATURAL ADVANTAGE OF NATIONS: BUSINESS OPPORTUNITIES, INNOVATION AND GOVERNANCE IN THE 21ST CENTURY 178 (2005) ("Hardin's paper is one of the most cited papers of the last 40 years.").

9. Garret Hardin, *The Tragedy of the Commons*, 162 SCIENCE 1243 (1968).

coordinating force arising either internally from the collection of individuals or externally from an outside authority, each individual's exercise of rational self-interest results in overconsumption of the natural capital and ultimately its complete and tragic elimination from the system.

B. Commons Resource Management, Traditional Natural Capital Commons, and Climate Change

1. Commons Resource Management

Commons scholars have settled on two key elements that define commons resources: depletability and non-excludability. Robert Keohane and Elinor Ostrom characterize commons resources as "depletable natural or human-made resources from which potential beneficiaries are difficult to exclude,"[10] while Oran Young similarly describes them as resources "used by a group of appropriators that is both non-excludable and depletable."[11] Stated differently, commons resources are "natural or human-made resources in which (a) exclusion is non-trivial (but not necessarily impossible) and (b) yield is subtractable."[12] As a simple illustration, the grass resource consumed by one herder is no longer available to others (depletable), and it is very difficult to exclude any one herder from consuming the resource (non-excludable).

The environment within which commons resources exist is known as a "resource system,"[13] which is comprised of "resource units," which are "what individuals appropriate or use from resource systems."[14] Resource units "*are not subject to joint use or appropriation*,"[15] meaning that appropriators *can* exclude other appropriators from the resource unit itself. Rather, the non-excludability requirement for a commons resource means it is exceedingly difficult to exclude other appropriators from the

10. Robert O. Keohane & Elinor Ostrom, *Introduction*, *in* Local Commons and Global Interdependence 1, 13 (Robert O. Keohane & Elinor Ostrom eds., 1995). Duncan Snidal asserts that commons analysis "focuses on the provision and appropriation of goods that are not joint in consumption (like private goods) but where exclusion is difficult (like public goods). Standard cases are natural resources, like forests or water, where the quantity available is less than the desired consumption of potential appropriators." Duncan Snidal, *The Politics of Scope: Endogenous Actors, Heterogeneity and Institutions*, *in* Local Commons and Global Interdependence, *supra*, at 47, 50.

11. Oran R. Young, *The Problem of Scale in Human/Environment Relationships*, *in* Local Commons and Global Interdependence, *supra* note 10, at 27, 29.

12. Steven Hackett et al., *Heterogeneities, Information and Conflict Resolution: Experimental Evidence on Sharing Contracts*, *in* Local Commons and Global Interdependence, *supra* note 10, at 93, 95.

13. Ostrom cites fishing grounds, groundwater basins, grazing areas, irrigation canals, bridges, parking garages, mainframe computers, streams, lakes, oceans, and other bodies of water as examples of "resource systems." *See* Elinor Ostrom, Governing the Commons: The Evolution of Institutions for Collective Action 30 (1990).

14. *Id.*

15. *Id.* at 31.

resource system. As described in prior research,[16] a fundamental understanding of the relationship between a resource unit and the resource system is important for arguments in this Article related to scale, which depend a great deal upon how one defines both the resource unit and the resource system. Here, for example, a resource unit may be defined by private property, local, state, or national geopolitical boundaries, and the resource system is the higher-level geopolitical jurisdiction that contains those respective resource units.

Finally, the act of withdrawing resource units from a resource system is the act of "appropriation," while those who withdraw resource units from a resource system are "appropriators."[17] Mechanisms aimed at preventing tragic over-appropriation of commons resources historically have taken one or a combination of three primary forms. On one end of the spectrum is government regulation, whereby an external authority mandates rules for herder appropriation of the resource and regulation of how appropriation occurs. On the other end of the spectrum is privatization, whereby an external authority establishes rules for "fencing" the commons and allocating property rights. In this way, each herder is thought to have a privatized interest in preserving the resource on a specific and dedicated portion of property. Highlighting a third mechanism, Ostrom argued that neither regulation nor privatization is a *necessary* component of sustainable commons management. Ostrom argued:

> One set of advocates presumes that a central authority must assume continuing responsibility to make unitary decisions for a particular resource. The other presumes that a central authority should parcel out ownership rights to the resource and then allow individuals to pursue their own self-interests within a set of well-defined property rights. Both centralization advocates and privatization advocates accept as a central tenet that institutional change must come from the outside and be imposed on the individuals affected. Despite sharing a faith in the necessity and efficacy of "the state" to change institutions so as to increase efficiency, the institutional changes they recommend could hardly be further apart.[18]

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16. *See* Hudson, *supra* note 4.

17. *See* Ostrom, *supra* note 13, at 31. Ostrom gives numerous examples of appropriators, such as herders, fishers, irrigators, commuters, and "anyone else who appropriates resource units from some type of resource system." *Id.*

18. *Id.* at 14. Furthermore, Ostrom argues that

> [a]n assertion that central regulation is necessary tells us nothing about the way a central agency should be constituted, what authority it should have, how the limits on its authority should be maintained, how it will obtain information, or how its agents should be selected, motivated to do their work, and have their performances monitored and rewarded or sanctioned. An assertion that the imposition of private property rights is necessary tells us nothing about how that bundle of rights is to be defined, how the various attributes of the goods involved will be measured, who will pay for the costs of excluding nonowners from access, how conflicts over rights will be adjudicated, or how the residual interests of the

Ostrom argued that advocates of both privatization and government regulation are "too sweeping in their claims," and that "neither the state nor the market is uniformly successful in enabling individuals to sustain long-term, productive use of natural resource systems."[19]

Invoking Thomas Hobbes,[20] Ostrom challenged the idea that government regulation—the "external Leviathan"—is the "only way" to resolve commons problems, as has been argued by some scholars.[21] Such a presumption has led scholars to recommend that central governments control most natural resource management within nations, whereby the "central authority will decide who can use the meadow, when they can use it, and how many animals can be grazed."[22] Yet central governments often do not maintain sufficient information to estimate the carrying capacity of commons resources or to design the appropriate penalties to induce behavioral change and to implement sufficient monitoring and enforcement. As a result, resource management policies are often ineffective and result in continued resource degradation.[23] It is perhaps no surprise, then, that federal systems of decentralized resource governance arose to cure central government deficiencies by harnessing the access to information maintained by subnational governments and the responsiveness of citizens more directly involved in resource appropriation and management.

Ostrom also challenged arguments of other scholars that stringent imposition of private property rights is the "only way" to prevent commons tragedies.[24] Privatization "would divide the meadow in half and assign half of the meadow to one herder and the other half to the second herder."[25] As Ostrom asserted, however, "each herder will be playing a *game against nature* in a smaller terrain, rather than a game against another player in larger terrain."[26] In other words, individuals may pit themselves against natural capital on private properties, often tragically appropriating it and replacing it with human-made capital,[27] even if the provision of private property rights allows them to exclude other appropriators from the property. In addition, a variety of market failures

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right-holders in the resource system itself will be organized.

Id. at 22.

19. *Id.* at 1.

20. THOMAS HOBBES, LEVIATHAN (Ian Shapiro ed., 2009).

21. *See* OSTROM, *supra* note 13, at 8.

22. *Id.* at 9.

23. *See id.* at 17.

24. *See id.* at 12.

25. *Id*.

26. *Id*.

27. Human-made capital includes "factories, buildings, tools, and other physical artifacts usually associated with the term 'capital.'" Robert Costanza & Herman E. Daly, *Natural Capital and Sustainable Development*, 6 CONSERVATION BIOLOGY 37, 38 (1992).

and externalities, such as imperfect information, "free-riders," transaction costs, and collective action problems lead to continued environmental destruction even in the presence of a private property rights system.[28]

As an alternative to these two extremes, Ostrom put forth what might be termed a "successful collective action model," arguing that herders are not inevitably locked into a tragic fate and that a variety of case studies demonstrate successful collective action to protect resources in the absence of private property rights or government regulation. Ostrom noted that "the capacity of individuals to extricate themselves from various types of dilemma situations *varies* from situation to situation"[29] and that instead "of presuming that some individuals are incompetent, evil, or irrational, and others are omniscient, I presume that individuals have very similar limited capabilities to reason and figure out the structure of complex environments."[30] Ostrom and other commons scholars building on her research have provided robust insights into the circumstances[31] under which groups of individuals have engaged in successful collective action to sustainably manage resources in the absence of private property rights or governmental regulatory intervention.[32]

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28. *See* Amy Sinden, *The Tragedy of the Commons and the Myth of a Private Property Solution*, 78 U. COLO. L. REV. 533, 538 (2007). *See generally* ERIC T. FREYFOGLE, THE LAND WE SHARE: PRIVATE PROPERTY AND THE COMMON GOOD (2003); Robert C. Ellickson, *Property in Land*, 102 YALE L.J. 1315 (1993).

29. OSTROM, *supra* note 13, at 14.

30. *Id.* at 25.

31. These circumstances include: (1) the boundaries of both the resource system and the parties who may appropriate resources are clearly defined; (2) appropriation and provision rules match (or are "congruent" with) local conditions, meaning rules restricting time, place, technology, and quantity of resource units that may be appropriated are related to those conditions; (3) most all appropriators have collective choice rights allowing them to participate in modifying operational rules; (4) monitors of rules and behavior are accountable to appropriators or are appropriators themselves; (5) appropriators who violate rules are likely to be assessed graduated sanctions; (6) adequate conflict-resolution mechanisms are low-cost and may be accessed quickly; (7) the rights of appropriators to devise their own institutions are not challenged by external governmental authorities; and (8) appropriative, monitoring, enforcement, and conflict resolution activities are organized in multiple layers of nested enterprises. *See id.* at 90. An article reviewing ninety-one empirical studies applying Ostrom's design principles found that

> the principles are well supported. The most trenchant critiques were abstract, rather than empirical. This does not mean that the principles are complete; their incompleteness is the most important empirical critique we found in the literature. Other factors such as the size of user groups, differing types of heterogeneity within or between user groups, and the type of government regime within which users operate are clearly important in many cases.

Michael Cox et al., *A Review of Design Principles for Community-Based Natural Resource Management*, 15 ECOLOGY & SOC'Y 38, 52 (2010).

32. Such groups include communities managing meadows and forests in Torbel, Switzerland, and Hirano, Nagaike, and Yamanoka villages in Japan, as well as communities managing irrigation systems in Valencia, Murica and Orihuela, and Alicante, Spain, and in the Philippines. *See* OSTROM, *supra* note 13, ch. 3. Importantly, many of Ostrom's design principles "appear relevant to resolve problems of international cooperation as well as those at a strictly local level." Keohane & Ostrom, *supra* note 10, at 2. Nonetheless, Ostrom's examples currently remain a distinct minority of cases. As observed by scholars, "[t]he real world commons problems that Ostrom studies usually involve repeated

2. *Traditional Natural Capital Commons and Climate Change*

Commons analysis and application of the three commons solutions outlined above have traditionally been applied to natural resources, as a framework for assessing their management. Domestic and global fisheries, groundwater aquifers, oil and gas resources, the atmosphere, wildlife, and forests, just to name a few resources, have historically presented a variety of commons problems. Of late, the attributes of the atmosphere that take on commons characteristics have shifted. Air pollution is the traditional conception of "atmosphere as a commons," when polluters—much like Hardin's herders—appropriate the clean air resource and replace it with pollution. Yet in modern times, climate change has given rise to new commons attributes of the atmosphere, as aggregated sources of carbon worldwide jeopardize an atmosphere that would otherwise adequately regulate global temperatures over time.[33]

A similar shift has taken place with forest resources, which are increasingly recognized as a common-pool resource. Despite the fact that forests may be anchored to the soil under the control of individual property owners or governments, the aggregated role of forests worldwide to act as a carbon sink and regulate the global atmosphere make them virtually as fluid and unbounded as fish in the sea. With nearly 20% of global carbon emissions resulting from forest degradation and destruction on private and government regulated forests in recent decades—an amount of carbon greater than that emitted by the transportation sector each year[34]—the forest resource is clearly a common-pool resource whose proper management is crucial to combating climate change. Even so, as noted earlier, these forests resources, even in the United States, are threatened by increasing urbanization and other pressures—with the projected disappearance of 13% of southeastern U.S. forests over the next fifty years providing only one example.[35] These threats largely result from a forest regulatory framework that is inconsistent or even non-existent at the subnational level, with extremely limited inputs at the federal level.

Wetlands provide another example of the carbon sequestration and climate change mitigation potential of what increasingly may be characterized as common-pool natural capital, notwithstanding private property ownership or government jurisdictions. While conventional

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interactions among a relatively small number of players who are able to develop subtle institutions for monitoring and enforcing a degree of cooperation." Theodore C. Bergstrom, *The Uncommon Insight of Elinor Ostrom*, 112 SCANDINAVIAN J. ECON. 245, 246 (2010).

33. *See generally* Elinor Ostrom, *Polycentric Systems for Coping with Collective Action and Global Environmental Change*, 20 GLOBAL ENVTL. CHANGE 550 (2010).

34. *See* Erin C. Myers Madeira, POLICIES TO REDUCE EMISSIONS FROM DEFORESTATION AND DEGRADATION (REDD) IN DEVELOPING COUNTRIES 8 (2008).

35. *See supra* note 3.

wisdom may conceptualize tropical forest preservation as crucial to natural capital-driven climate change mitigation, coastal wetlands in the United States and elsewhere are equally if not more crucial. The International Union for Conservation of Nature reports that coastal wetlands sequester fifty times more carbon in their soil per unit of area than tropical forests, and ten times more than temperate forests.[36] In other words, the preservation of a smaller area of coastal wetland sequesters more soil carbon than the protection of a larger area of tropical or temperate forests. Empirical studies in California and Florida suggest that coastal wetlands offer excellent potential for carbon sequestration since their continual accretion and burial of nutrient-rich sediments causes them to accumulate carbon over longer time periods and at higher rates than other ecosystems.[37]

Even so, these wetlands are subject to tremendous threats—many of which are related to development activities in the coastal zone guided almost exclusively by subnational governments.[38] Other threats come in the form of industrial and energy development along the coast.[39] Many, if not a majority of the United States' coastal wetland areas have already been developed,[40] with coastal wetland losses accelerating in recent years in spite of a technical gain in wetlands in the United States on the whole.[41] The state of Louisiana loses 6600 acres of coastal wetlands a year,[42] while coastal watersheds in the Great Lakes, Atlantic Ocean, and Gulf of Mexico lost 59,000 acres each year from 1998 to 2004.[43] While the federal government does maintain a wetland fill permitting program under § 404 of the Clean Water Act, it approves a vast majority of wetland fill permits, while subnational governments, as with forests, are largely failing to preserve these resources.

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36. *See* IUCN, THE MANAGEMENT OF NATURAL COASTAL CARBON SINKS 49 (Dan Laffoley & Gabriel Grimsditch eds., 2009).

37. *See* Joy B. Zedler & Suzanne Kercher, *Wetland Resources: Status, Trends, Ecosystem Services, and Restorability*, 30 ANN. REV. ENV'T & RESOURCES 39, 55 (2005); *see also* Gail L. Chmura et al., *Global Carbon Sequestration in Tidal, Saline Wetland Soils*, 17 GLOBAL BIOGEOCHEMICAL CYCLES 22-1 (2003); A.H. Hussein et al., *Modeling of Carbon Sequestration in Coastal Marsh Soils*, 68 SOIL SCI. SOC'Y AM. J., 1786, 1786–87 (2004).

38. *See* IUCN, *supra* note 36, at 8–9.

39. COASTAL LA. ECOSYSTEM ASSESSMENT & RESTORATION (CLEAR), REDUCING FLOOD DAMAGE IN COASTAL LOUISIANA: COMMUNITIES, CULTURE AND COMMERCE 2 (2006).

40. The United States as a whole has lost over half of its wetlands. *See* David Moreno-Mateos et al., *Structural and Functional Loss in Restored Wetland Ecosystems*, 10 PUB. LIBR. SCI. BIOLOGY 1, 1 (2012).

41. *See generally* SUSAN-MARIE STEDMAN & THOMAS E. DAHL, NAT'L OCEANIC & ATMOSPHERIC ADMIN. NAT'L MARINE FISHERIES SERV. & U.S. DEP'T OF THE INTERIOR FISH & WILDLIFE SERV., STATUS AND TRENDS OF WETLANDS IN THE COASTAL WATERSHEDS OF THE EASTERN UNITED STATES 1998 TO 2004 (2008).

42. ROBERT R.M. VERCHICK, FACING CATASTROPHE: ENVIRONMENTAL ACTION FOR A POST-KATRINA WORLD 19 (2010).

43. STEDMAN & DAHL, *supra* note 41, at 5.

In addition to forests and wetlands, agriculture provides another potentially significant carbon sink subject to commons dynamics. Even though agricultural lands are privatized, individual herders, not surprisingly, appropriate natural capital from their respective pastures through the cultivation of the land. They do so, however, in a manner with profound implications for the global climate commons. Their actions can be either a great benefit to climate change mitigation, if agricultural operations tip toward being a sink for greenhouse gases ("GHGs"), or they can be a significant contributor to climate change if agricultural operations tip toward being a source of carbon. Agriculture is a significant source of global GHGs, accounting for about 10% to 12% of annual global carbon emissions.[44] Yet it also has the potential to provide a significant GHG sink upon the appropriate adjustment of agricultural operations and policies. The agricultural sector can sequester large amounts of carbon in soil and crops after a variety of adjustments in crop cultivation (rotation, tillage, adoption of organic practices, and use of agro-forestry) and other management changes. Studies have shown, however, that GHG sink potential in the agricultural sector is far below the technical potential.[45]

Despite the GHG sink potential of agriculture, governments at all levels in the United States are doing very little to directly regulate and ensure its use as a sink.[46] The federal government maintains a variety of incentive-based, voluntary subsidy and other programs that have impacts on carbon sequestration, but these are necessarily limited in scope (primarily by budgetary constraints) and breadth of impact.[47] In addition, the federal government maintains few prescriptions regulating agriculture. Many federal statutes contain agricultural exemptions, while others, like the Clean Water Act, do not regulate agricultural activities traditionally considered to fall within the state governments' land use regulatory role, like nonpoint source water pollution.[48] Subnational

44. PETE SMITH ET AL., AGRICULTURE, INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE 498 (Bert Metz et al. eds., 2007).

45. *Id.* at 522.

46. Governments at all levels have taken steps to regulate some agricultural uses that have indirect effects on GHG emissions and sinks. For example, many state and local governments regulate the use of fertilizers and pesticides, several of which, if unregulated, would result in GHGs being emitted directly into the atmosphere when the proper land conditions are not met. *See, e.g.*, MINN. STAT. § 103E.021 (2012) (limiting the use of certain fertilizers and manure in conservation grassed buffer zones); VT. STAT. ANN. tit. 10, § 1427 (2010) (same).

47. BLAKE HUDSON, *Agriculture and Forestry*, *in* GLOBAL CLIMATE CHANGE AND U.S. LAW (Michael Gerrard & Jody Freeman eds., 2d ed. forthcoming 2013).

48. Robin Kundis Craig contends that Congress' operation "within constitutional federalism requirements" has caused it to miscalculate the constitutionality of direct federal regulatory inputs into nonpoint pollution assumed to be the sole regulatory role of state and local governments. Robin Kundis Craig, *Local or National? The Increasing Federalization of Nonpoint Source Pollution Regulation*, 15 J. ENVTL. L. & LITIG. 179, 179–81 (2000). Craig notes that "[c]omprehensive federal

governments in the United States, on the other hand, maintain a wide range of tools to regulate agricultural activities, particularly those related to their police power to regulate land use activities. These governments have passed urban growth boundaries, farmland preservation programs, and large lot zoning statutes and ordinances to, for example, help directly or indirectly preserve existing farmland. They have also utilized agricultural zoning laws to regulate the when, where, and how of agricultural production within a municipal unit.[49] State governments also retain the authority to regulate GHG emissions from agriculture, as well as a variety of land use activities that can either act as source or sink of carbon. Yet states "have generally refrained from regulating emissions from any agricultural sources."[50] The states' reluctance to prescriptively regulate a variety of agricultural activities related to greenhouse gas emissions leaves subsidy programs, tax policy, and market-driven instruments as the primary means of shaping agricultural policy in the context of climate change mitigation at both the federal and state levels. As a result, it is perhaps no surprise that GHG sink activity in the agricultural sector is far below its technical potential.

Ultimately, commons resources like forests, wetlands, and agricultural lands are subject to traditional commons management mechanisms such as private property and government regulation, yet remain in a tragic plight—with stark implications for climate change. This evidence supports the view that some critical components of the commons resource management mechanisms the United States maintains are malfunctioning. The inadequate balance of private property rights and government regulation in managing resources crucial to combating climate change across scales in the United States supports this Article's deconstruction of the nested commons in order to determine where these malfunctions are taking place and how they might be corrected.

C. New Commons Resources and the Nested Governance Commons

Commons scholarship has expanded over time beyond the natural environment to include a variety of non-traditional commons resources, such as medical care, parking spaces, sidewalk vending, knowledge, government budgets, silence, email inboxes, and presidential primaries.[51]

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regulation of nonpoint source pollution would thus arguably engage the federal government in land use regulation—a type of regulation historically viewed as belonging almost exclusively to more local levels of government," and that "because of federalism restrictions, Congress cannot and has not forced states to assume any regulatory burden with respect to nonpoint sources of water pollution. Therefore, regulation of nonpoint source polluters is left largely to states' individual regulatory discretion." *Id.* at 182, 186.

49. *See* Donald B. Pedersen & Keith G. Meyer, Agricultural Law in a Nutshell 356–61 (1995).

50. Viney P. Aneja et al., *Effects of Agriculture upon the Air Quality and Climate: Research, Policy, and Regulations*, 43 Envtl. Sci. & Tech. 4234, 4236 (2009).

51. For discussion of commons scholarship expanding to include presidential primaries, see

Each of these newly categorized commons resources is subject to rivalrous depletion by non-excludable appropriators, even though they do not arise out of traditional, natural environment commons.

New Commons scholarship continues to expand, with recent research describing how a governance structure itself can operate like a commons.[52] This concept is further expanded in the next Part, detailing how the federal system of government may operate as a commons, primarily through the allocation of governance authority among levels of government and between branches of government.[53] One of the roles that our federal system of government has increasingly assumed, of course, is the management of natural resource commons. Yet in our federal system, more natural capital governance authority maintained by the federal government may mean less for subnational governments, and vice versa. If subnational governments, such as the fifty states, maintain more or nearly exclusive authority then, by virtue of the governance structure those entities are allowed to "roam" on the commons freely: appropriating natural capital without federal coordination and perhaps without coordinating with each other to ensure non-tragic resource management. We see this in the context of land-use planning at the subnational level and the resultant urban sprawl that is threatening natural capital crucial to climate change. In this way, our federal system of government is a nested governance commons that overlays natural resource commons. Stated differently, natural resource commons are embedded within the governance framework that sets the rules for appropriation and management of those resources—a framework that itself may be segmented in a way that tracks a commons. Ultimately, though private property rights and government regulation are the tools used to manage natural resources in the United States (or, traditional commons resources), the federal governance structure within which they are embedded and implemented may also be considered a new commons, as further detailed in the next Part.

Brigham Daniels, *Governing the Presidential Nomination Commons*, 84 TUL. L. REV. 899 (2010).

52. *See* Brigham Daniels & Blake Hudson, Our Constitutional Commons (unpublished manuscript) (on file with authors). Daniels and Hudson describe (in part) how the Constitution establishes a governance structure that takes on dimensions of a commons resource. Institutions, like federal systems of government, allocate rules of governance among levels of government and between branches of government, and allocate citizen rights through rivalrous jockeying over constitutional resources by non-excludable citizens, states, executives, courts, and legislatures—creating what Daniels and Hudson term a "constitutional commons." *See id.* The component of the constitutional commons that allocates rules of governance for private property among local, state, and national governments may be described more generally as a nested governance commons across levels of government.

53. *See id.*

II. Denesting the Federal Governance Commons: The Legal Theoretical Framework

Natural resource commons are multi-scalar, in that resources are contained in vertically and horizontally structured governance scales that include a complex web of appropriators within each scale and across scales. For example, forests are horizontally scaled across the geopolitical boundary between the United States and Canada and vertically scaled within each of those nations across national and subnational government jurisdictions and private properties—with numerous entities playing a role in appropriating those resources. But it is important to ask: *Precisely* what is it that makes natural resources multi-scalar? It is not the natural environment itself, at least in the primary sense used by governance scholars,[54] since the biota, absent artificial human divisions and consumptive influence, is interconnected in a way that creates a highly functional, integrated, unified, and natural scale globally. What makes natural resources multi-scalar are the artificial geopolitical boundaries and corresponding allocations of governance authority creating the governance systems within which natural resources are embedded. This is what commons scholars mean when they refer to the potential to scale up analysis of local commons to the national and international scales.[55] There are very few open pastures remaining, with governments and private property owners controlling most natural resources worldwide. And aside from some ocean resources, open-access properties that remain are embedded within some country with ultimate governmental authority over them if they choose to exercise it. In this way we can see that it is the *intersection* between natural resource commons and the nested governance commons where modern resource commons problems arise.

To understand the complexity and dynamism of the nested governance commons, it is important to first break it down to its constituent parts. This necessitates analyzing each "nest" as a horizontal construct within the vertically nested governance commons, as well as analyzing the relationship of each nest with the successive nest up or down the vertical scale. Within each nest there are two primary components that intersect to determine whether and how natural resources are managed on private or government-owned lands: (1) legal authority of horizontal or vertical governments to enact regulatory policies, and (2) political action on the part of those governments to actually do so. These components intersect in a variety of scenarios, the most notable of which we have attempted to describe below. (This is, however, by no means an exhaustive

54. Of course, the global environment is made up of thousands of vastly different ecosystems that operate on different biological scales, but the natural function of ecosystems is not scaled vertically in the sense that scholars use to describe multi-scalar governance and management of resources.

55. *See generally* Local Commons and Global Interdependence, *supra* note 10.

list.) In addition, the scenarios discussed below are applied throughout the remainder of this Article to the U.S. federal system, though they could certainly be applied to other federal systems of government.

To begin, let us consider scenarios that avoid natural capital tragedies because, first, there are no legal, *institutional* barriers to natural capital management. Second, natural capital tragedies are avoided under these scenarios because horizontal or vertical entities, or both, have exercised their legal authority to sustainably manage natural capital. Management of natural capital resources within each nest may not result in tragedy if at least one of five scenarios manifests (depicted as "NT" [non-tragic] in Figure 2A below):

NT-1) Higher levels of government *have the legal authority* to vertically regulate the resource and exercise that authority through political action, while entities at the lower level *lack the legal authority* to horizontally coordinate.[56]

NT-2) Higher levels of government *lack the legal authority* to vertically regulate the resource, but entities at the lower level *have the legal authority* to horizontally coordinate and undertake horizontal self-coordination through political action.

NT-3) Higher levels of government *have the legal authority* to vertically regulate the resource and exercise that authority through political action, and entities at the lower level *have the legal authority* to horizontally coordinate, but they do not exercise that authority through political action.[57]

NT-4) Higher levels of government *have the legal authority* to vertically regulate the resource, but fail to exercise that authority through political action, and entities at the lower level *have the legal authority* to horizontally coordinate and undertake horizontal self-coordination through political action.

NT-5) Higher levels of government *have the legal authority* to vertically regulate the resource and exercise that authority through political action, and entities at the lower level *have the legal authority* to horizontally coordinate and also undertake horizontal self-coordination through political action.[58]

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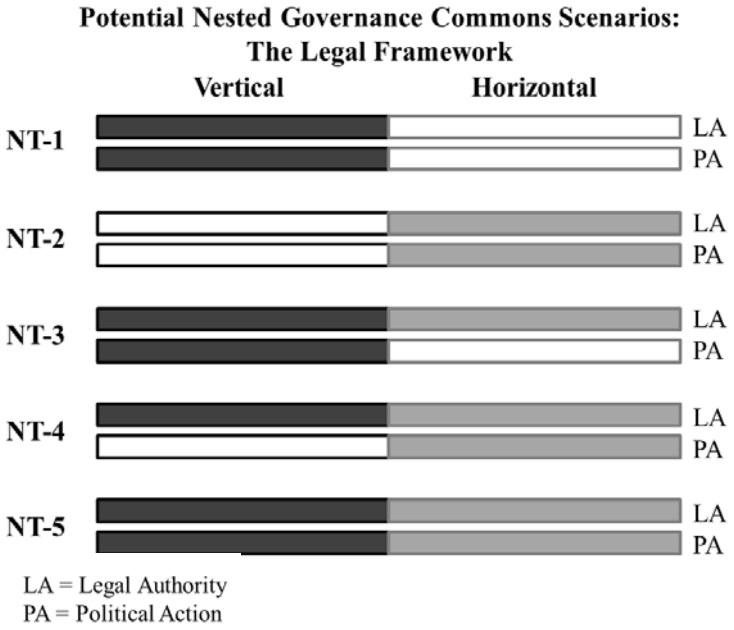
56. Lower levels of government may lack legal authority to horizontally coordinate because higher-level governments have preempted them from doing so or have simply not granted them authority to do so, or due to a number of other reasons outside the scope of this Article.

57. As discussed in more detail below, for purposes of this Article we refer to the failure to take political action as meaning either the failure to exercise legal authority at all, or the failure to exercise that authority in a way that resolves the commons dilemma.

58. An NT-5 scenario is consistent with recent calls for legal authority and political action at all levels of government to address natural capital dilemmas—a type of federalism termed "dynamic federalism," whereby legal authority at any level of government is not impeded by other levels of government or principles of constitutional law. Hari M. Osofsky has promoted "diagonal federalism" strategies that "incorporate key public and private actors at different levels of government (the vertical piece) and within each level of government (the horizontal piece) simultaneously in order to create needed crosscutting interactions." Hari M. Osofsky, *Diagonal Federalism and Climate Change: Implications for the Obama Administration*, 62 ALA. L. REV. 237, 241 (2011). For other examples

FIGURE 2A



advocating a dynamic regulatory approach to natural capital management, see DILEMMAS OF SCALE IN AMERICA'S FEDERAL DEMOCRACY (Martha Derthick ed., 1999); BARRY G. RABE, STATEHOUSE AND GREENHOUSE: THE EMERGING POLITICS OF AMERICAN CLIMATE CHANGE POLICY 1–37 (2004); David E. Adelman & Kirsten H. Engel, *Reorienting State Climate Change Policies to Induce Technological Change*, 50 ARIZ. L. REV. 835 (2008); Robert B. Ahdieh, *Dialectical Regulation*, 38 CONN. L. REV. 863 (2006); Robert B. Ahdieh, *Foreign Affairs, International Law, and the New Federalism: Lessons from Coordination*, 73 MO. L. REV. 1185 (2008); Robert B. Ahdieh, *From Federalism to Intersystemic Governance: The Changing Nature of Modern Jurisdiction*, 57 EMORY L.J. 1 (2007); Robert B. Ahdieh, *When Subnational Meets International: The Politics and Place of Cities, States, and Provinces in the World*, 102 AM. SOC'Y INT'L L. PROC. 339 (2008); Joseph W. Dellapenna, *Law in a Shrinking World: The Interaction of Science and Technology with International Law*, 88 KY. L.J. 809 (2000); Kirsten H. Engel, *Harnessing the Benefits of Dynamic Federalism in Environmental Law*, 56 EMORY L.J. 159 (2006); Kirsten Engel, *State and Local Climate Change Initiatives: What Is Motivating State and Local Governments to Address a Global Problem and What Does this Say About Federalism and Environmental Law?*, 38 URB. L. 1015 (2006) [hereinafter Engel, *State and Local Climate Changes Initiatives*]; David R. Hodas, *State Law Responses to Global Warming: Is It Constitutional to Think Globally and Act Locally?*, 21 PACE ENVTL. L. REV. 53 (2003); Blake Hudson, *Reconstituting Land-Use Federalism to Address Transitory and Perpetual Disasters: The Bimodal Federalism Framework*, 2011 BYU L. REV. 1991 (2011); Alice Kaswan, *Climate Change, Consumption, and Cities*, 36 FORDHAM URB. L.J. 253 (2009); Alice Kaswan, *The Domestic Response to Global Climate Change: What Role for Federal, State, and Litigation Initiatives?*, 42 U.S.F. L. REV. 39 (2007); Barry G. Rabe, *North American Federalism and Climate Change Policy: American State and Canadian Provincial Policy Development*, 14 WIDENER L.J. 121, 128–51 (2004); Judith Resnik, *Law's Migration: American Exceptionalism, Silent Dialogues, and Federalism's Multiple Ports of Entry*, 115 YALE L.J. 1564 (2006); Robert A. Schapiro, *Toward a Theory of Interactive Federalism*, 91 IOWA L. REV. 243 (2005); Richard B. Stewart, *States and Cities as Actors in Global Climate Regulation: Unitary vs. Plural Architectures*, 50 ARIZ. L. REV. 681 (2008); Michael P. Vandenbergh et al., *Individual Carbon Emissions: The Low-Hanging Fruit*, 55 UCLA L. REV. 1701 (2008); Tseming Yang & Robert V. Percival, *The Emergence of Global Environmental Law*, 36 ECOLOGY L.Q. 615 (2009).

Correspondingly, natural capital commons tragedies can result when at least one of four scenarios manifests (depicted as "T" [tragic] in Figure 2B):

T-1) Higher levels of government *have the legal authority* to vertically regulate the resource, but fail to exercise that authority through political action,[59] and entities at the lower level *lack the legal authority* to horizontally coordinate.[60]

T-2) Higher levels of government *lack the legal authority* to vertically regulate the resource, and entities at the lower level *have the legal authority* to horizontally coordinate, but it is not exercised through political action.

T-3) Higher levels of government *have the legal authority* to vertically regulate the resource, but fail to exercise that authority through political action, and entities at the lower level *have the legal authority* to horizontally coordinate, but also fail to exercise that authority through political action.

T-4) Higher levels of government *lack the legal authority* to vertically regulate the resource, *and* entities at the lower level *lack the legal authority* to horizontally coordinate, failing to produce either vertical regulatory coordination or horizontal self-coordination. This scenario requires more thorough explication, as it can play out in more complex ways. In the United States, the Tenth Amendment makes it clear that legal authority must reside with the federal or state governments—if the federal government does not have legal authority to act, then the states must have it, and vice versa. As a result, there will not be a scenario where both the federal and state governments in the United States do *not* maintain legal authority to act. The T-4 scenario, however, could play out quite frequently at state or local scales, as well as on the global scale. If the federal government, for example, preempts state authority to act, then neither the state nor the local government maintains the legal authority to act, resulting in a T-4 scenario at the state scale. Similarly, if the state government preempts local authority to act, then a T-4 scenario could play out on the local scale, where the local government actors and private property owners do not have the legal authority to act. A T-4 scenario could also occur on the global scale when the state government has the legal authority to act and the federal government does not. In this circumstance, restrictions on nested governance would be operating in reverse, with the federal government not legally permitted to horizontally coordinate with other nations in a way that binds the states, which in turn prevents it from authorizing a global body to vertically regulate via treaty.[61]

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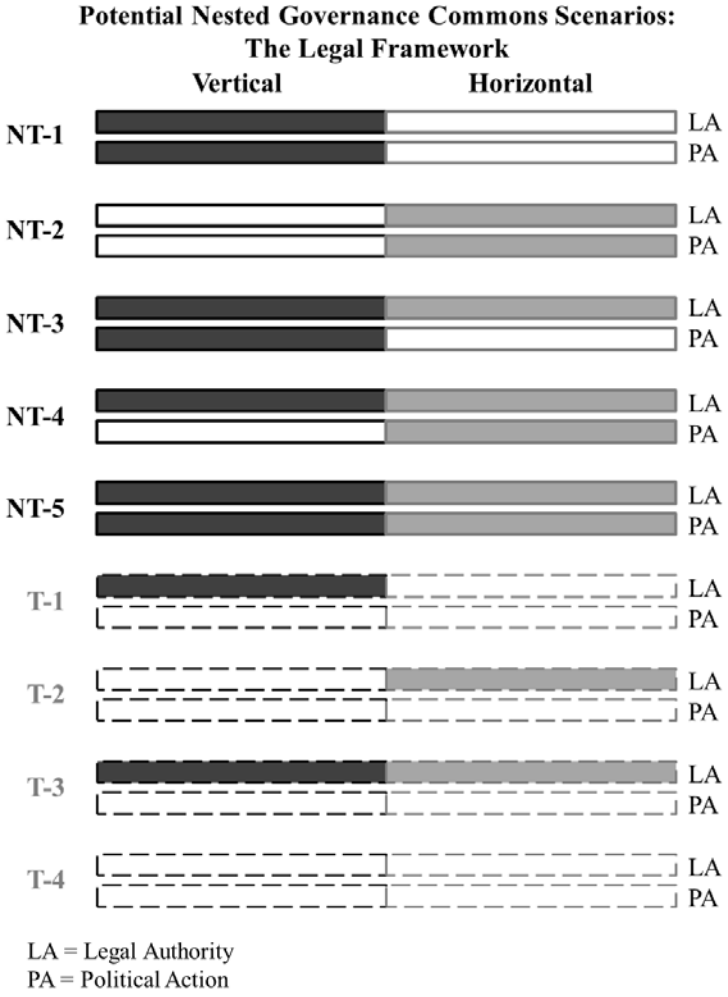
59. Perhaps they do technically exercise that authority, but they do so in a way that does not resolve the commons dilemma.

60. Again, due to preemption by higher-level governments, failure of higher-level governments to grant legal authority, etc.

61. *But see* United States v. Pink, 315 U.S. 203, 210–13 (1942) (holding that state laws, and

FIGURE 2B



Before moving to a discussion of the global, national, state, and local scales within which these scenarios play out and are nested, we should pause a moment to provide three clarifications of this legal authority/ political action framework. First, though unlikely from a practical perspective, theoretically a tragedy could be avoided within a given nest even in the absence of either vertical or horizontal legal authority or political action. In this situation, a critical mass of entities within each nest could *altruistically, but individually*, act against perceived self-interest by limiting their own use of the resource—but they would not do so in

presumably local laws, are invalid when conflicting with an international treaty).

coordination with others, nor would they be directed by higher-level governments. This Article is not concerned, however, with the coincidental de facto coordination of separate actors, but rather with the institutional and legal mechanisms that are needed horizontally or vertically to avoid commons resource tragedies.

Second, this Article is concerned somewhat quantitatively with whether commons management institutions are or are not in place and whether there are legal barriers to such institutions, rather than with a qualitative analysis of policy. As a result, the scenarios presented in this Article are focused primarily on the issue of legal authority, though political action is certainly a necessary component of proper commons resource management both vertically and horizontally. Indeed, we do not suggest that simply maintaining adequate legal authority will result in sustainable decisionmaking and the proper government exercise of that authority, whether vertically or horizontally. For example, there could be authority at the higher level of government that is acted upon through vertical regulatory action, but in a way that does not address the resource management issues and that may even exacerbate the commons conditions—i.e., bad policy.

Nonetheless, a necessary precursor to efficacious political action is whether proper institutions are in place to legally facilitate that political will in the first instance. This is why we necessarily presume for the purposes of conveying the theoretical framework that if legal authority exists and political action is taken in the NT scenarios above, then the resulting policy resolves the commons dilemma. In the real world, we understand that policy actions may be taken but not be efficacious. For this reason, in the T scenarios dealing with preemption, for example, we do make some qualitative observations—only in furtherance of the framework—noting that legal authority may exist at a higher level of government and may be acted upon, but in a way that does not resolve the commons dilemma. We make this observation in the preemption context merely because in the absence of preemption, the lower-level government might be able to resolve said dilemma more effectively than the higher-level government. So, to provide a clearer conception of the framework, we are using the efficacy of political action very much like 1s and 0s in binary code—either political action at that level of government resolves the commons dilemma or it does not. Given the complexities of assessing the relative success of policy, our model is purposefully lacking in analysis of policy sufficiency.

Third and finally, as indicated earlier, this Article purposefully and over-simplistically discusses these scales in relative isolation, leaving the full complexity of cross-cutting scalar interactions to future research. One of the reasons scalar analysis is so complex is because a degree of "scale jumping" may occur, as represented by the T-4 scenario above. In part, the

Constitution dictates how these scale-jumping interactions occur and acts as a gatekeeper[62] by identifying what natural capital resources will become the subject of a legal authority dispute on the global, national, state, or local governance commons. For example, if the Constitution grants the federal government authority to regulate certain resources all the way down to private individuals, then the federal government may exercise that authority, leading to an NT scenario; or it may preempt state, local, or private action, creating either an NT or T scenario, depending on whether Congress crafts policy addressing the commons dilemma or not; or the federal government may operate concurrently with entities across those lower scales, leading to an NT or T scenario, depending on whether Congress, states, local governments, or private actors craft policies addressing the commons dilemma.

On the other hand, if the Constitution does not grant Congress the legal authority to regulate at the state scale and on down, then state constitutional law and legislation become the gatekeeper and determine the ultimate outcome of a variety of T or NT commons management scenarios at those scales. In the same way, lack of national authority in the U.S. Constitution can affect T or NT scenarios at the global level, since entities at the state or local scales may impede the ability of the national government to participate in global scale governance arrangements to address commons problems. Furthermore, the coordinated actions of every private property owner on the earth, theoretically and however unlikely, could resolve the commons dilemma across every higher scale—jumping from the lowest scale to the highest in resolving the problem. Similarly, a global arrangement successfully negotiated and successfully implemented in every country on the globe could compel actors at all lower scales to address the commons dilemma—thus jumping from the highest scale to the lowest. And there are a variety of permutations of scale jumping in between. The reality is that these types of cross-cutting interactions do not occur within only these two dimensions of vertical and horizontal. Rather, they occur in different ways across different horizontal jurisdictional and geographic lines. It is this aspect of nested governance commons that will be further analyzed in our future research. Yet we acknowledge here that we are well aware of this complexity.

We have now established the basic operation of each nest within a governance commons, and how each nest may result in tragedy depending on the presence or absence of legal authority and political action both vertically and horizontally. However, there are multiple nests scaled vertically and horizontally in the United States within which natural capital commons are embedded. So, to gain a clearer and more

62. *See generally* Hudson, *supra* note 4.

precise conception of the nested commons in the United States, we can describe each nest as one of four, scaled from units as small as private properties to the largest unit we can assess, the globe. As described above and further detailed in the Subparts below, the legal entrenchment of commons at each scale can arise out of very different legal authority/political action scenarios, which are in turn determined by matters of simple geopolitics (as in the case of the global commons), constitutional law (as in the case of the national and state scale commons), or legislative preemption (as in the case of some national, state, and local scale commons). On any individual scale, as depicted in Figure 3, a natural capital commons may occur (notwithstanding the overarching governance commons), and each level may look like the following:

(1) In the absence of vertical inputs by a global governance arrangement or horizontal self-coordination among groups of nations, national governments may act as individual herders on the natural capital "pasture" that is the globe. The resource unit is natural capital within a single nation, while the resource system is global natural capital.

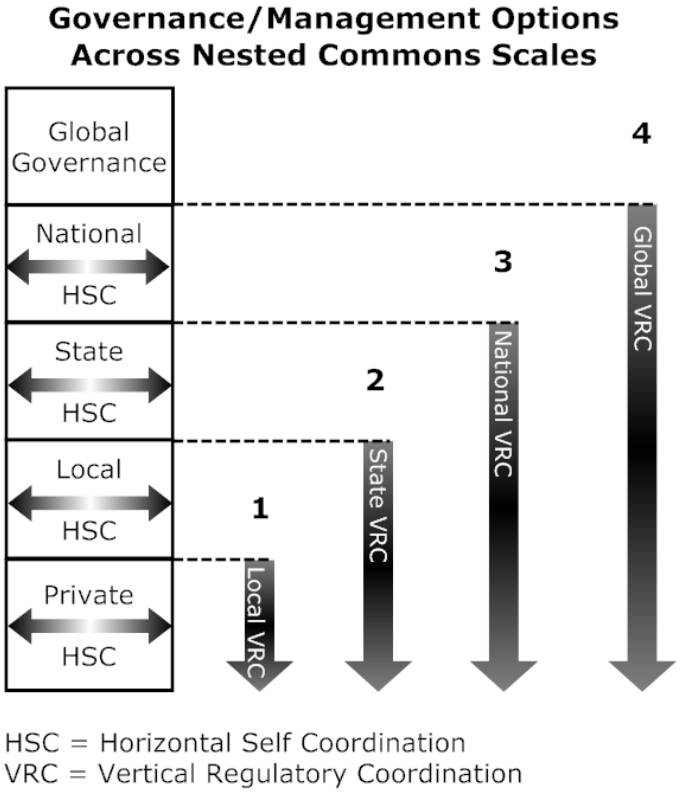
(2) In the absence of vertical inputs by the federal government or horizontal self-coordination with each other, state governments may act as individual herders on the natural capital "pasture" defined by national jurisdictional boundaries. The resource unit is natural capital within a single state, while the resource system is natural capital within the collection of local governments that make up the state.

(3) In the absence of vertical inputs from state governments or horizontal self-coordination with each other, local governments may act as individual herders appropriating natural capital from the "pasture" defined by state jurisdictional boundaries. The resource unit is natural capital within a single local government, while the resource system is natural capital within the collection of local governments that make up the state.

(4) In the absence of vertical inputs from local governments or horizontal self-coordination with each other, private property owners act as individual herders appropriating natural capital from the "pasture" defined by local government jurisdictional boundaries. The resource unit is natural capital on private property, while the resource system is natural capital within the collection of private properties that exist within local government boundaries.[63]

63. This Article breaks down local governments on the basic line between state level governments and general purpose incorporated subdivisions that are self-governed, including cities, towns, villages, counties (boroughs and parishes), but not special purpose or quasi-public entities (such as housing authorities). Obviously, depending on jurisdiction, there may be towns or cities embedded within townships embedded within counties, and so on and so forth. But the basic operation of the nest is the same, and what we call "local governments" suffice for the time being as covering all the different categories and subcategories of sub-state actors that may be found.

FIGURE 3



While each level in isolation may constitute a typical natural resource commons, whereby individual appropriators appropriate resource units from the resource system, it is the integration of each scale within a federal system of government that creates multi-scalar natural resource management issues. Stated differently, it is the synergy between the natural environment and the system of governance designing rules for its management that presents the complete picture of the commons. In this way, federal systems of government can operate as a nested governance commons that overlays the natural environment—thus adding another layer of complexity to the management approaches needed to address climate change.

A. GLOBAL GOVERNANCE COMMONS

On the global scale, nations are the individual actors appropriating natural capital resource units from the global commons. In this way, we can look at the legal policies of each nation regarding climate regulating natural capital protection as a representation of either rational or

irrational herder mentality on the global commons. Individual nations may act alone to curb emissions or establish carbon sinks in forests, wetlands, and agriculture. Yet there are strong disincentives from doing so, not the least of which is that other nations will continue to grow their own GHG-based economies by free riding on the GHG emissions limitation-sink preservation efforts of others. So to achieve the most viable climate change response on the global scale, individual nations must either cooperatively and horizontally coordinate with each other, agreeing to domestically adjust land use, forest, wetland, agricultural, or other resource policies crucial to combatting climate change, or they must cede sovereignty to an international treaty or other protocol establishing rules of governance that will vertically coordinate those activities through standards set at the international level and implemented by nations.

The global governance commons has the potential to devolve into a tragedy because—absent a legally binding treaty or other arrangement—there is no vertical legal authority at the global level to coordinate the activities of nations engaged in natural capital appropriation, and therefore whether a natural capital commons exists depends entirely on the individual (or incidental collective) political action of nations to harness their authority for natural capital management. At first glance it might appear that horizontal self-coordination among nations and nations coming together to craft a global vertical regulatory structure are one and the same, since the creation of vertical regulatory structure at the global level obviously requires horizontal coordination. Yet nations can go about crafting global resource management regimes in different ways.

For instance, nations might cede all or a degree of sovereignty over domestic resource management to an international body that crafts rules for nations to implement domestically, which results in more direct and robust vertical authority.[64] Or perhaps rules are developed directly by nations engaged in protocol negotiation, and any nation who wishes to be a part of the protocol, at the present or in the future, must abide by those rules and standards. On the other hand, individual nations may not cede rulemaking authority to an international body or an international protocol, but may agree to horizontally coordinate with other nations to utilize domestic rule making, with a degree of flexibility, to meet certain resource management targets. The treaty may still be binding, as with a vertical regulatory structure, but in a true horizontal collaboration the individual

64. This mode of vertical regulatory coordination at the international level is termed an "international delegation," defined as "a grant of authority by two or more states to an international body to make decisions or take actions." Curtis A. Bradley & Judith G. Kelley, *The Concept of International Delegation*, 71 LAW & CONTEMP. PROBS. 1, 3 (2008); *see* Neil S. Siegel, *International Delegations and the Values of Federalism*, 71 LAW & CONTEMP. PROBS. 93, 93 n.1 (2008) ("[I]nternational delegations take many different forms, leaving nations and subnational units of nations (for example, U.S. states) with varying degrees of regulatory control regarding the subject matter of the delegation.").

nations—and not a third party—are responsible for monitoring, sanctioning, and adjudicating disputes regarding other nations' appropriation of the resource.

In addition, horizontal governance at the international level can occur in a variety of other ways that are not driven by global standards or targets. Horizontal collective action may involve far fewer nations than would a legally binding global governance regime, as a handful of nations may come together to craft rules for localized governance problems that cross only some national jurisdictional boundaries. The United States and Mexico coordinating access to Colorado River resources or the United States and Canada coordinating management of North American migratory birds would be examples.[65] Even though vertical regulatory coordination and horizontal self-coordination at the global level can be differentiated in some ways, at some point the two begin to merge due to the ceiling that the globe places on governance: Unlike at lower levels of government, the vertical and horizontal actors on the global scale are on the same plane.

The presence of a global governance arrangement that establishes binding rules at the international level can result in proper commons resource management at the national scale, even if nations are not individually engaged in domestic rule creation (absent the global push) due to collective action, free rider, or other commons problems. This might be characterized as NT-3 in Figure 2B, at least in part. Yet, since ceding authority to an international body requires some degree of horizontal collective action, it might also be characterized in part as an NT-5 scenario. This is where the merger described above becomes apparent. Similarly, in the absence of rules arising out of an international body and implemented through domestic law, nations may choose to harness their domestic authority to craft their own rules aimed at hitting a resource management target and therefore manage natural capital in a non-tragic way (scenario NT-2). On the other hand, the lack of a global governance arrangement can devolve into a tragedy if countries do not individually take political action pursuant to their legal authority (scenario T-2). Or, perhaps a state or provincial government has the constitutional authority to act and the federal government does not, which results in the federal government not being legally permitted to horizontally coordinate with other nations and in turn prevents it from authorizing a global body to vertically regulate via treaty (scenario T-4).

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65. We also recognize that a vertical regulatory regime could exist among a handful of nations where those nations cede authority to a third party or newly created entity. *See, e.g.*, Council of Great Lakes Governors, The Great Lakes Charter: Principles for the Management of Great Lakes Water Resources, Feb. 11, 1985, at 1; Treaty Between the United States and Great Britain Relating to Boundary Waters Between the United States and Canada, U.S.-Gr. Brit., 36 Stat. 2448 (1909); The Trail Smelter Case (U.S. v. Canada), 3 R.I.A.A. 1905 (1941).

Ultimately, the global governance commons exists merely as a matter of geopolitics. There is no global constitution that may be amended to grant global regulatory authority to a global congress or other legislative body. There is also no global enforcement mechanism to ensure compliance, short of military action. This is in sharp contrast to the deference that subnational governments in the United States, for example, maintain for national authority—even if initially defiant, states will ultimately comply with federal mandates if upheld as constitutional in the courts, even if the National Guard must intervene. In contrast, international law relies solely on the political action of nations to self-regulate natural capital appropriation, voluntarily coordinate with other nations to do so through global agreements on targets, or voluntarily relinquish authority and at least some degree of sovereignty to meet standards set at the international level. As a result, depletable global natural capital is subject to rivalry by non-excludable nations, none of which may be *legally* excluded from appropriating the resource unit of natural capital over which they maintain control from the global resource system. In this way, the global governance commons operates very much like a national governance commons wherein the national government maintains no constitutional authority to coordinate subnational natural capital appropriation.

B. National Governance Commons

At the national scale, the commons dilemma shifts, with the group of rational, self-interested actors changing from national governments to state governments. State governments become herders on the national commons, and avoiding a tragedy of the commons requires self-coordination among the states or vertical coordination arising from federal government regulation.

In the United States, natural capital commons are subject to private property rights or government regulation, and most frequently both. Management of these resources takes place within a federal system of government that contains designed, vertical, multi-scalar divisions of governance authority. The federal form of governance in the United States maintains dimensions of a commons that currently manifest in the text of the Constitution and, as described by recent research, one of these dimensions consists of rules of governance related to the allocation and division of governance authority between branches of government or between levels of government.[66] This allocation is in a constant state of rivalry, as demonstrated by two examples in particular: the continued wrangling over the scope of federal authority under the Commerce Clause

66. *See generally* Daniels & Hudson, *supra* note 52.

and the related, subsidiary issue of complete preemption by the federal government of subnational regulatory authority.

Regarding the scope of federal authority under the Commerce Clause, more authority granted to subnational governments means less for the federal government and vice versa (meaning there is rivalry over a depletable resource). For example, state governments may wish to maintain exclusive regulatory authority over areas traditionally governed solely by states. So any expansion of federal power that allows either concurrent regulation by the federal government, or perhaps even preemption, results in a depletion of state government authority to exclusively regulate (or authority to see those activities remain unregulated, as they may prefer). In addition, it is very difficult to exclude any commons user (the executive, legislature, judiciary, states, and citizenry) from accessing the institutions that shape the appropriation of that authority over time. In this way, the federal system can be seen as a governance commons that overlays the natural resource commons it was intended to govern.

So let us place the national governance commons in the context of the scenarios discussed above. The presence of federal legal authority over subnational resource appropriation (via the Commerce Clause) can result in proper commons resource management at the national scale if the national government exercises political action pursuant to that authority to coordinate subnational activities in the absence of subnational action (scenario NT-3), or completely in lieu of subnational action through preemption (scenario NT-1). Similarly, in the absence of federal Commerce Clause authority, subnational entities may choose to harness their authority to manage natural capital in a non-tragic way (scenario NT-2), or they may do so when the federal government maintains legal authority but chooses not to politically act (scenario NT-4). Finally, both the federal and subnational governments may maintain legal authority and both levels exercise that authority through political action to properly manage resources (scenario NT-5).[67] On the other hand, even if the federal government maintains Commerce Clause authority, a tragedy may result if it chooses not to exercise its authority through political action to coordinate subnational activities at the same time that it also preempts the legal authority of subnational governments to manage the resource (scenario T-1). Similarly, the lack of federal Commerce Clause authority can divulge into a tragedy if subnational governments do not act politically on their legal authority (scenario T-2). Finally, a tragedy may result if both the national and subnational governments maintain legal authority, but each fails to exercise that authority through political action to manage the resource (scenario T-3).

67. *See supra* note 58.

Ultimately, it is the Constitution's arguable depletion of federal authority over some resource management that legally entrenches a constitutional governance commons scenario. The Constitution grants primary regulatory authority over certain types of natural capital appropriation to a vast quantity of subnational governments. Thus, the depletable national natural capital is subject to rivalry by non-excludable subnational governments, none of which may be *legally* excluded from appropriating the resource unit of natural capital over which they maintain control from the national resource system (scenario T-2). Unless subnational actors work together to craft sustainable resource management rules (scenario NT-2), there is no higher level of government with authority to coordinate their activities. It is this vertical overlay of potentially rational governance authority that facilitates the potential rationality of natural capital appropriators along the horizontal plane.

Managers of the governance commons (Congress, the judiciary, the executive, the states, and the citizenry) can always seek to adjust the constitutional structure to redress a legally entrenched commons. Congress could pass a statute claiming authority over natural resources, the regulation of which was previously considered the sole sphere of state governance authority—no legislator is excluded from proposing such a statute and legislators do so in rivalry with those opposing that appropriation or reallocation of governance authority (which would, of course, deplete, at least to an extent, the discretionary governance authority of the states). A president may then veto the statute, or in the alternative sign the legislation to ensure its passage, weighing in either against or in agreement with the new appropriation of governance authority. Any citizen or state that opposes the statute may lodge a challenge against its constitutionality, in rivalry with those citizens or states that would see governance authority appropriated in exactly the manner Congress chose to appropriate it. But unless managers of the governance commons seek to adjust the governance structure in this way, natural resources will remain embedded on a horizontal plane within a vertical governance structure that legally insulates levels of government from inputs by other levels.

Similarly, preemption by the federal government of subnational regulatory authority also may or may not result in commons tragedies. Under this scenario, the federal government forbids subnational governments from exercising what would otherwise be their constitutional authority over natural capital appropriation. It may be that this supplanting of subnational control results in better resource management, as is arguably the case with certain federal preemptive provisions in the Clean Water Act and Clean Air Act that supplant state or local rules that may conflict with the federal scheme (scenario NT-1). Yet under other scenarios federal preemption may result in a supplanting

of state or local authority in a way that prohibits the development of more optimal natural capital appropriation measures (scenario T-1), as is arguably the case in the context of mobile source regulation under the Clean Air Act. In the context of climate change, there are a number of examples in which state governments sought to address climate-change-related issues and were preempted by federal law, contributing to potentially tragic consequences in the aggregate.[68] This result is represented by T-1 in Figure 2B, whereby subnational governments do not choose to rush toward commons tragedies, but are actually legally required to act in a rivalrous manner in appropriating depletable resource units of natural capital from the national commons.

C. State Governance Commons

As the commons dilemma shifts from the national to state scale, the group of rational, self-interested actors changes from state governments to local governments. On the state commons, state governments, which constituted the potential herders on the national scale, are transformed into the vertical regulatory authority. Local governments assume the role of potential herders, seeking to appropriate natural capital by growing local economies, generating local revenues, increasing the tax base, and so on, and doing so by competing with other local governments.[69] This competition, a form of "race-to-the-bottom" that can lead to lax land-use or forest-management standards, for example, results in potentially tragic mismanagement of climate-crucial natural capital in the absence of horizontal self-coordination among local governments or vertical coordination arising from state government regulation.

As the commons dilemma shifts from the national to the state scale, the tussle over legal authority also shifts to a battle between state and local governments. The outcome of this tussle is determined almost entirely by state constitutional and statutory law.[70] Unlike state governments, local

68. *See, e.g.*, Engine Mfrs. Ass'n v. S. Coast Air Quality Mgmt. Dist., 541 U.S. 246 (2004) (holding that the Clean Air Act preempted state standards pertaining to new motor vehicle and new motor vehicle engine emissions); Cent. Valley Chrysler-Jeep v. Witherspoon, No. CV F 04-6663 AWILJO, 2007 WL 135688 (E.D. Cal. Jan. 16, 2007) (holding that the Clean Air Act preempted state efforts to reduce global warming pollution). *But see* Green Mountain Chrysler Plymouth Dodge Jeep v. Crombie, 508 F. Supp. 2d 295 (D. Vt. 2007) (holding that Vermont's GHG regulations were not preempted).

69. A survey of recent scholarship reveals several articles applying a *Tragedy of the Commons* analysis to local governments, including Thomas Gremillion, *Setting the Foundation: Climate Change Adaptation at the Local Level*, 41 Envtl. L. 1221 (2011) (climate change); Emily C. Powers, *Fracking and Federalism: Support for an Adoptive Approach That Avoids the Tragedy of the Regulatory Commons*, 19 J.L. & Pol'y 913 (2011) (hydrofracking); Sarah B. Schindler, *Following Industry's LEED: Municipal Adoption of Private Green Building Standards*, 62 Fla. L. Rev. 285 (2010) (land use); Hannah Wiseman, *Expanding Regional Renewable Governance*, 35 Harv. Envtl. L. Rev. 477 (2011) (renewables and urban sprawl).

70. *See* Hunter v. City of Pittsburgh, 207 U.S. 161, 174–80 (1907) (holding that local governments are creatures of state law and that the U.S. Constitution does not protect local governments from state

governments—the rational, self-interested actors on the state commons—do not exist under the U.S. Constitution.[71] Local governments are a legal concept constructed out of state laws and they do not have inherent regulatory authority under, or protected by, the Constitution.[72] The Constitution is relevant on the state scale, however, because local governments have only that authority granted to them by the states. As a result, the federal government assumption of legal authority to act on the national scale, through preemption or otherwise, leaves state and local governments without the legal authority to act (on either the national or state scale)—avoiding a conflict between state and local governments at the state scale (scenario T-4). Accordingly, avoiding a tragedy at the state scale when the federal government is the sole governmental entity with the legal authority to act on the national scale is dependent upon federal action, as neither state nor local governments on the state scale have the legal authority to act.

Alternatively, if on the national scale state governments maintain the legal authority to act, either exclusively or shared with the federal government, then the potential for a new struggle arises on the state commons—a struggle between state and local governments. One example of this struggle involves traditional notions of economic pressures as described in the *Tragedy of the Commons*, whereby in the absence of state government regulatory restrictions, local governments are engaged in the oft-discussed race to the bottom phenomenon stemming from a traditional, natural capital commons structure. The local governments are believed to appropriate depletable and non-excludable resources in competition with other local governments because of the economic incentives in doing so. An alternative description of the commons dilemma at the state scale is rooted in the legal pressures that actually influence local governments to act rationally. These pressures are frequently overlooked and stem from the fact that state law often compels local governments to manage natural capital resources in a rational, and thus potentially tragic, manner. In particular, local governments are often prohibited from having extraterritorial impacts and are limited to regulating solely within their borders.[73] The combination of multi-

government intrusion). *But see* Avery v. Midland Cnty., 390 U.S. 474, 482–86 (1968) (holding that a state may not create a general purpose local government that apportions voting unequally in violation of the Constitution); Gomillion v. Lightfoot, 364 U.S. 339, 346–48 (1960) (holding that the Constitution protects individuals from state-created local self-government based on race).

71. *See Hunter*, 207 U.S. at 178.

72. *See id*.

73. Further discouraging local governments from taking sustainable action on common resources are damage awards stemming from a finding of an impermissible extraterritorial impact. *Cf.* Owen v. City of Independence, 445 U.S. 622, 651–52 (1980) ("The knowledge that a municipality will be liable for all of its injurious conduct, whether committed in good faith or not, should create an incentive for officials who may harbor doubts about the lawfulness of their intended actions to err on the side of

jurisdictional natural capital resources and limited local government authority to regulate those resources creates inefficiencies that discourage local governments from seeking innovative solutions to commons challenges.[74]

There are four potential legal scenarios within a state that inform the nested governance commons and influence local government actors' behavior on the state scale.[75] The first stems from an early twentieth century doctrine—Dillon's Rule.[76] Under this rule a local government may act only if the action is expressly authorized by the state, is incidental to an expressly stated authorization, or is "indispensable" to performing the local government's tasks.[77] Further, any fair, reasonable doubt concerning the existence of the power is resolved by the courts against the local government, and the power is denied.[78] The remaining three state legal scenarios informing the state governance commons are commonly referred to as "home rule" laws. Home rule laws vary in the amount of autonomy granted to local governments and come in three forms: (1) legislative home rule,[79] (2) imperio home rule,[80] and (3) hybrid legislative/imperio.[81] Ultimately, all four of these legal scenarios—Dillon's Rule and the three types of home rule laws—limit local government authority to some degree.

State preemption laws determine when a local government has exceeded its legal authority under either Dillon's Rule or the three types of home rule authority, or when the state government has recaptured some of that authority.[82] Incorporated into the home rule and preemption

protecting citizens' constitutional rights.").

74. *See* Rosenbloom, *supra* note 4, at 446–62 (discussing state home rule and preemption laws and the impact they have on local governments).

75. While we recognize that the probability of a state/local conflict and the outcome of that conflict is heavily influenced by which of the four state legal scenarios is applicable, an in-depth analysis of the four is beyond the scope of this Article, as we are establishing a foundation to understand the state governance commons in which to later detail the nuances.

76. 1 JOHN F. DILLON, COMMENTARIES ON THE LAW OF MUNICIPAL CORPORATIONS (5th ed. 1911).

77. *Id.* at 448–49. For an example of specific state authorization to act in a Dillon's Rule state, see VA. CODE ANN. § 15.2-2280 (1997) (enabling local zoning).

78. DILLON, *supra* note 76, at 452–53; *see* S. Constructors, Inc. v. Loudon Cnty. Bd. of Educ., 58 S.W. 3d 706, 711 (Tenn. 2001) (applying a narrow view of local authority to act under Dillon's Rule); Early Estates, Inc. v. Hous. Bd. of Review of Providence, 174 A.2d 117 (R.I. 1961) (same).

79. *See, e.g.*, ARK. CONST. art. X, § 11.

80. *See, e.g.*, CAL. CONST. art. III, § 5(a).

81. *See, e.g.*, IOWA CONST. art. III, § 38A.

82. The federal government may jump scales and also preempt a local law. We explore this jumping of scales in more detail in a forthcoming companion piece. Here, we are establishing a foundation by isolating the commons at each scale and its relationship to the direct and immediate horizontal and vertical forces before exploring the dynamic and multi-layered interaction among scales and commons. State preemption of a local law may occur in three ways: (1) conflict preemption, where there is a direct conflict between the local ordinance and state law; (2) express preemption, where the state specifically notes that it is preempting the subject matter; and (3) implied preemption, where the state preempts a subject matter indirectly through prior actions, such as existing state legislation. *See* Talbot Cnty. v.

analyses is an inquiry into whether a particular local action has an impermissible extraterritorial impact.[83] While state judicial interpretation of when a local government is acting extraterritorially may differ, many courts "use a finding of extraterritoriality as the basis for the conclusion that [a local government] . . . has exceeded the [locality's] . . . powers, or has been preempted by the state legislature."[84]

The combination of Dillon's Rule, home rule laws, and the judicial interpretation of preemption laws coerces local governments to consider only the impacts within their jurisdiction. Local government actors are at a minimum encouraged, and at most legally compelled, not to consider their externalities or to act "rationally," resulting in a legally entrenched commons.[85] Because many natural capital resources are not confined to a local government's borders, any benefit that may stem from one local government's irrational protective action to preserve the resource can be quickly lost. Therefore, the free-riding actions of neighboring jurisdictions discourage "irrational" (responsible) horizontal management of commons resources by those jurisdictions that would otherwise do so. Each locality is therefore faced with both economic and legal pressure to adopt a dominant strategy to benefit its inhabitants—internalizing those benefits—while externalizing the costs to the other state common pool actors.[86] Each locality is reduced to competing with other localities for the appropriation of natural resources, including those relevant to climate change, such as forests, wetlands, and agricultural resources.

When more authority is assumed by state governments under strict interpretations of Dillon's Rule, home rule, and preemption laws, less authority is granted to local governments and vice versa. In this way, state constitutional and statutory provisions formulate a governance commons that overlays the natural resource commons it was intended to govern at the state level. The presence of Dillon's Rule, home rule, and preemption provisions over local resource appropriation can result in proper commons resource management at the state scale if the state government acts on its legal authority to regulate local activities (scenario NT-1).[87] State legislation pertaining to GHG reductions

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Skipper, 620 A.2d 880, 886 (Md. 1993). *See generally* Goodell v. Humboldt Cnty., 575 N.W. 2d 486 (Iowa 1998) (holding county ordinances preempted by state legislature); RICHARD BRIFFAULT & LAURIE REYNOLDS, CASES AND MATERIAL ON STATE AND LOCAL GOVERNMENT 406–49 (7th ed. 2009).

83. *See* Laurie Reynolds, *Home Rule, Extraterritorial Impact, and the Region*, 86 DENV. U. L. REV. 1271, 1274 n.19 (2009) (citing Seigles, Inc. v. City of St. Charles, 849 N.E.2d 456, 458) (Ill. App. Ct. 2006)) (noting that the court called it "axiomatic" that a local government may not act outside its borders).

84. *Id*. at 1275.

85. *See* Rosenbloom, *supra* note 4, at 453–61.

86. This is not to suggest that local governments do not act in an individual altruistic or collective manner. Despite the inefficiencies of acting alone, local governments have been a leading force to address many common pool challenges. *See id.* at 466–68.

87. While local governments often control significant amounts of authority, particularly as related

enacted in California,[88] Oregon,[89] and Washington[90] represent examples of the NT-1 scenario on the state scale, where state governments have the legal authority to address climate change, take proactive political action to do so, and presumably preempt any local action contrary to the laws. Similarly, if a state constitution grants exclusive legal authority through home rule or specific constitutional protections[91] to local governments to manage a resource, they may choose to harness their collective action and coordinate with each other to manage the resource in a non-tragic way (scenario NT-2).[92]

Because a number of natural capital resources, such as wetlands, forests, and agricultural resources, are simultaneously managed by state and local governments, avoiding a tragedy of the commons could occur when (a) the state vertically regulates local activities pertaining to the resource in the absence of otherwise legitimate horizontal local government political action (scenario NT-3); (b) local governments horizontally coordinate in the absence of otherwise legitimate vertical state political action (scenario NT-4); or (c) the state vertically regulates *and* local governments horizontally coordinate (scenario NT-5). Local government collaborations, such as C40 Cities Climate Leadership

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to land use, waste management, and building codes, many cities do not have the home rule authority to act (regardless of preemption laws) on a number of climate-crucial issues, such as energy and agriculture, as reflected in scenario NT-1. *See generally* ARUP, CLIMATE ACTION IN MEGACITIES: C40 CITIES BASELINE AND OPPORTUNITIES 4–11 (2011).

88. Assemb. B. 32, § 2, 2006 Gen Assemb., Reg. Sess. (Cal. 2006) (Global Warming Solutions Act) (establishing GHG reduction goals and a framework for achieving the goals).

89. H.B. 3543, 74th Leg. Assemb., Reg. Sess. (Or. 2007) (Climate Change Integration Act) (setting specific GHG reduction goals for Oregon, including reducing GHG levels to 10% below 1990 levels by 2020 and to 75% below 1990 levels by 2050).

90. H.B. 2815, 60th Leg., Reg. Sess. (Wash. 2008) (implementing GHG reduction strategies through trading and vehicle miles traveled).

91. One of the most common specific state constitutional protections includes a state ban on special commissions. *See, e.g.*, S.D. CONST. art. III, § 26 (prohibiting the state from delegating enumerated functions over local governments to a special commission). Also common are state bans on special legislation. *See, e.g.*, IOWA CONST. art. III, § 30 (prohibiting the state from passing enumerated special laws).

92. We acknowledge that scenario NT-2 is less common than NT-3, -4, and -5, where state and local governments share authority. In the majority of cases, courts readily recognize a state's authority to resume control granted to a local government. *See* People *ex rel.* Bernardi v. Highland Park, 520 N.E.2d 316, 322–23 (Ill. 1988) (holding that local government exceeded home rule authority when it hired a contractor who paid less than state mandated prevailing wage); City of Des Plaines v. Chi. & N.W. Ry. Co., 357 N.E.2d 433, 435–36 (Ill. 1976) (striking down a local law concerning noise pollution controls because the city attempted to regulate noise from a train originating outside of its borders). However, there are instances in which local governments have been authorized to act under general home rule constitutional provisions or specific constitutional provisions that insulate them from state legislative—as opposed to constitutional—action, thus resulting in scenario NT-2. *See, e.g.*, Kalodimos v. Vill. of Morton Grove, 470 N.E.2d 266, 273–77 (Ill. 1984) (holding that a local law barring possession of handguns did not exceed the village's home rule power even though it would create a patchwork of different local laws); Peters v. City of Springfield, 311 N.E.2d 107. 111–12 (Ill. 1974) (upholding a local ordinance setting a mandatory retirement age for policemen and firemen below the state statute).

Group,[93] the U.S. Conference of Mayors,[94] and Union of the Baltic Cities,[95] represent horizontal collaborative attempts to avoid a tragedy relevant to climate change at the state scale. When these attempts are coupled with state legal authority but the state does not take political action, then an NT-4 scenario can arise. Relatedly, when horizontal collaborations similar to these are coupled with state legal authority and political action, an NT-5 scenario can arise and avoid the tragic overconsumption of resources.

Conversely, a tragedy may result if the state has not authorized local governments to act, and the state fails to vertically regulate local activities (scenario T-1). Over the past year, a T-1-like scenario has arisen in several states over zoning and natural gas fracturing (or "fracking"). State laws in Pennsylvania, for example, have attempted to carve out exceptions from local zoning laws for various oil- and gas-related activities.[96] In these circumstances, local governments are powerless to protect the resource, and the state has failed to take action to protect the resource (and in some cases, such as fracking in Pennsylvania, has facilitated the consumption of the resource). A tragedy may also occur if local governments are authorized through home rule or specific enabling laws to manage a resource, they fail to horizontally coordinate their activities, and the state (1) fails to reclaim the legal authority from local governments (scenario T-2); (2) is prohibited from reclaiming the authority by the state constitution (scenario T-2); or (3) maintains concurrent legal authority and fails to regulate through vertical state political action (scenario T-3).[97]

At the state scale, a legally entrenched nested governance commons results most often from a lack of state political action to vertically

93. *See* C40 CITIES CLIMATE LEADERSHIP GRP., http://www.c40cities.org (last visited Feb. 25, 2013) ("Acting both locally and collaboratively, C40 Cities are having a meaningful global impact in reducing both greenhouse gas emissions and climate risks.").

94. The U.S. Conference of Mayors has produced a document in which 1054 mayors representing almost eighty-nine million people have agreed to GHG reductions in a similar fashion to that set forth in the Kyoto Protocol. *See U.S. Conference of Mayors Climate Protection Agreement*, MAYORS CLIMATE PROT. CTR., http://www.usmayors.org/climateprotection/agreement.htm (last visited Feb. 25, 2013).

95. UNION OF THE BALTIC CITIES, http://www.ubc.net (last visited Feb. 25, 2013) ("Union of the Baltic Cities is a voluntary, proactive network mobilizing the shared potential of over 100 member cities for democratic, economic, social, cultural and environmentally sustainable development of the Baltic Sea Region.").

96. 58 PA. CONS. STAT. §§ 2301–3504 (2012) (seeking to preempt local zoning ordinances that regulate oil and gas operations). This law was partially struck down in *Robinson Twp. v. Commonwealth*, 52 A.3d 463 (Pa. Commw. Ct. 2012). A number of local coastal communities are experiencing similar T-1-like scenarios where states are "transfer[ing] authority over armoring from local to state control." J. Peter Byrne, *The Cathedral Engulfed: Sea-Level Rise, Property Rights, and Time*, 73 LA. L. REV. 69, 97 n.127 (2012) (citing Maryland's Living Shoreline Protection Act of 2008, MD. CODE ANN., ENVIR. § 16-201 (Westlaw 2012); Connecticut's Act Concerning the Coastal Management Act and Shoreline Flood and Erosion Control Structures, S.B. 376, 2012 Reg. Sess. (Conn. 2012)).

97. In theory, a T-2 scenario may also exist where local governments are insulated from state action, and the local governments fail to take action. As discussed above, a more common scenario is T-3, where the state maintains some authority to reassume control or concurrently regulate. *See supra* note 92.

regulate local government activities, a lack of local government collective action when authorized by home rule or enabling laws, or a narrow judicial interpretation of home rule provisions and the prohibition on extraterritorial actions preventing local governments from taking actions they otherwise might take. This structure subjects the depletable state natural capital to rivalry by non-excludable local governments that may either choose to appropriate the resource unit of natural capital over which they maintain control from the state if the state does not intervene, or may even be compelled to do so by state law.

D. Local Governance Commons

At the lowest scale on the governance commons, private sector actors compete for vital natural resources most immediately within the bounds of the local government in which their property is situated. Land use activities undertaken by private property owners who fail to self-coordinate or who are not governed by local rules for appropriating natural capital can remove or mismanage vast amounts of natural capital that could be used to sequester carbon, with tragic climate change impacts. Urban sprawl, subnational forest management, and wetland disturbance/disappearance each constitute valuable case studies of this phenomenon. In other words, private property owners are potential herders on the local commons in the absence of horizontal self-coordination among property owners or vertical regulatory coordination arising from local government regulation.

In order to avoid a natural capital commons dilemma at the local scale, the local government must have the legal authority to vertically regulate, or private sector actors must have the legal authority to horizontally coordinate. If neither local government nor private sector actors have legal authority to vertically regulate or horizontally coordinate due to federal or state preemption of their ability to do so, then the local governance commons devolves into a T-4 scenario on the local scale, where the vertical and horizontal legal authority are absent, and avoiding a tragedy of the commons can only occur by higher-level action. Higher-level action would require a jumping of scales, so to speak, in the form of federal or state vertical regulatory or horizontally coordinated activities—a scenario we will further analyze in future research.

Alternatively, if states maintain legal authority to act on the national scale, and an individual state allocates some or all of that legal authority to local governments to act on the state scale (through Dillon's Rule or home rule provisions, and without preemption), a tragedy may be avoided at the local scale through vertical regulatory action on the part of the local government. If private parties are left a degree of legal authority to devise their own commons management solutions notwithstanding local government regulation, then it may constitute an NT-3 or an NT-5

scenario (depending on whether private property owners actually do take action, NT-5, or do not take action, NT-3). For example, landowners might come together to create a trust or execute formal private land use controls, such as private covenants, to protect forests or wetlands.[98] They might also enter into forest, wetland, or agricultural cooperatives to achieve sustainable resource management.[99] If local government regulation completely preempts private property owner authority, then it is an NT-1 scenario. For example, as discussed further in Part III, Washington County Maryland's Forest Conservation Ordinance, which requires that developers of projects removing 40,000 square feet of forest submit a mitigation plan for approval, arguably represents an NT-1 scenario at the local scale.[100]

It is also possible that the federal or state governments may maintain authority to vertically regulate—and that they will do so in a way that prevents local governments from also acting—but that allows for concurrent, private-property owner horizontal action. This is the NT-2 scenario at the local scale, where the local government does not maintain legal authority but private property owners can self-coordinate. Finally, private property owners may of their own accord horizontally coordinate for proper commons resource management in the absence of otherwise authorized local government regulation (scenario NT-4).

Conversely, scenario T-1 results when a local government maintains legal authority to vertically regulate, but fails to do so *and* prevents private property owners from acting. T-2 results when the state or federal governments withhold legal authority from local governments to vertically regulate a resource but allow concurrent private property owner action that does not then come to fruition. The fracking example represents a T-2 scenario at the local scale, as local governments have been preempted by state authority. Presumably, private landowners still have the authority to refuse to allow fracking on their property, but many have not done so.[101] T-3 results when local governments have the legal authority to act—granted by the state and not preempted by state or federal authority—but fail to

98. *See, e.g.*, *Working Conservation Easements*, PACIFIC FOREST TRUST, https://www.pacificforest.org/working-forest-conservation-easements.html (last visited Feb. 25, 2013) ("Working forest conservation easements provide private landowners the means to permanently conserve their forests for a variety of public benefits while keeping them in private ownership and productive forestry.").

99. *See, e.g.*, SARAH F. ASHTON ET AL., FOREST MANAGEMENT IN THE INTERFACE: FOREST COOPERATIVES (2011).

100. WASH. CNTY., MD., FOREST CONSERVATION ORDINANCE (2008); *see infra* notes 154–155 and accompanying text.

101. *See, e.g.*, 58 PA. CONS. STAT. §§ 2301–3504 (2012); H.B. 464, 61st Leg., 2d Reg. Sess. (Idaho 2012) (requiring "uniformity and consistency in the regulation" of fracking); Sub. H.B. 278, 25th Gen. Assemb. (Ohio 2004) (prohibiting local governments from determining placement or permitting of fracking wells).

take necessary political action at the same time that private property owners fail to exercise concurrent management authority.

III. The Climate Governance Commons: Divergent Approaches to Climate Policy Within Each Nest

Climate change is the quintessential global commons problem. The atmosphere, when free from human GHG inputs, maintains a climatic balance that slowly shifts over time due to natural causes. But humans have rushed the atmospheric commons and flooded it with carbon dioxide and other GHGs in a remarkably short time period, geologically speaking.[102] As with Hardin's herders, society has done so because humans, particularly in the developed world, have received the full benefit of taking actions that result in the appropriation of resource units by emitting GHGs, while the negative effects of those emissions (climate change impacts) are being shared by actors across the entire globe and across time (i.e., future generations).

Part II established a theoretical foundation for exploring how different legal authority and political action scenarios within levels of government horizontally and across governments vertically complicate natural capital management in a governance commons like a federal system. The various ways in which those scenarios may play out across different parts of the United States, and how those differences may be overcome to address climate change in the United States, are the subject of future research building upon this Article. This Part, on the other hand, will provide examples of how *within each individual scale* action might be taken either vertically or horizontally to protect natural capital crucial to combatting climate change, like forests, wetlands, and agricultural resources.

The description of these two approaches is purposefully divergent and is oversimplified by design—looking at vertical and horizontal approaches within each scale in a vacuum. We take this approach because it is necessary to break into constituent parts the two primary mechanisms by which commons resources can be managed in federal systems. First, this is necessary in order to demonstrate more clearly how both vertical and horizontal approaches may be crafted within each scale, which also represents the two-dimensional narrative in which the tone of the debate is often pitched. Second, we wish to provide a foundation for future research focusing on how both vertical and horizontal approaches play out quite differently within a third dimension that accounts for different geolegal and geopolitical challenges across the United States. These challenges, in

102. U.S. Global Change Research Program, Global Climate Change Impacts in the United States 9 (2009) ("Observations show that warming of the climate is unequivocal. The global warming observed over the past 50 years is due primarily to human-induced emissions of heat-trapping gases.").

turn, drive a need to craft a convergent approach that optimizes the combination of vertical and horizontal approaches across regions of a federal system of government (like the United States) to more effectively address climate change.

At the risk of stating the obvious, natural capital tragedies may result within each scale because of mismanagement of resources crucial to successful climate change policy at successive scales. Though individual entities within scales—whether private property owners or local, state, or national governments—may altruistically act irrationally and maximize the conservation and management of natural capital to mitigate climate change, there remain large gaps regarding the proper management of climate-crucial natural capital. This is evidenced by urban sprawl and lax land-use regulation, insufficient forest management standards leading to potentially grave threats to forests, continued wetland loss, poor agricultural practices, and so on. These tragedies may occur because entities within the scale fail to horizontally coordinate, or because governments higher up the scale fail to coordinate the activities within the scale.

As discussed above, the failure to horizontally coordinate or vertically regulate is a product of legal authority and political action scenarios that vary by scale. Each scale of governance has a unique set of legal authority/political action permutations to which the actors are bound. Ultimately, it is these scenarios that shape the degree to which the management or mismanagement of natural capital within that scale is likely to result in commons tragedies. It is therefore useful to look to models of vertical regulatory coordination or horizontal self-coordination that have been used to successfully manage natural capital within each scale. These models may apply to different categories of natural capital that are less relevant to climate change mitigation, but their approaches may be transferable. These models may also be very familiar in approach or implementation, as, for example, a national policy aimed at clean water (the Clean Water Act) might provide a model for federal inputs into forest regulation. Alternatively, they may be quite unfamiliar and novel, as might be the case with one local government out of approximately 88,000 in the United States that has designed a unique and successful policy aimed at protecting natural capital. To this end, one Subpart below will detail vertical regulatory coordination for each scale, whereby the next scale up coordinates the activities of entities within the scale through a top-down approach to managing natural capital climate commons resources. Another Subpart will detail what horizontal self-coordination for managing natural capital climate commons resources would look like within each scale, whereby private-property owners or similarly situated governments work with each other to manage resources in the absence of, or supplemental to, vertical regulatory coordination.

A. Vertical Regulatory Coordination

Vertical regulatory coordination for climate change at the global scale would seek to accomplish many of the same objectives that have been discussed in the international community but which have yet to be implemented via a treaty-based climate change response. The Kyoto Protocol provides an example of an international framework that seeks to achieve legally binding emissions limits on individual countries agreed upon at the international level.[103] This approach has yet to succeed in gaining the support of the most significant global emitters of carbon, and indeed some scholars have noted that in the absence of global consensus the process has broken down into a variety of transnational, regional approaches to addressing climate change.[104] Nonetheless, given both the ever-shifting climate and ever-shifting political attitudes, such a treaty could emerge in the future. While the Kyoto Protocol focuses primarily on emissions limits—the *source* component of carbon—a treaty might also focus on the preservation of natural capital crucial as a carbon *sink*, like forests, wetlands, and agricultural resources. Each of these, as described above, are the resources most affected by the overlay of the governance commons in the U.S. federal system given the current division of federal/subnational regulatory authority over their management. Of course, a combined approach regulating both carbon emissions and sinks might be a viable option as well, whereby vertical emissions limits result in carbon offset markets that drive the preservation of forests, wetlands, and agricultural lands. No matter the target of vertical regulation—and though the examples of successful vertical regulatory coordination are rare at the global level—success stories exist and provide one mechanism for addressing global commons concerns notwithstanding the current pessimism regarding treaty viability.

The Montreal Protocol is instructive on this point. The Protocol is one of the most successful international agreements, having been ratified by nearly 200 countries,[105] and it "provides a useful model for other long-

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103. Melissa J. Durkee, *Persuasion Treaties*, 99 Va. L. Rev. 63, 71 n.30 (2013) ("The Kyoto Protocol is the world's only legally binding agreement on climate change." (citing United Nations Framework Convention on Climate Change, Q&A with UNFCCC Executive Secretary Christina Figures: The UNFCCC and the UN Climate Change Conference in Durban (2011)); José Antonio Urrutia, *The Equator Principles or How the Way to Do Business Has Changed*, 54 Rocky Mountain Min. L. Inst. 16-1 (2008) ("The major feature of the Kyoto Protocol is that it sets binding targets for 37 industrialized countries and the European community for reducing greenhouse gas (GHG) emissions.").

104. *See* Kenneth W. Abbott, *The Transnational Regime Complex for Climate Change*, 30 Envt. & Plan. C: Gov't & Pol'y 571 (2012); Daniel Bodansky, A Tale of Two Architectures: The Once and Future U.N. Climate Change Regime (Mar. 1, 2011) (unpublished manuscript), *available at* http://papers.ssrn.com/sol3/papers.cfm?abstract_id=1773865.

105. *Status of Ratification*, United Nations Environment Programme (Jan. 2, 2013), http://ozone.unep.org/new_site/en/treaty_ratification_status.php.

term environmental challenges such as climate change."[106] In fact, in "no other treaty have so many disparate actors in international society successfully cooperated and compromised to address a global environmental threat."[107] The Montreal Protocol took a prescriptive approach to the ozone problem, freezing both production and consumption levels of ozone-depleting CFCs and other chemicals as well as implementing a reduction schedule for their use. Importantly, these standards were set and agreed upon at the international level and subsequently agreed to by a vast majority of nations, rather than being merely targets or commitments developed domestically. The Protocol further prescribed strict trade measures on products containing or produced by the use of CFCs to encourage treaty signage and ratification.[108]

In addition to prescriptions, the Protocol further provided technical and financial assistance to aid developing countries that might be limited in achieving reductions.[109] Finally, the Protocol adopted a flexible approach allowing evolution over time, with parties assessing and reviewing controls at least every four years so that if "any of the controlled substances were found to be less harmful than thought or the schedules proved too stringent, the Protocol's reduction schedules could be modified with a two-thirds majority of countries representing two-thirds of global consumption."[110] The Protocol has been effective in keeping ozone depletion on the international environmental agenda, and the parties have "met regularly since 1987, typically to tighten reduction schedules, bring new chemical substances under control, and establish many rules and operating procedures to implement what has become a comprehensive regime for managing a growing number of chemicals."[111] Though there are current and future challenges to be faced by the Montreal Protocol regime,[112] it has been regarded as a "triumph of international diplomacy," reducing CFC and other ozone depleting use and production in the developed world more than 95% and with developing countries also making strides.[113]

There are, of course, important distinctions between the problems addressed by the Montreal Protocol and those brought about by climate change, presenting additional challenges to adopting a global vertical regulatory approach both with regard to emissions limitations and

106. DAVID HUNTER ET AL., INTERNATIONAL ENVIRONMENTAL LAW AND POLICY 533 (4th ed. 2010).
107. *Id.* at 595.
108. *Id.* at 584.
109. *Id.* at 585.
110. *Id.* at 554.
111. *Id.* at 555.
112. *Id.* at 566–68.
113. *Id.* at 595.

preservation of natural capital carbon sinks. Regarding emissions limitations, CFCs were used in fewer products and processes globally (relative to carbon), and as a result fewer sectors of the economy were implicated. Additionally, alternatives to CFCs became available relatively quickly, whereas there are very few readily available technologies for carbon as an energy source, at least on a scale that could rival the expansive use of carbon globally.

Regarding the preservation of natural capital such as forests, wetlands, and agricultural resources as carbon sinks, the first challenging distinction is the connection of these resources to land-use policies. Each of these resources is implicated by a variety of land-use and other resource extraction policies related to the development, cultivation, or other use of land, whereas CFCs are industrial products manufactured or used in manufacturing processes and entering the stream of commerce. Tracking CFC emissions levels from a relatively uniform and limited set of industrial players within a global economic market might seem like an easy task when faced with the proposition of tracking GHG-emitting or GHG-sequestering land-use activities undertaken across a spectrum from individuals all the way up to corporations and governments—each engaged in a myriad of different economic endeavors on every square inch of surface area within a country. Virtually everywhere and everyone within a jurisdiction are implicated within any single land-use policy. Achieving adjustments of land use policies would also prove more difficult than emissions limitations because the division among levels of government vertically and across jurisdictions horizontally would require a far greater degree of coordination than a centralized authority setting standards across the country for an industry emitting or producing a handful of readily identifiable gases.

Yet, despite these challenges, countries may one day agree to take action on both carbon emissions limitations and natural capital preservation. Indeed, for a time the Montreal Protocol seemed doomed to fail, until the political and scientific winds shifted enough to make the threat of ozone depletion to global populations very real.[114] As a result, it seems premature to match the doom and gloom tone of climate change dialogue with a similar tone regarding the probability or efficacy of vertical global action to address it. For GHG emissions limitations, nations may agree to be bound to legal requirements that they achieve certain reductions in emissions over set periods of time, with economic and other penalties doled out at the international level in the event of noncompliance. Yet emissions reductions generally do not present the nested commons problems presented by the preservation of certain carbon-critical natural capital as GHG sinks. Emissions reductions tend to

114. *See generally* HUNTER, *supra* note 106, ch. 10.

focus on regulation of industrial players involved in the national and global stream of commerce, which is far less impacted by the fragmented jurisdictions present in a federal system of government, at least in the United States.

A global, legally binding treaty requiring the preservation of forests, wetlands, or agricultural resources, on the other hand, would be just the type of vertical regulatory arrangement complicated by the nested governance commons. Yet preservation of these types of natural capital could also be the most effective and efficient mechanism for combating climate change. Restrictions on industrial emissions, transportation emissions, or emissions from other sectors are often seen as potentially costly climate mitigation methods, due to technological and economic constraints of changing methods of production or energy portfolios over short time scales. On the other hand, the preservation of existing forest, wetlands, or agricultural resources requires little upfront cost, other than the potential cost of foregone development (which would likely be carbon intensive at any rate). And restoration of certain natural capital, like forests, is relatively low cost also, requiring far less significant human and financial capital expenditures to achieve than pure industrial emissions reductions.

A global forest protocol, long the subject of discussion at the international level,[115] could require certain stand density standards for participant countries' forests, as well as riparian buffer zone, clear-cutting, road-building, afforestation and reforestation, and a variety of other forest practice requirements that have impacts on GHG sources and sinks from forestry.[116] As the Montreal Protocol proceeded regarding financial and technological assistance, a forest protocol could also facilitate investment mechanisms like those already on the table at the international level, such as Reduced Emissions from Forest Degradation and Destruction ("REDD") programs, or what has become known as "REDD-plus." REDD-plus seeks to curb forest destruction and degradation and enhance forest carbon stocks, but also promotes "conservation [and] sustainable management of forests . . . in developing countries"[117] through programs aimed at alleviating rural poverty, conserving biodiversity, and sustaining forest ecosystem services.[118] These programs could promote afforestation or forest preservation within individual nations in need of such projects and where the institutional or

115. *See* Blake Hudson, *Climate Change, Forests, and Federalism: Seeing the Treaty for the Trees*, 82 U. COLO. L. REV. 363, 372–78 (2011).

116. CONSTANCE L. MCDERMOTT ET AL., GLOBAL ENVIRONMENTAL FOREST POLICIES: AN INTERNATIONAL COMPARISON 15–18 (2010).

117. FOUND. FOR INT'L ENVTL. L. & DEV., GUIDE FOR REDD-PLUS NEGOTIATORS 4 (2011).

118. CHARLIE PARKER ET AL., THE LITTLE REDD+ BOOK 14 (3d ed. 2009).

political capacity does not exist to effectively carry out the prescriptive dictates of an international regime absent such assistance.

Similarly, a wetland protocol might provide prescriptions on the filling or destruction of wetlands deemed of critical importance within nations, and might also set up international investment mechanisms for wetland restoration. These prescriptions could serve the purpose of both providing a sink for carbon as well as preserving or restoring wetlands as natural capital crucial to curb coastal land loss and threats to human settlements caused by increased hurricane and flood events.[119] An international agricultural protocol might set limits on crop cultivation, such as soil tillage (carbon) and fertilizer use (nitrous oxide), or livestock manure management or diet (methane).[120] It might also set up investment mechanisms to establish biofuel or methane energy generation technologies in areas where adoption of such technologies would be cost prohibitive. The use of forests and agricultural resources for energy in lieu of fossil fuels releases carbon dioxide, but "this CO_2 is of recent atmospheric origin (via photosynthetic carbon uptake) and displaces CO_2 which otherwise would have come from fossil carbon."[121] In other words, even though these fuels might be cultivated from agricultural or forest carbon sinks, "the primary GHG benefits of these options can generally be treated as equivalent to permanent emission reductions."[122]

Even if a stand-alone forest, wetland, or forest protocol is never developed, potentially significant mechanisms for encouraging wetland, forestland, and agricultural resource conservation and preservation are offset programs that are coupled with or subsumed under another prescriptive vertical regulatory program, such as a regulatory cap-and-trade or carbon taxation system. Indeed, most iterations of proposed domestic carbon cap and trade legislation in the United States have provided for carbon offset projects driven by investment in, or credit purchases from, approved carbon sequestration projects—particularly those related to forests.[123] In addition, the United States has considered agricultural offset programs to encourage conservation tillage, reduction of nitrogen fertilizer, changing manure management practices, and converting agricultural lands to forests or grasslands.[124] These programs

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119. *See* Blake Hudson, *Coastal Land Loss and the Mitigation-Adaptation Dilemma: Between Scylla and Charybdis*, 73 LA. L. REV. 31, 61 (2012).

120. *See* HUDSON, *supra* note 47.

121. SMITH ET AL., *supra* note 44, at 499.

122. U.S. ENVTL. PROT. AGENCY, GREENHOUSE GAS MITIGATION POTENTIAL IN U.S. FORESTRY AND AGRICULTURE 2–9 (2005).

123. *See* Lieberman-Warner Climate Security Act, S. 2191, 110th Cong. (2007); *see also* American Clean Energy and Security Act (Waxman-Markey Bill), H.R. 2454, 111th Cong. (2009); *Dingell-Boucher Cap-and-Trade Bill*, INST. FOR ENERGY RESEARCH (Oct. 7, 2008), http://www.instituteforenergyresearch.org/2008/10/07/dingell-boucher-cap-and-trade-bill.

124. *See* JOHN HOROWITZ & JESSICA GOTTLIEB, U.S. DEP'T OF AGRIC. ECON. RESEARCH SERV., ECON.

have heightened appeal over stand-alone arrangements for either emissions reductions or natural capital preservation because policies aimed at reducing emissions alone from the forest, agricultural, or development sectors (in the case of wetlands) may not be as attractive as those that both reduce emissions and increase productivity of operations.[125] Increasing productivity may occur through expansion or adjustment of agricultural or forestry operations in a way that causes more carbon to be sequestered, or by simply offsetting or perhaps even increasing profits displaced by emissions reduction expenses. It is true that offset projects have raised concern in some sectors regarding leakage, permanence, additionality, and other issues. Still, others have called for incorporating farming and land use offset investments into cap-and-trade programs.[126]

A treaty might also require an adjustment in domestic subsidy programs related to natural capital cultivation and preservation. For example, the United States is one of the largest subsidizers of agriculture in the world, paying billions each year, with many subsidies supporting GHG-intensive commodity crop production.[127] These subsidies largely "exacerbate chemical use, the expansion of cropland to sensitive areas, and overexploitation of water and other resources, while distorting trade and reinforcing unsustainable agricultural practices."[128] Yet, an international arrangement might follow the lead of the European Union, which in 2003 began requiring that certain environmental requirements must be met before agricultural interests could receive subsidies.[129] Similarly, perhaps an international regime could require that domestic subsidies within participant countries not be granted unless certain natural capital preservation and carbon sink activities were taken within forests, for wetlands, or on agricultural lands.

Ultimately, vertical regulatory coordination at the global level, whether for emissions reductions, natural capital preservation, the inclusion of offset programs for natural capital within a prescriptive emissions reduction regime, subsidy restrictions, or otherwise, may require nations to give up a degree of sovereignty over each of these subject areas if legal requirements or targets for carbon emissions, or forest, wetland, and agricultural resource preservation are to be met. Even so, we have

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BRIEF NO. 15, THE ROLE OF AGRICULTURE IN REDUCING GREENHOUSE GASES 1 (2010).

125. *See* SMITH, *supra* note 44, at 515.

126. SARA J. SCHERR & SAJAL STHAPIT, WORLDWATCH INST., MITIGATING CLIMATE CHANGE THROUGH FOOD AND LAND USE 6 (2009). For a review of the offset potential of agriculture, see ROGER CLAASSEN & MITCH MOREHART, U.S. DEP'T OF AGRIC. ECON. RESEARCH SERV., ECON. BRIEF NO. 14, AGRICULTURE LAND TENURE AND CARBON OFFSETS (2009).

127. *See* Mary Jane Angelo, *Corn, Carbon, and Conservation: Rethinking U.S. Agricultural Policy in a Changing Global Environment*, 17 GEO. MASON L. REV. 593, 597 (2010).

128. SCHERR & STHAPIT, *supra* note 126, at 32.

129. *See* Daniel Bianchi, *Cross Compliance: The New Frontier in Granting Subsidies to the Agricultural Sector in the European Union*, 19 GEO. INT'L ENVTL. L. REV. 817, 820 (2007).

succeeded before in crafting just such a regime, and though the challenges are more varied, complex, and numerous, when the metaphorical hole in the ozone becomes large enough for the international community in the context of climate change, we may be able to coordinate and take action far more effectively than seems possible now.

In a way, shifting from the global to the national scale provides little room to expound on vertical regulatory approaches, since most of the approaches described above as part of a binding global treaty would be implemented by national regulations. In addition, in the United States, federal legislation on capping or taxing carbon emissions has yet to be enacted, and there is currently very little in the way of federal regulation of natural capital like forests, wetlands, or agricultural resources, aside from activities that occur on federally owned lands, of course. For example, federally owned forests make up more than one-third of U.S. forests.[130] Thus, national parks, wilderness areas[131] and forests subject to the roadless rule[132] may be considered de facto natural capital preservation areas. Policies on these lands could certainly change at any time, but currently they protect a significant quantity of resources crucial to combating climate change.

Despite the current lack of vertical regulatory approaches at the national level, the United States could pass a federal statute pursuant to Commerce Clause authority setting emissions limitations or standards for natural capital preservation. In the forest context, the federal government could enact statutes setting stand density, riparian buffer zone, clear-cutting, road-building, afforestation, or reforestation requirements for private forest owners. This would remedy the wide degree of regulatory inconsistency across states managing important forest resources. While the Commerce Clause case is strong for regulating private property owners engaged in the forest products market, the question becomes trickier in the context of preserving forests as carbon sinks—that is, preventing forests from being cleared, not by foresters, but by entities seeking to use the land for commercial or residential development. This might be achieved by the establishment of urban growth boundaries at the national level, setting a maximum standard of development density around cities of a certain size to forestall urban sprawl. Furthermore, any of the objectives described above could be a corollary of a national emissions cap-and-trade or carbon tax scheme that allows for forest offsets, as discussed above (or wetland or agricultural operation offsets).

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130. *See Forestry*, U.S. ENVTL. PROT. AGENCY, http://www.epa.gov/agriculture/forestry.html (last updated June 27, 2012).

131. Bryan Finegan, *Forest Succession*, 321 NATURE 109 (1984).

132. *Roadless Area Conservation*, U.S. DEP'T. OF AGRIC. FOREST SERV., http://www.fs.usda.gov/help/roadless (last visited Feb. 25, 2013).

The federal government might pass a similar statute aimed specifically at the preservation of wetlands as a carbon sink. Indeed, the federal government already maintains what might be considered a federal natural capital preservation statute aimed at private lands in the form of its § 404 wetland fill permitting program.[133] Though the Clean Water Act's prohibition on the dredging and filling of wetlands facilitates potential federal government conservation or preservation of carbon-loaded wetlands, a vast majority of wetland fill permits are currently approved despite the potential of wetlands to sequester substantial quantities of carbon.[134] The Clean Water Act does not explicitly contemplate impacts on climate prior to approving a fill permit. Rather, the Clean Water Act focuses primarily on water quality impacts, allowing wetlands to be filled when there is no practicable alternative less damaging to aquatic resources and when national waters would not be significantly degraded.[135] Nonetheless, the program does require wetland offsets that could be significant carbon sinks—if the program were to be utilized more aggressively.[136] Additional tweaks in the § 404 program may allow it to play a more substantial role in preserving wetlands. The § 404 program presently exempts "normal agricultural operations."[137] Some scholars have argued that removal of this exemption "could protect many jurisdictional wetlands that are currently allowed to be plowed with impunity," and that "without the exemption for those wetlands that are impacted, mitigation would be required to offset the functions impacted by the agricultural activities, as is required for other types of activities that impact jurisdictional wetlands."[138]

In addition to forests and wetlands, the federal government's primary involvement in agricultural policy is through the provision of subsidies for agricultural operations. There is little reason, besides politics, that the

133. *See* Brandee Ketchum, Note, *Like the Swamp Thing: Something Ambiguous Rises from the Hidden Depths of Murky Waters—The Supreme Court's Treatment of Murky Wet Land in* Rapanos v. United States, 68 LA. L. REV. 983, 1011 (2008). The CWA is one of two such federal statutes, since the Endangered Species Act and its focus on species and critical habitat might also be characterized as a federal natural capital preservation statute, even on private lands.

134. The Corps receives approximately 80,000 permit requests annually, and only about 9% are required to go through a "detailed evaluation for an individual permit." *Id*. at 1011. Most are approved through a nationwide or region-specific permit. *Id.* at 1011–12. Of the 9% required to file for an individual permit, less than 0.3% are denied. *Id*. at 1012. The EPA only exercised its veto authority over Corps wetland permitting eleven times between 1972 and 2007. *Id.*; *see* CRAIG PITTMAN & MATTHEW WAITE, PAVING PARADISE: FLORIDA'S VANISHING WETLANDS AND THE FAILURE OF NO NET LOSS 167 (2009).

135. *See* U.S. ENVTL. PROT. AGENCY, EPA843-F-04-001, WETLANDS REGULATORY AUTHORITY, *available at* http://water.epa.gov/type/wetlands/outreach/upload/reg_authority.pdf (last accessed Feb. 25, 2013).

136. Leonard Shabman & Paul Scodari, *The Future of Wetlands Mitigation Banking*, 20 CHOICES MAG. 65, 65 (2005). *See generally* PITTMAN & WAITE, *supra* note 134.

137. Clean Water Act § 404(f)(1)(A), 33 U.S.C. §§ 1251–387 (2012).

138. Angelo, *supra* note 127, at 642.

federal government could not use its subsidy program to effectively coerce changes in agricultural operations related to GHG emissions and sinks, such as soil tillage (carbon) and fertilizer use (nitrous oxide), or livestock manure management or diet (methane), much as has the European Union.

Shifting to the state scale, we might also see state regulations take the many forms described above related to both emissions caps or natural capital preservation. While a cap-and-trade program for carbon emissions has not materialized at the federal level, the state of California has recently created such a program, and one that provides a model for other states seeking to both cap carbon emissions as well as establish markets for natural capital preservation. The Global Warming Solutions Act of 2006,[139] also known as "AB 32," has a goal of capping and reducing GHG emissions to 1990 levels by the year 2020 and achieving an 80% reduction from 1990 levels by 2050.[140] AB 32 also provides a GHG offset program for certain types of agricultural (livestock-related) and forestry (including urban forestry) projects.[141] Entities may use offset credits to meet up to 8% of their triennial compliance obligation under the program.[142]

Rather than tying natural capital preservation to voluntary offset markets embedded in emissions reduction regulations, state governments may use their land use regulatory authority to zone for the conservation or preservation of agricultural lands, wetlands, or forestlands. An example would be the Maryland Forest Conservation Act, which requires all counties in Maryland with less than 200,000 acres of forest cover to adopt ordinances to conserve forests.[143] The Forest Practices Act in Washington[144] is one of the most stringent forest management regulations in the country. In addition to setting strict standards regarding riparian buffer zone, reforestation, and other forest management standards, the act also serves a preservation function.[145] If a landowner plans to convert forests without an approved forest practices application declaring that the forest will be converted, the Washington Department of Natural Resources will issue a "notice of conversion" to the local government where the property is located.[146] The local government then is required to deny a building or subdivision permit application for the property for six

139. California Global Warming Solutions Act of 2006, ch. 488, §§ 1–2 (West 2006).

140. *Cap-and-Trade Program*, CAL. ENVTL. PROT. AGENCY AIR RES. BD., http://www.arb.ca.gov/cc/capandtrade/capandtrade.htm (last reviewed Apr. 10, 2013).

141. *Compliance Offset Program*, CAL. ENVTL. PROT. AGENCY AIR RES. BD., http://www.arb.ca.gov/cc/capandtrade/offsets/offsets.htm (last reviewed Mar. 1, 2013).

142. *Id.*

143. *Forest Conservation Ordinance*, WASH. CNTY., MD., DEP'T OF PLANNING & ZONING, http://www.washco-md.net/planning/forest.shtm (last modified May 30, 2012).

144. WASH. CODE § 76.09 (2012), *available at* http://apps.leg.wa.gov/rcw/default.aspx?cite=76.09.

145. *Id.*

146. *Id.*

years from the time of the notice of conversion.[147] This provides a strong incentive for private property owners to curb their rationality and gain approval of a higher-level authority before appropriating forest resources. Contrast this approach to that regarding forests in the southeastern United States, where most states maintain forest management "best practices" that are entirely voluntary, where there is no regulatory oversight of forest operations, much less a comprehensive state regulation to ensure the conservation or preservation of forest resources.

Michigan has its own wetland regulatory program, whereby property owners must receive a state permit to fill, use, drain, or develop wetlands over a certain acreage and connected to the Great Lakes or inland ponds, lakes, rivers, and streams.[148] Even "isolated wetlands" not covered by the federal § 404 program or connected to any of these waterways or larger than a certain acreage may be covered under the regulatory program if the "DEQ has determined that these wetlands are essential to the preservation of the state's natural resources and has notified the property owner."[149] It is this latter focus on isolated wetlands that may not be reached by the § 404 program that make these types of vertical regulatory approaches on the state scale arguably more effective at wetlands preservation than the § 404 program. Indeed, Maine, Connecticut, New Hampshire, Rhode Island, Massachusetts, Vermont, New York, New Jersey, Maryland, Virginia, Florida, Minnesota, Michigan, Pennsylvania, and Oregon all maintain isolated wetland protections.[150] In an example of bridging state and local scales, most of these regulations are "cooperative state/local regulatory efforts where much of the actual regulation is achieved in cooperation with local governments."[151]

State governments may also develop urban growth boundaries to protect agricultural, wetlands, and/or forestlands. Oregon is instructive on this point, maintaining a comprehensive growth boundary plan,[152] and protecting rural lands outside the boundary including non-urban agricultural and forested lands.[153]

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147. *See Forest Practices Act*, MUN. RESEARCH & SERVS. CTR. OF WASH., http://www.mrsc.org/subjects/environment/forest/forest.aspx (last updated Sept. 2010) (providing detailed information on the Washington Forest Practices Act).

148. Geomare-Anderson Wetlands Protection Act, Natural Resources and Environmental Protection Act pt. 303, 1994 Mich. Pub. Acts 451, *available at* http://legislature.mi.gov/doc.aspx?mcl-451-1994-iii-1-inland-waters-303.

149. *See State and Federal Wetlands Regulation*, DEP'T. OF ENVTL. QUALITY, http://www.michigan.gov/deq/0,4561,7-135-3313_3687-10801--,00.html (last visited Feb. 25, 2013).

150. *See generally* JON KUSLER, ASS'N OF STATE WETLAND MANAGERS, INC., THE SWANCC DECISION AND STATE REGULATION OF WETLANDS (2004).

151. *Id.*

152. OR. DEP'T. OF LAND CONSERVATION & DEV., OAR 660-015-0000(14), OREGON'S STATEWIDE PLANNING GOALS & GUIDELINES (2006).

153. *Rural Development in Oregon*, OR. DEP'T. OF LAND CONSERVATION & DEV., http://www.oregon.gov/LCD/pages/ruraldev.aspx#Rural_Development_in_Oregon (last visited Feb. 25, 2013).

Finally, shifting to the local scale demonstrates how intertwined state governments are with the local governments that they empower to either implement state regulatory plans or pass their own regulatory programs. Providing yet another demonstration of the nested, scale-bridging nature of federal governance and resource commons, the Maryland statute described above, requiring local governments to develop forest preservation plans, results in a variety of regulatory approaches by local governments. One example is Washington County Maryland's Forest Conservation Ordinance,[154] which requires that development of land that is projected to remove at least 40,000 square feet of forest must submit a mitigation plan to the county planning commission. Mitigation options available to private or government property owners include on-site retention or planting, off-site retention or planting, natural regeneration, and payment-in-lieu of planting or retention. The funds generated by the payment-in-lieu of planting option are used to facilitate conservation easement purchases and forest planting operations in sensitive environmental areas, thus providing "the opportunity to plant and then protect, by easement, large contiguous areas of forest rather than promote small-scattered forested areas in order to enhance optimum benefit to the environment."[155]

Washington also has a number of local governments engaged in the preservation of natural capital within local jurisdictions. The city of Bellingham, for example, maintains a municipal code regulating the clearing of any removal of vegetation, including trees, on any lot or property within the city.[156] Similarly, Monroe issues land-clearing permits for the conversion of all forests within the municipality.[157] Issaquah actually places a six-year moratorium on the conversion of forests currently managed under a forests practices permit to other development.[158]

Regarding wetlands, between four and six thousand local governments have adopted local wetland regulations in order to conserve wetlands via the zoning process.[159] These regulations focus on the preservation of wetlands, offsetting wetlands that are filled for development, or the usage of wetlands for flood control.[160]

Not only might local governments engage in preservation of natural capital like forests or wetlands—or the aforementioned zoning to preserve agricultural open space free from development—but governments might

154. WASH. CNTY., MD., FOREST CONSERVATION ORDINANCE, *supra* note 100.

155. *Forest Conservation Ordinance*, *supra* note 143.

156. BELLINGHAM, WASH., MUN. CODE ch. 16.60.50 (1992).

157. MONROE, WASH., MUN. CODE ch. 20.08 (2012).

158. ISSAQUAH, WASH., MUN. CODE ch. 16.26.185 (2012).

159. *See* JON KUSLER, ASS'N OF STATE WETLAND MANAGERS, INC., COMMON QUESTIONS: LOCAL GOVERNMENT WETLAND PROTECTION PROGRAMS 2 (2006).

160. *Id.*

also engage in vertical regulation of emissions. San Francisco officials recently adopted a rule to control emissions from one particular cement plant in Cupertino.[161] While not focused on carbon, but rather nitrogen oxides, particulate matter, and mercury, these limits are more stringent than the suggested federal standards. The impetus for the regulation was citizen concern over health impacts and, although many GHGs are not as obvious of a health concern and local governments have a race-to-the-bottom incentive to refuse carbon emissions regulations in their local jurisdiction, there is no reason that local governments could not begin to regulate carbon emissions much the same way many vertically regulate carbon sinks like forests or wetlands.

B. Horizontal Self-Coordination

Horizontal self-coordination among federal, state, or local governments or private sector parties explores "how a group of principals who are in an interdependent situation can organize and govern themselves to obtain continuing joint benefits when all face temptations to free-ride, shirk, or otherwise act opportunistically."[162] It is an attempt by similarly situated actors to coordinate their appropriation of a commons resource to avoid a tragedy of the commons. The horizontal self-coordinated approach differs from the vertical regulatory approach set forth above in that at each scale a higher scale entity does not set standards of appropriation, monitor appropriation, or sanction misappropriation. Rather, the actors are actively involved in managing the resource. They coordinate their efforts as independent bodies and cooperatively develop objectives relevant to appropriation with other similarly situated actors. They then achieve those objectives through collective regulation, oversight, and sanctions. Critical attributes of successful common pool resource management through horizontal collaboration have been detailed in the factual and theoretical literature.[163] Those attributes include

161. Bay Area Air Quality Mgmt. Dist., Reg. 9, Rule 13 (Sept. 19, 2012), *available at* http://www.baaqmd.gov/~/media/Files/Planning%20and%20Research/Rules%20and%20Regs/reg%2009/RG0913.ashx.

162. *See* Ostrom, *supra* note 13, at 29.

163. *See id.* at 90–91. Ostrom identifies crucial attributes of successful collaborations, stating that each attribute is "an essential element or condition that helps to account for the success of these institutions in sustaining the [common pool resource] . . . and gaining the compliance of generation after generation of appropriators to the rules in use." *Id.* at 90; *see also* Thomas Dietz et al., *The Struggle to Govern the Commons*, 302 Science 1907 (2003). A 2010 study of ninety-one empirical studies applying the attributes identified by Ostrom found:

> [T]he principles are well supported. The most trenchant critiques were abstract, rather than empirical. This does not mean that the principles are complete; their incompleteness is the most important empirical critique we found in the literature. Other factors such as the size of user groups, differing types of heterogeneity within or between user groups, and the type of government regime within which users operate are clearly important in many cases.

Michael Cox et al., *A Review of Design Principles for Community-Based Natural Resource*

management approaches that define clear boundaries and users, adopt rules concerning appropriation that are based on local conditions, incorporate flexibility to modify rules, monitor usage, impose graduated sanctions, provide conflict-resolution mechanisms, insulate from higher scale interference, and organize in multiple levels of nested enterprises.[164]

In the context of climate change, horizontal coordination on the global scale is an attempt to cooperatively organize, manage, and control global GHG emissions through collaboration among national governments. Building off of Ostrom's collaborative model, a horizontal self-coordinated approach to address GHG emissions would consist of individual nations agreeing on target levels of GHG emissions, enacting domestic standards based on local conditions for achieving those emissions levels, flexibly adjusting rules for GHG emissions over time as needed, establishing metrics to measure GHG emissions, monitoring GHG emissions both domestically and cooperating with other nations to allow necessary measures of horizontal oversight, establishing horizontally levied sanctions for exceeding target usage, and adjudicating disputes concerning usage through collaborative engagement with other nations.[165] Alternatively, individual nations could sustain the global commons atmosphere and avoid a climate tragedy of the commons by horizontally collaborating on preserving and developing GHG sinks. Collective action on protecting, conserving, and growing forests and wetlands or in adjusting agricultural production methods could result in individual nations working together to achieve the overall targeted results in a non-competitive, non-tragic manner.

While collective action on GHG emissions and sinks exists among some of the relevant actor nations on the global scale, there is no horizontal collaboration that incorporates all, or most, nations. Nonetheless, existing horizontal efforts are instructive on how more robust forms of horizontal coordination might be achieved on the global scale. For example, in the wake of failed negotiations on legally binding global agreements pertaining to GHG emissions, such as a successor to the Kyoto Protocol, some nations have attempted to horizontally coordinate their efforts to limit GHG emissions. The framework for *Europe 2020: A European Strategy for Smart, Sustainable and Inclusive Growth* provides such an example.[166]

Management, ECOLOGY & SOC'Y, Dec. 2010, at 38.

164. *See* OSTROM, *supra* note 13, at 91–102.

165. *See id.* at 92–95, 100–01.

166. *Communication from the Commission, Europe 2020: A Strategy for Smart, Sustainable and Inclusive Growth*, COM (2010) 2020 final (Mar. 3, 2010). Similar examples can be found relative to GHG sinks. *See, e.g.*, Council Recommendation (EC) No. 413/2002of May 30, 2002, 2002 O.J. (L 148) 24 (recommending that individual nations partner with regional and local authorities (public and private) to determine who has the authority to control coastal zones with the goal that nations will be better able to coordinate their efforts when they know who has authority to act).

Pursuant to the framework, the European Council agreed to a broad reform strategy that included a plan to combat climate change. In particular, the Council committed E.U. members to reducing their collective emissions to at least 20% below 1990 levels.[167] While at the outset this would appear to represent individual actors ceding authority to a higher body to vertically regulate, importantly, the individual E.U. member nations did not relinquish sovereignty to the Council or the E.U. Commission. Rather, the individual members are responsible for identifying their respective national targets, planning a strategy to achieve those targets, and monitoring or enforcing the individual nations' targets. The Council framework establishes an overall goal, but each individual nation designs its own carbon dioxide emission reduction strategy.[168] The Council does not mandate the target, nor does it devise the strategy for achieving the target. While each nation is responsible for creating a plan to meet its target, those efforts are supported by other E.U. nations through the collaborative process of sharing information and resources.

By April 2011, each nation had established its own target and a process for achieving that target. The targets ranged from a 20% *increase* to a 20% *decrease* from 1990 levels.[169] The variation in the individual nation targets illustrates the flexibility embedded in the horizontal approach. By allowing each actor to develop its targets and strategy based on individualized local conditions, the collaborative approach does not attempt to force a single standard for multiple and diverse jurisdictions.[170] This coordinated effort among E.U. nations, however, does not provide for individual nations (or a higher authority) to monitor and sanction failure to achieve the targets. Thus, even this example does not fully incorporate the full scope of recommended elements to achieve a successful horizontal collaboration at the global scale.

Horizontal self-coordination on the national scale parallels that taking place on the global scale. Instead of individual nations collaborating, horizontal self-coordination on the national scale involves collective action among state government actors to avoid the tragic depletion of natural resources. When state actors confront commons resources that are not managed by federal vertical regulation (either by a lack of legal authority (scenarios NT-2, T-2, T-4) or political action (scenarios NT-4, T-1, T-3)), states often compete with each other in a "race to the bottom," resulting in

167. The Council also agreed to achieve 20% of EU energy consumption from renewable resources and a 20% reduction in primary energy use compared with projected levels through energy efficiency. *Communication from the Commission, Europe 2020*, *supra* note 166, at 11.

168. We recognize that many actions on the global scale incorporate a mixture or hybrid of horizontal and vertical actions. The *Europe 2020* strategy is one such example.

169. Targets can be found at *Europe 2020 Targets*, Europe 2020, http://ec.europa.eu/europe2020/pdf/targets_en.pdf (last visited Feb. 25, 2013).

170. *See* OSTROM, *supra* note 13, at 92.

the overconsumption of natural capital resources. The Apalachicola/Chattahoochee/Flint river system ("ACF") provides a good example of states on the national scale commons actively engaged in an unresolved competitive conflict over natural capital resources in the absence of federal vertical regulation. The ACF is composed of the Apalachicola, Chattahoochee, and Flint Rivers. The Chattahoochee's headwaters flow south from the mountains of northern Georgia toward Atlanta. Prior to reaching Atlanta, the Chattahoochee is delayed by the Buford Dam, forming Lake Lanier.[171] From Atlanta the Chattahoochee flows southwest and traces the boundary between Georgia and Alabama. The Flint rises just south of Atlanta, meets with the Chattahoochee at the Georgia-Florida border, and the two become the Apalachicola.[172] About 75% of the ACF basin lies in Georgia, 12.5% in Florida, and 12.5% in Alabama.[173]

The relevant state actors appropriating from the ACF resource on the national commons, Georgia, Alabama, and Florida, have had a contentious relationship dating back to the 1970s.[174] All of the state actors are motivated by self-interest that at times includes both overlapping and differing concerns.[175] For a variety of reasons, the parties have been unable to negotiate a mutually agreed-upon resolution to properly manage the resource. They have spent enormous amounts of time and money inefficiently depleting the resource and litigating how much each actor can appropriate, how often, and for what purposes. As for federal vertical regulation, the Army Corps of Engineers attempted to address ACF water allocation issues several times between 1989 and 2009. At each attempt, one of the states or non-state government actors went to court and succeeded in preventing the Corps from doing so.[176]

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171. The Chestatee River also feeds into Lake Lanier.

172. *See* Heather Ellit, *Alabama's Water Crisis*, 63 ALA. L. REV. 383, 395 (2012).

173. *See* Steve Leitman, *Lessons Learned from Transboundary Management Efforts in the Apalachicola-Chattahoochee-Flint Basin, USA*, *in* TRANSBOUNDARY WATER RESOURCES: A FOUNDATION FOR REGIONAL STABILITY IN CENTRAL ASIA 197 (John E. Moerlins et al. eds., 2008).

174. Atlanta is also a relevant actor on the national commons with potentially conflicting interests and is in competition with the state actors in the ACF dispute. *See id*. at 198–99. (noting Atlanta's interests in growing water demands and maintaining Lake Lanier for recreational purposes). We will explore this jumping of scales further in further research based on this Article.

175. For example, actors' self-interest may vary from upstream desires to maximize water withdrawals for in-state users, maintain reservoir levels for periods of draught, and provide recreational uses, to downstream desires for commercial navigation, pollution control from upstream dumping, wildlife preservation, and economic development. *See id.* at 197–98.

176. *See In re* MDL-1824 Tri-State Water Rights Litig., 644 F.3d 1160, 1183 (11th Cir. 2011). The Tarrant Water District represents another example of state actors failing to horizontally coordinate in the absence of vertical regulation on the national scale. In 2004, Oklahoma passed a law that barred out-of-state water sales pending the completion of a state-wide water study. OKLA. STAT. tit. 82, § 1B(A) (2004). Oklahoma's actor had a large impact on the Fort Worth/Arlington area, which relied on the Oklahoma-based Red River for its water supply. The Tarrant Water District sought and was denied rights to purchase water from the Red River. In January 2012 it filed a petition with the Supreme Court claiming that the Commerce Clause precludes Oklahoma from barring interstate

Addressing commons dilemmas similar to the ACF conflict through horizontal self-coordination involves individual states collaborating to self-regulate, monitor, sanction, and adjudicate usage of the commons resource. It does not involve ceding authority to the federal government or another higher-level entity (such as the Tennessee Valley Authority)[177] to regulate resource appropriation and management. Rather, the individual states coordinate their management of the resource to avoid destroying the resource. In the context of climate change, a theoretical horizontal collaboration among states would consist of states collectively setting GHG emission standards, protecting and growing GHG sinks, monitoring and assessing emissions and sinks, and sanctioning lack of compliance.

In the absence of vertical regulation, the Chesapeake Bay Program is an example of state actors horizontally coordinating on the national scale to, among other things, address natural capital commons relevant to climate change. The Chesapeake Bay Program is a regional partnership among state actors and other public and private entities.[178] The state actors include the "Principle Partners," Pennsylvania, Virginia, and Maryland, and the "Headwater State Partners," Delaware, New York, and West Virginia.[179] The six states work together to collaborate, share information, and set goals.[180] The states jointly address issues, such as climate adaptation and mitigation, relevant to sea level rises[181] and forest restoration.[182] In December 2007, the state partners committed to conserve and restore forests in the Bay watershed by, among other things, permanently protecting an additional 695,000 acres of forest by 2020 and establishing and implementing mechanisms to track and assess forest land cover change at the county and township level every five years.[183] The state partners have also engaged in a monitoring program, which is a Bay-wide cooperative effort to observe numerous physical, chemical, and biological characteristics twenty times a year in the mainstream and tributaries.[184] Monitoring important natural capital includes observing changes in the levels of nutrients and sediment, chemical contaminants, plankton,

transfer of water. Tarrant Reg'l Water Dist. v. Herrmann, 656 F.3d 1222 (10th Cir. 2011), *cert. granted*, 2013 WL 49810 (Jan. 4, 2013) (No. 11-889).

177. The Tennessee Valley Authority's geographic area covers parts of seven states and addresses a number of natural capital related issues.

178. *Partner Organizations*, CHESAPEAKE BAY PROGRAM, http://www.chesapeakebay.net/about/partners (last visited Feb. 25, 2013).

179. *Id.*

180. *How We Work*, CHESAPEAKE BAY PROGRAM, http://www.chesapeakebay.net/about/how (last visited Feb. 25, 2013).

181. *Climate Change*, CHESAPEAKE BAY PROGRAM, http://www.chesapeakebay.net/issues/issue/climate_change (last visited Feb. 25, 2013).

182. *Forests*, CHESAPEAKE BAY PROGRAM, http://www.chesapeakebay.net/issues/issue/forests (last visited Feb. 25, 2013).

183. *See Partner Organizations*, *supra* note 178.

184. *Id.*

benthos, finfish and shellfish, underwater bay grasses, water temperature, salinity, and dissolved oxygen.[185]

As international and federal vertical regulatory actions stall, a number of states are horizontally collaborating on multi-jurisdictional GHG emission reduction plans.[186] This past summer, governors of all six New England states agreed to coordinate efforts to make large-scale investments in cost-effective renewable energy resources.[187] The effort will allow the states to leverage their collective purchasing power, and avoid the costly process of competing with each other in the way that the ACF state actors have. In lieu of a race to the bottom, the New England states' behavior may more aptly be described as a relay race to the top. Similarly, the Western Climate Initiative has had a variety of climate change related successes through state (U.S. state and Canadian province) collaboration.[188] What began as individual states and provinces formulating their respective emissions reduction plans, morphed into a multi-jurisdictional effort to collaborate on reducing GHG emissions, develop an emission trading program, and monitor and track cross-border GHG emissions. As a horizontal collaboration, the Western Climate Initiative has no oversight or regulatory authority over the individual states and provinces. The individual actors remain the primary managers of appropriation. However, a system of appropriation and monitoring by the states was never formally adopted, and by 2011, the majority of the participating U.S. states had formally withdrawn. Importantly, California and the Canadian provinces continue to develop a regional cap-and-trade market for voluntary and mandatory emission reductions.

Similar to state actors on the national commons, local actors on the state commons have an opportunity to address mitigation and adaption measures relevant to climate change in the absence of vertical regulation.

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185. *Monitoring*, CHESAPEAKE BAY PROGRAM, http://www.chesapeakebay.net/about/programs/monitoring (last visited Feb. 25, 2013).

186. *See, e.g.*, Ryan Lizza, *As the World Burns: How the Senate and the White House Missed Their Best Chance to Deal with Climate Change*, NEW YORKER, Oct. 11, 2011 (detailing the failure of Congress to pass comprehensive legislation on climate change).

187. Kelsey Lafreniere, *New England Governors Announce Clean Energy Resolution on Regional Procurement*, NEW ENGLAND CLEAN ENERGY COUNCIL (July 30, 2012, 5:24 PM), http://www.cleanenergycouncil.org/blog/2012/07/30/new-england-governors-announce-clean-energy-resolution-on-regional-procurement.

188. Current WCI Partners are British Columbia, California, Manitoba, Ontario, and Quebec. *See WCI Provincial and State Partner Contacts*, W. CLIMATE INITIATIVE, http://www.westernclimateinitiative.org/wci-partners (last visited Feb. 25, 2013). Current WCI, Inc. participants are British Columbia, California, Ontario, Quebec, and Manitoba. *See Program Design*, W. CLIMATE INITIATIVE, http://www.wci-inc.org/program-design.php (last visited Feb. 25, 2013); *see also* Reg'l Greenhouse Gas Initiative, Memorandum of Understanding (Dec. 20, 2005) (establishing the framework for collaboration among northeast and mid-Atlantic states and creating the Regional Greenhouse Gas Initiative); *Mission Statement*, REG'L GREENHOUSE GAS INITIATIVE, http://www.rggi.org/rggi (last visited Feb. 25, 2013) (listing the participating state actors as Connecticut, Delaware, Maine, Maryland, Massachusetts, New Hampshire, New York, Rhode Island, and Vermont).

Even so, as the scale moves down from the national commons to the state commons, action by individual actors on multi-jurisdictional issues, such as climate change, becomes less economically efficient and more irrational.[189] Not only must local actors overcome international, national, and state legal barriers that may prohibit cohesive (or, at times, any) local action on climate change, but also there are a combination of social, political, and economic obstacles that encourage local actors to tragically deplete resources. Nonetheless, in the face of international, federal, and, at times, state inaction, local governments—regardless of national and state affiliation—have horizontally coordinated to tap into expanded opportunities to tackle climate change.

While many cities are individually reducing their own GHG emissions and adopting protective ordinances for GHG sinks (and thus acting irrationally),[190] others are attempting to tackle the challenges together through horizontal collaboration. The following two examples illustrate the potential to have far-reaching geographical agreements among local governments that collectively impact millions of individuals and large economies. Further, the examples exemplify the kind of local preferences that can drive climate change mitigation and adaptation strategies, regardless of federal or state action or local government location. They are an attempt to leverage the collective will and resources of local governments to avoid a tragedy in the absence of vertical regulation.

The C40 Cities: Climate Leadership Group is a horizontal self-coordinated effort comprised of local governments across the globe seeking to address climate change.[191] In 2005, representatives from eighteen megacities agreed to cooperate on "reducing climate emissions by taking decisive and immediate action"[192] Over the next several years, the cooperative expanded to include fifty-eight megacities, representing 18% of the global GDP, approximately 8% of the world's population, and over 4700 climate-mitigation or climate-adaption actions.[193] C40 continues to develop collaborative efforts among municipalities, and it now collaborates with the Clinton Climate Initiative, World Bank, and ICLEI—Local Governments for Sustainability—to facilitate financing and to track, monitor, and report on GHG emissions.[194] Most relevant to collective action, the C40 city members collaborate on best practices and

189. *See* Engel, *State and Local Climate Change Initiatives*, *supra* note 58, at 1022; Rosenbloom, *supra* note 4, at 446–62.

190. *See* CARBON DISCLOSURE PROJECT, MEASUREMENT FOR MANAGEMENT: CDP CITIES 2012 GLOBAL REPORT (2012) (setting forth individual local government initiatives to address climate change).

191. *History of the C40*, C40 CITIES: CLIMATE LEADERSHIP GROUP, http://www.c40cities.org/history (last visited Feb. 25, 2013).

192. *Id*.

193. *C40 Cities*, C40 CITIES: CLIMATE LEADERSHIP GROUP, http://www.c40cities.org/c40cities (last visited Feb. 25, 2013).

194. *History of the C40*, *supra* note 191.

the development of programs to leverage their collective knowledge, experience, wealth, purchase power, and other assets.

In doing so, the members have initiated programs, such as C40-CCI Climate Positive Development Programme (supporting and collaborating on best practices relevant to large urban development projects) and the Carbon Finance Capacity Building Programme (sharing knowledge for various local climate and carbon financing ideas), that federal and state governments have been unable or unwilling to develop.[195] Recently, C40 staff have been working more directly with local government staff on establishing metrics and baselines relevant to climate change and implementing many of the best practices to support climate action in their respective cities.[196] Because the C40 cities are located in numerous countries and subnational states and because they represent a significant portion of the world's population and GDP, their combined efforts have the potential not only to alter climate-changing conditions, but also to motivate other levels of governments to take similar action. And, of course, if local efforts reach a critical mass, they can efficiently address global collective action problems in the absence of vertical regulation by higher levels of government.

Similarly, the Union of the Baltic Cities ("UBC") was founded in 1991 by thirty-two member cities to foster sustainable development in the Baltic Sea Region.[197] The UBC was created in the wake of social and environmental changes occurring in the region. Many of the natural resources bordering on or part of the Baltic Sea had been subjected to tragic overconsumption in a manner very much resembling the ACF dispute. In the absence of vertical regulation compelling the sustainable management of natural resources, 108 cities from ten countries in the Baltic Sea region entered into a collaborative relationship to do so.[198] The goals of the UBC, as stated in the Statute of the Union of the Baltic Cities, are:

> to promote and strengthen cooperation and exchange of experience among the cities in the Baltic Sea Region, to advocate for common interests of the local authorities in the region, and to act on behalf of the cities and local authorities in common matters towards regional, national, European and international bodies, as well as achieving sustainable development in the Baltic Sea Region with full respect to

195. *See id.*

196. *See id.*

197. *XI General Conference, Liepāja, 5–6 October 2011*, UNION OF THE BALTIC CITIES, http://www.ubc.net/documentation,56,1006.html (last modified Dec. 8, 2011); *UBC Strategy 2010–2015*, UNION OF THE BALTIC CITIES, http://www.ubc.net/documentation,55,195.html (last modified Jan. 29, 2010).

198. Those countries are Germany, Denmark, Norway, Sweden, Finland, Russia, Estonia, Latvia, Lithuania, and Poland. *Member Cities*, UNION OF THE BALTIC CITIES, http://www.ubc.net/member_cities (last visited Feb. 25, 2013).

> European principles of local and regional self-governance and subsidiarity.[199]

This definition not only recognizes the multi-jurisdictional challenges facing local governments (and the corresponding difficulties with addressing those challenges on the local level), but it also acknowledges the importance of preserving local sovereignty and the benefits that can be achieved through local government collaboration, as opposed to vertical regulation.[200] This is reflected in UBC's actions, which on the one hand attempt to address many climate commons challenges at the local level though programs like the *UBC Agenda 21 Action Program* and *BUSTRIP-Baltic Urban Sustainable Transport Implementation and Planning*, and on the other hand actively advocate for local governance in Europe through programs like *Challenge of eCitizen: Promoting eGovernment Actions in Cities* and *MUE-25: Sustainable Future for Cities*.[201]

In addition to federal, state, and local governments, private sector individuals may collectively manage their appropriations of natural capital resources to avoid a tragedy of the commons. In some ways, the challenges facing these actors in forming horizontal collaborations are the most complex, as they are potentially subject to three tiers of vertical regulation (international, federal, and state) and can quickly jump scales from local to state to national to global.

Horizontal collaboration among these individuals has taken a variety of forms, many of which have been detailed in Ostrom's work.[202] One increasingly common collaborative effort relevant to climate change and GHG sinks are private sector individuals' attempts to collectively preserve forests. Individual landowners' have collaborated to create trusts to halt the depletion of forests.[203] The Pacific Forest Trust, for example, is a voluntary horizontal collaboration of landowners (including

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199. *UBC Statute*, UNION OF THE BALTIC CITIES, http://www.ubc.net/documentation,55,194.html (last visited Feb. 25, 2013).

200. The UBC members are engaged in a host of climate-change-related activities, including compiling a best practices database that represents their shared experiences. Through this database, member cities have the ability to learn from past failures and successes of the other member cities. In addition, the UBC's Commission on the Environment has implemented the UBC Sustainable Action Programme, focusing on four sustainability processes: awareness and commitment, management of resources, management and leadership, and quality of life. UNION OF THE BALTIC CITIES, UBC SUSTAINABILITY ACTION PROGRAMME 2010–2015: AGENDA FOR SUSTAINABLE BALTIC CITIES (2010).

201. *See, e.g.*, UNION OF THE BALTIC CITIES, AGENDA 21 ACTION PROGRAMME 2004–2009, ROADMAP FOR SUSTAINABLE BALTIC CITIES (2004); *BUSTRIP Final Conference, UBC Commission on Environment*, UNION OF THE BALTIC CITIES, http://www.ubc.net/news,50,396.html (last visited Feb. 25, 2013); *The Challenge of Managing Urban Environments*, MUE-25 (UBC Commission on Environment Secretariat, Turku, Finland) (Feb. 2006).

202. *See* OSTROM, *supra* note 13.

203. *See, e.g.*, *Working Forest Conservation Easements*, PACIFIC FOREST TRUST, https://www.pacificforest.org/working-forest-conservation-easements.html (last visited Feb. 25. 2013) ("Working forest conservation easements provide private landowners the means to permanently conserve their forests for a variety of public benefits while keeping them in private ownership and productive forestry.").

individuals and corporations) that works to obtain conservation easements on forestland.[204] The individual members contribute property interests in the form of conservation easements and collectively manage the pool of easements for both economic and environmental gain.[205] As the President and Co-Founder of PFT stated, the "overall impact of these [easements] is to make natural and environmentally beneficial management more competitive economically."[206]

This economic benefit is made possible through the leveraging of the individual actors' efforts through the horizontal collaborative. The PFT promotes the growth of older and larger trees before harvest and the conservation of forests from development.[207] PFT maintains a full-time staff responsible for monitoring easement performance, including visiting each easement at least once per year, reviewing project plans submitted by landowners, verifying timber harvest levels against established limits, and reviewing aerial imagery over time to identify changes not observed with site visits.[208] If necessary, PFT enforces the terms of the easement against the individual actor misappropriating. In doing so, PFT meets with the actor to attempt to remedy the issue. If no resolution can be agreed upon, the easement specifies the process for enforcement.[209]

The horizontal collaborative approach is designed to encourage individual actors on a given scale to proactively reduce GHG emissions and increase GHG sinks by providing an additional option to avoid the tragic consumption of natural resources vital to maintaining a stable climate. It attempts to incentivize action on climate change without devolving into a tragedy of the commons and without ceding sovereignty to a higher-level body for standard setting, monitoring, or sanctioning.

Conclusion: A Need for Convergent Nested Commons Governance

At its core, the purpose of this Article has been to provide a number of insights into federal governance structure as a complex, multiscalar commons within which natural capital commons resources are embedded. The primary contribution of this Article is to deconstruct the scales of a federal system of government in an attempt to isolate and identify

204. *See* Laurie A. Wayburn, *Conservation Easements as Tools to Achieve Regulatory Environmental Goals*, 74 Law & Contemp. Probs. 175, 181 (2011).

205. *Id.* "The easements provide financial incentives to landowners to hold their forests longer, leave more structure after harvest, and provide for a more-complex native forest. The economic value . . . is appraised, and this value is returned to landowners either directly in the purchase of the conservation easement, through tax benefits, or a combination thereof." *Id.*

206. *Id.*

207. Email from Ivy Kostick, Stewardship Manager, Pacific Forest Trust, to John Remus, Drake Law School (July 23, 2012) (on file with authors).

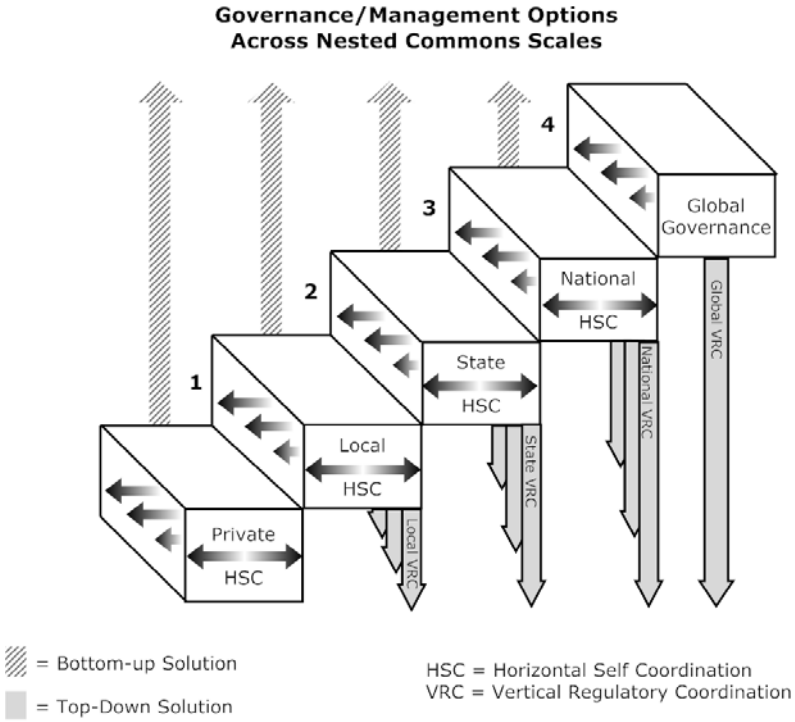
208. *See id.*

209. *See id.*

potential commons resource management complications in individual governance scales. This Article seeks to demonstrate how a natural capital commons exists within at least four individual governance scales—private property owners operating on the local governance commons, local governments operating on the state governance commons, state governments operating on the national governance commons, and national governments operating on the global governance commons. An analysis of each successive scale reveals that within each two-dimensional (horizontal and vertical) scale, a number of scenarios may arise with regard to the existence of horizontal actors' or vertical governments' *legal authority* to engage in resource management and their *political action* to sustainably do so. As represented in Figure 4, these two-dimensional scales are nested one within another and with multiple nations, states, and local governments vertically regulating or horizontally coordinating across scales—creating an even more complex structure that under a number of circumstances takes on the characteristics of a legally entrenched natural capital governance commons. This nesting of governance scales, and the interplay between the commons users and resources within and across scales, adds a feature to natural capital governance and commons analysis that is largely overlooked and little understood.

Second, this Article has sought to analyze in an isolated manner the potential solutions within each scale—either horizontal coordination among actors appropriating resources on the same scale or vertical coordination of those actors by the government situated at the next scale up—and the divergent approaches that may be taken within each to address climate change. As noted, this divergent analysis was purposefully oversimplistic, only intending to demonstrate how each of the two dimensions of resource management may play out within each scale.

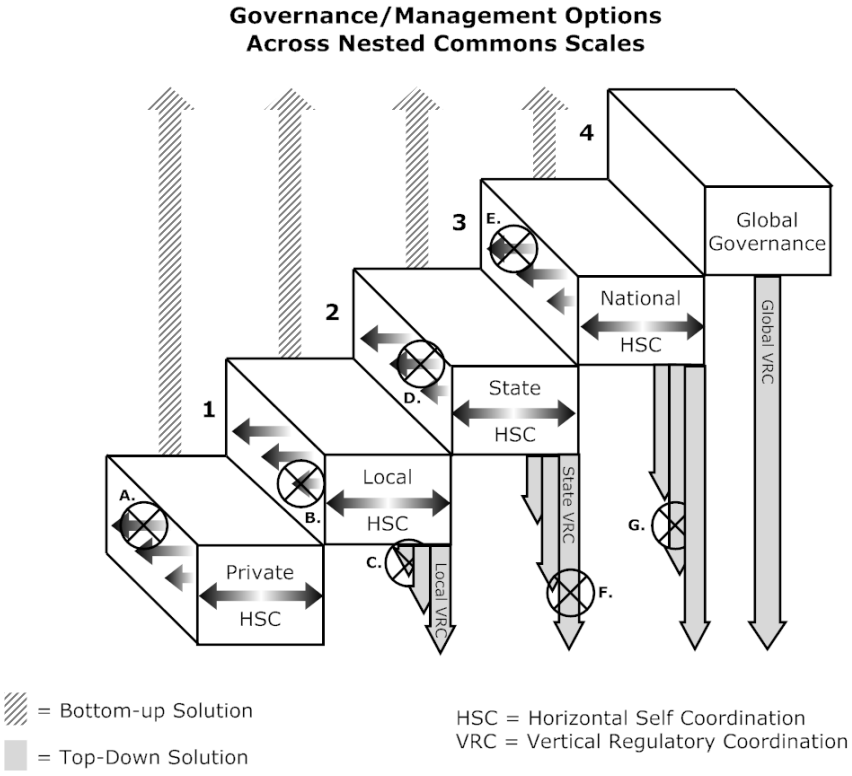
FIGURE 4



The insights provided in this Article lay a foundation for the next step in this research that will undertake a more holistic analysis of the legal authority and political action scenarios influencing resource management within and across scales. The differing allocations of legal authority among jurisdictions (geolegal variations) may make vertical approaches more viable than horizontal approaches in some locations and vice versa. These geolegal differences come in the form of legal constraints placed either on higher-level governmental entities that prevent vertical regulation or on higher- or lower-level entities that prevent them from taking successful horizontal collective action for resource management. It is our hope that further research on the third dimension, which helps incorporate legal authority and political action analysis into commons resource management, will give rise to a wealth of case-study-based research on natural capital management in federal systems, and how that management may be improved to avoid commons tragedies across vertical and horizontal scales. For example, if a state government legally preempts local government authority over resource management, then it may prevent local government vertical regulation or horizontal

coordination with other local governments, as depicted by *B* and *C* respectively in Figure 5, below. Yet, as also depicted in Figure 5, other local governments in other states may not be legally preempted in such a manner and therefore remain free to vertically regulate or horizontally coordinate. In the same way, the national government may preempt state authority over certain forms of resource management, preventing vertical state regulation or horizontal coordination with other states, as depicted by *D* and *F* in Figure 5. If states, on the other hand, maintain exclusive resource management authority under a national constitution, as with the Canadian provinces over subnational forest management, then they may restrict the nation's ability to engage in horizontal coordination with other nations (*E* in Figure 5) as well as that nation's ability to vertically regulate (*G* in Figure 5). These are merely a few general examples. Future work will analyze specific cases for specific resources to identify potential solutions that can resolve the governance commons dilemma.

FIGURE 5



Similarly, political differences across jurisdictions (geopolitical variations) may make vertical approaches more viable than horizontal approaches in some locations and vice versa. For example, and as described earlier, simple geopolitics makes vertical regulation of forest management policy more politically viable in the Pacific Northwest than in the Southeast, where political considerations might block vertical regulatory efforts at the state or local government levels, as depicted by *F* and *C* in Figure 5. In addition, certain countries maintain political climates that may block vertical regulatory action, as depicted by *G* in Figure 5. Such is arguably the case in the United States, where the failure of the federal government to provide a more uniform approach to forest management standards across the nation demonstrates a political choice not to even test the waters of its potential legal authority under the Constitution. And of course, on any scale, even in the presence of legal authority, entities may make political choices not to horizontally coordinate their activities (depicted in *A*, *B*, *D*, and *E* in Figure 5).

Ultimately, the success of a two-dimensional solution on a given scale may vary within and across the scale depending upon the third dimension of geolegal and geopolitical variations. Case studies on how these scenarios play out within and among different countries will be valuable to forging a convergent approach to natural capital management in those countries that maximizes the vertical regulatory and horizontal coordination opportunities across jurisdictions.

Not only will future research grapple with the need to account for geolegal and geopolitical differences in shaping holistic resource management policies, but it will also grapple with the implications of cross-cutting interactions that "jump scales." For clarity, in this Article we limit our discussion of upper-scale governance to that immediately scaled up vertically. That said, we are not suggesting that a single actor functions identically at all levels, in that a single private property owner acting on the local scale commons may or may not perceive his situation the same when framed as acting on the state or national scale commons. Theoretically, as demonstrated in Figures 4 and 5, horizontal self-coordination of all private property owners across the United States regarding the management of certain natural capital could "jump scales" and provide a bottom-up solution that resolves the commons dilemma all the way up and across the chain (even to the global level if property owners in other nations did the same).

Similarly, at the other extreme, if vertical regulatory coordination occurred at the global scale and was successfully implemented, it could theoretically resolve commons dilemmas all the way down and across scales. Indeed, a single appropriator can act on multiple higher levels—adding complexity to an already complex multi-layered commons structure. For example, the resource units could be natural capital on

private property, while the resource system is natural capital present on the collection of private properties contained within *any* higher scale—whether local, state, federal, or global. So private property owners could be herders appropriating resource units of natural capital from local, state, federal, and global resource systems simultaneously. Similarly, we might characterize states as appropriating resource units of natural capital from either a national resource system or the global resource system (or both), and so on.

Yet there may also be geolegal and geopolitical barriers to jumping scales. As a result, vertical regulatory coordination and horizontal self-coordination approaches again may vary depending on the scale and region of the country where the policy is instituted. If vertical regulatory coordination for a type of natural capital management is prohibited at the national scale due to state government reservation of that legal authority under the constitution, then horizontal collective action should be promoted among states to resolve the commons dilemma until an institutional adjustment is made to change the legal authority status quo.

States may, in turn, work horizontally to harness their individual vertical regulatory coordination authority to successfully implement proper management down the scale. If all states do so, this may also resolve issues up the scale, rendering national vertical regulation unnecessary. It may also facilitate that nation's involvement in a global governance arrangement, or make national government involvement in such an arrangement unnecessary. Yet the chances of all states doing so is unlikely—due primarily to geopolitical considerations. Thus while the commons dilemma may be resolved down the scale within a certain group of states (Pacific Northwest forests, for example), the national-scale commons dilemma remains because other herders (states) are continuing to appropriate forest resources in a tragic manner.

Both the geolegal-geopolitical dimension and the jumping-of-scales dynamic represent only a few notable observations concerning the complexity stemming from the three-dimensional federal governance commons. Yet this complexity has stark implications for climate change mitigation as actors at every governance scale—local, state, national, and global—appropriate natural capital essential to combatting climate change. While each commons within and across scales presents a distinct body of actors that have diverse perceptions of their respective commons, they appropriate the same or similar natural capital resources as actors on other scales. In other words, each scale holds several potential opportunities to devolve into a tragedy of the commons and deplete natural resources necessary to combat climate change, irrespective of the actions taken by appropriators at other levels or on the same level and dependent very much upon the legal or political constraints existing in that scale. Thus a "convergent" approach to

natural capital commons management in federal systems becomes necessary to fully account for legal constraints that may exist on vertical regulation across scales or horizontal collective action within scales, geopolitical circumstances positively or negatively impacting political action within scales, and the ability of management actions on one scale to "jump" to higher or lower scales to resolve commons dilemmas. Recognizing the impacts that geolegal constraints and geopolitical differences have on the viability of vertical or horizontal policies, a convergent approach encourages the proper management of natural capital resources by more fully accounting for the complexities of the governance commons that is a federal system of government.