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SOIL GOVERNANCE AND PRIVATE PROPERTY

Sarah J. Fox*

Abstract

This is an Article about soil. In consequence, it is also an Article about our relationship to land, and about how that relationship can and must change to confront the many environmental crises facing the United States. Questions about our relationship with the physical environment around us necessarily come to the fore in conversations about soil because of its several identities. It is one of Earth's most precious resources—the substance responsible for allowing plants to grow, filtering pollutants out of water, providing habitat to countless organisms, sequestering carbon, and providing many other valuable functions. Soil also, however, makes up the top layer of land, or the “portion of the earth's solid surface distinguishable by boundaries or ownership.”¹

These kinds of dual identities are not unusual for conversations surrounding natural resources and private property rights. What is notable about soil governance in the United States is the lack of mechanisms to mediate between its identities as resource and property. Soil lacks the more robust statutory framework that resources like air and water have. Instead, the federal law dimension of soil governance offers a top-down, parcel-based approach generally devoid of benchmarks or action-forcing provisions. And the level of government historically vested with land-use planning and management responsibility in the United States—local governments—offers a dimension of soil governance focused much more on property rights and values than on environmental health.

This divided governance ignores the interconnected nature of soil. The harms stemming from this fractured attention to soil as a natural resource and all the environmental benefits that it provides have never been clearer. Soil erosion, flooding, decreased agricultural productivity, declining carbon storage, and more can be attributed to declines in the soil resource. Climate change is only exacerbating these issues. Bringing

* © 2024 Sarah J. Fox. Associate Professor, Northern Illinois University College of Law. My thinking on the topic of this Article has been refined over the course of many helpful conversations. Many thanks to the participants in the online Environmental Law Colloquium (with special thanks to Sharon Jacobs for the suggestion of the title), the Starved Rock Environmental Law Workshop sponsored by Loyola University Chicago School of Law, the AALS Works-in-Progress Session co-sponsored by the Environmental Law, Natural Resources Law & Agriculture Law Sections, and the Rocky Mountain Mineral Law Foundation's Works-in-Progress Session.

¹ *Land Definition & Meaning*, MERRIAM-WEBSTER, <https://www.merriam-webster.com/dictionary/land> [<https://perma.cc/JY4M-35UZ>] (last visited July 28, 2023).

in a commons-oriented perspective as a third dimension of soil governance clarifies the path and lends support to changes in both soil regulation and soil ownership that better account for soil's interconnected nature.

This Article takes on the question of soil governance as a common resource problem. It is ground-breaking (pun intended) in centering soil—and the biological functions it supports—as a resource in its own right. Using that lens, this Article offers suggestions for both substantive and structural changes to soil governance and private property, centered ultimately on the role of local actors. Overall, this Article is the first of several designed to explore the role of local governments as resource managers and incubators of the kind of environmental and community values that will be needed in the face of the climate crisis. And in this way, it is part of the broader project to articulate the legal dimensions of the huge societal shifts needed to confront the realities of climate change.

INTRODUCTION

On a city block, a tree stands on a parkway, surrounded by a square of grass and a sea of concrete. Year after year, the tree grows taller, providing shade and beauty to the street, shelter and food for animals and birds, and a canopy that helps to mitigate urban heat island effects. And year after year, in the soil below, the tree's roots extend downward and outward. The soil supports the growth of those roots. As they extend outward, the soil also serves as a medium for signals sent to other trees through a tangle of roots and fungal connections, allowing the trees to both communicate and to send resources to one another through the soil. In this way, one tree is connected to its closest arboreal neighbor down the block, and others farther off. Over, under, and around the roots, organisms like worms, bacteria, and other microorganisms digest bits of plant waste and organic material; these organisms generate new soil, aerate what is already there, and allow the roots of the tree and other plants to grow unimpeded. As the trees grow and create canopies, they provide protection and support for all walks of life below their branches.

This network of life hums away around the globe, in settings urban and rural, suburban and wilderness. Meanwhile, humans are making decisions about where to put homes and sidewalks and sewer lines and schools and swimming pools and highways, about cutting down trees and tearing up fields and laying down asphalt, and about churning, compacting, and removing the soil in countless ways. Some communications in the soil are deadened; if given the chance, new connections may form. Removal of trees and vegetation exposes soil to the elements and takes away key stores of nutrients, causing it to erode, weakening its ability to regenerate, and releasing stored carbon into the atmosphere. Trees that were once connected may now be increasingly on their own—making them less able to weather a year of invasive beetles, drought, or record-setting heat. Those trees may also be more prone

to damage in a large storm now that their connections in the soil have been disrupted and be less able to survive once cut off from back up stores of food.²

This story of the trees is a simplified stand-in for the complex and far-reaching dynamics between uses of private property and the environmental impacts those uses have on soil. And while trees may offer a charismatic megafauna³ lens for the soil discussion, the implications of private land decisions for soil and overall ecosystem health are far broader. Soil⁴ may be “our most underappreciated, least valued, and yet essential natural resource.”⁵ It is also a resource for which individual decisions have enormous consequences.

Soil operates in a somewhat unique space. On the one hand, like many resources, it relies on interconnectivity for the health of its systems and to provide environmental benefits to human and animal life on Earth. On the other hand—and unlike other resources such as air and water—it is also the literal foundation upon which private property rights in the United States are layered.

The United Nations Intergovernmental Technical Panel on Soils defines soil health as “the ability of the soil to sustain the productivity, diversity, and environmental services of terrestrial ecosystems.”⁶ To attain those benefits requires

² Similar stories have been told in, for instance, the forests of British Columbia. *See, e.g.*, Ferris Jabr, *The Social Life of Forests*, N.Y. TIMES (Dec. 2, 2020), <https://www.nytimes.com/interactive/2020/12/02/magazine/tree-communication-mycorrhiza.html> [<https://perma.cc/CGC5-R4JV>]. Previously, the thinking regarding clear-cutting forests was that “[w]ithout any competitors . . . the newly planted trees would thrive. Instead, they were frequently more vulnerable to disease and climatic stress than trees in old-growth forests.” *Id.* The vulnerability of new growth in those forests has been linked to the destruction of mycorrhizal networks, or the connections between and among trees in the form of “[t]hreadlike fungi [that] envelop and fuse with tree roots, helping them extract water and nutrients like phosphorus and nitrogen in exchange for some of the carbon-rich sugars the trees make through photosynthesis.” *Id.*

³ *See, e.g.*, C. Michael Hall, Michael James & Tim Baird, *Forests and Trees as Charismatic Mega-Flora: Implications for Heritage Tourism and Conservation*, 6 J. HERITAGE TOURISM 309 (2011).

⁴ For one definition of soil, *see, e.g.*, Alexandra M. Wyatt, *The Dirt on International Environmental Law Regarding Soils: Is the Existing Regime Adequate?*, 19 DUKE ENV'T L. & POL'Y F. 165, 167–68 (2008) (defining soil as “[t]he natural dynamic system of unconsolidated mineral and organic material at the earth’s surface. . . . Soil materials include organic matter, clay, silt, sand and gravel mixed in such a way as to provide the natural medium for the growth of land plants. Soil comprises organi[z]ed profiles of layers more or less parallel to the earth’s surface and formed by the interaction of parent material, climate, organisms and topography over generally long periods of time.” (citation omitted)).

⁵ DAVID R. MONTGOMERY, *DIRT: THE EROSION OF CIVILIZATIONS* 3 (2012); *see also, e.g.*, Wyatt, *supra* note 4, at 165 (“[s]oil, ‘the living skin of Earth’ and a foundation for all terrestrial life, does not tend to get the respect or attention it deserves.”).

⁶ INTERGOVERNMENTAL TECH. PANEL ON SOILS, FOOD & AGRIC. ORG. OF THE U.N., *SOIL LETTERS #1: TOWARDS A DEFINITION OF SOIL HEALTH* (2020), <https://www.fao.org/3/cb1110en/cb1110en.pdf> [<https://perma.cc/NXF2-3EQE>]; *see also, e.g.*, ABBEY WARNER & DARYA WATNICK, *SOIL HEALTH POLICY: DEVELOPING COMMUNITY-DRIVEN STATE SOIL*

both health of the individual parcel of property but also the preservation of interconnections between and among parcels. Soil's "ecological condition is governed by the condition of its surrounding environment"⁷ Scientists have cautioned that these kinds of interconnections warrant an "ecological approach . . . toward law and policy making in general, and land-use decision-making in particular."⁸ This kind of ecosystem approach would necessarily study "the *relationship* between soil, as living ecological communities, and the environment."⁹ But current soil governance frameworks in the United States do not adequately capture those interconnections. Instead, existing legal frameworks at the federal, state, and local level tend to treat soil in two separate dimensions: In one dimension, top-down governmental controls and incentives are aimed at the health of individual parcels. In the other dimension, bottom-up land-use planning considers the interactions between different parcels but is focused to a large extent on property values and rights rather than soil health.

In consequence, these frameworks do not accurately reflect the agents that determine the rate of soil degradation—namely biophysical elements, socio-economic elements, and political forces—and the interactions among them.¹⁰ To date, however, improving those frameworks has not been studied extensively, at least in the legal literature. Despite the acknowledged importance of soil health, "it is a resource that fails to garner the same attention as other aspects of our natural world."¹¹ The ubiquity of soil may mean that we take it for granted, or it may be that it lacks the glamour of the other natural resources.¹² Whatever the reason, the law has not yet adapted to reflect the well-documented and well-known relationship between private use of property, the laws surrounding it, and overall soil health impacts. That two-dimensional treatment of soil has led to perhaps predictable

HEALTH POLICY AND PROGRAMS 6 (2021) (quoting NRCS definition of soil health: "Soil health, also referred to as soil quality, is defined as the continued capacity of soil to function as a vital living ecosystem that sustains plants, animals, and humans.").

⁷ IAN HANNAM & BEN BOER, LEGAL AND INSTITUTIONAL FRAMEWORKS FOR SUSTAINABLE SOILS: A PRELIMINARY REPORT 16 (IUCN Env't Pol'y & L. Paper No. 45, 2002), https://www.researchgate.net/publication/228133713_Legal_and_Institutional_Frameworks_for_Sustainable_Soils_A_Preliminary_Report [<https://perma.cc/A5M7-NQC2>].

⁸ *Id.* at 17.

⁹ *Id.*

¹⁰ *Id.* at 12–13.

¹¹ Jessica Owley, *The Use of Property Law Tools for Soil Protection*, in 2017 INT'L Y.B. SOIL L. & POL'Y 339 (Harald Ginzky et al. eds.).

¹² See, e.g., Richard J. Lazarus, *Crystals and Mud in Nature*, 18 YALE J.L. & HUMANS. 134, 139 (2006) (comparing attention given to water as a resource versus dirt and noting that "[a]ttention and resources routinely are disproportionately allocated to the crystals, the so-called charismatic resources. Mud is, by contrast, seemingly doomed for underappreciation at best and hostility at worst."); see also, e.g., Peter M. Lacy, *Our Sedimentation Boxes Runneth Over: Public Lands Soil Law as the Missing Link in Holistic Natural Resource Protection*, 31 ENV'T L. 433, 437 (2001) (noting gap in soil protections and postulating that one reason the gap exists is "perhaps because the soil resource is less glamorous than endangered species.").

results. Within the United States and globally, we are seeing record levels of topsoil loss from erosion, biodiversity loss, declining agricultural productivity, desertification, and countless other impacts related to the health of soil (or lack thereof).

The goal of this Article is to propose a shift in law to reflect soil's reality as a common resource. Rather than simply a matter of parcel-specific health or a question of use of the surface, soil itself is a series of living ecological communities throughout the earth's ecosystem¹³ upon which all humans, and multitudes of other species, depend for survival. Adding in a third dimension to soil governance frameworks—that of soil as a common resource—would make it possible to better assess and protect the health of this vital part of the environment. On the substantive side, changes in the law are needed to capture the cumulative health of the soil resource in much more relevant ways. From a structural standpoint, local governments may be best positioned to take the lead on new forms of soil governance. Soil is, of course, just one thread in the tapestry of overall ecosystem health. It is, however, one that contains lessons for resource management and for relationships between communities, individuals, and the land.

This Article will offer an account of how soil is currently managed at the federal, state, and local level. After laying out those legal frameworks, it will explain why acknowledging soil's role as a common resource is vital to its protection. Finally, the Article will suggest both substantive and structural changes to the way that soil governance operates in the United States to incorporate a more three-dimensional view.

I. THE SEVERAL REALITIES OF SOIL

Soil, at a basic level, is defined as that part of the earth bounded at the upper level by “air, shallow water, live plants, or plant materials that have not begun to decompose”¹⁴ Soil's lower boundary might be said to be where “soil grades . . . to hard rock or to earthy materials virtually devoid of animals, roots, or other marks of biological activity.”¹⁵ The layer between the two is a critical natural resource, making up Earth's non-aquatic land surface. This physical reality also means that soil is the site of homes, farms, businesses, and countless other uses of land—the vast majority of which are in private ownership, both the buildings and land these structures sit upon. Thus, soil constitutes both resource and private property. It is a

¹³ HANNAM & BOER, *supra* note 7, at 12.

¹⁴ Lacy, *supra* note 12, at 439–40.

¹⁵ *Id.* at 439 (noting that, at a more technical level, soil is defined to mean “a natural body composed of solids (minerals and organic matter), liquid, and gases that occurs on the land surface, occupies space, and is characterized by one or both of the following: horizons, or layers, that are distinguishable from the initial materials as a result of additions, losses, transfers, and transformations of energy and matter or the ability to support rooted plants in a natural environment.” (quoting SOIL SURVEY STAFF, U.S. DEP'T OF AGRIC., KEYS TO SOIL TAXONOMY 9 (8th ed. 1998))).

natural resource necessary for survival of humans, animals, and plants, as well as the basic physical form over which private property rights are layered.

Many resources present similar competing interests between the preservation of the environment and private rights.¹⁶ But soil is distinct in its ubiquity and its near-total overlap with the way property rights are assigned. Because soil is also highly susceptible to degradation from human activity,¹⁷ many individuals are implicated in, and therefore stand to be impacted by, a framing of soil as resource (and any restrictions or affirmative obligations that may imply).

Soil takes on many identities that may both help and hinder an understanding of it as a common resource. The complicated questions that soil raises may be responsible for a reluctance to treat soil in ways similar to other common resources such as air and water.¹⁸ To better understand soil, it is helpful to unpack its several realities. The discussion herein will explain those identities: that of environment, or something that is of and in constant interaction with the natural world; of natural resource, an important part of growing food and providing habitat; and of property, as privately owned land in the United States, with all the associated rights. All of these identities are bound up in the understanding, and the legal treatment, of soil in the United States. And the strength of the law's ability to account for interactions between and among those realities impacts the health of soil throughout the country.

A. Resource

Soil provides a tremendous number of public benefits, making it an invaluable resource. It is both "critical to human existence"¹⁹ and, given the slow pace of its

¹⁶ Public lands, while enormously important to the overall health of the soil resource, are not the subject of this Article.

¹⁷ *Id.* at 441 (noting that "[h]uman land management activities may degrade soils in a variety of physical and chemical ways, including erosion, depletion of nutrients, loss of organic matter, compaction, reduced infiltration and porosity, physical breakdown of soil structure, saturation, and salinization.").

¹⁸ *Id.* at 440 (noting that "policy makers and land managers [may at times] simply . . . consign consideration of soils to the management of other resources, rather than create an independent management scheme for soil. However, this approach ignores both the critical central role of soils in ecosystem health and the fragility of soils as natural resources.").

¹⁹ *Id.* (listing "six significant functions of soil for human life: 1) production of biomass by agriculture and forestry; 2) filtering, buffering and transformation between the atmosphere, groundwater, and plant cover; 3) value as biological habitats and gene reserves, much larger in quantity and in quality than the total above-ground biomass; 4) service as a spatial base for technical, industrial and socio-economic structures; 5) use as a source of raw materials (for example, clay, sand, and gravel for construction); and 6) repositories of a 'geogenic and cultural heritage, forming an essential part of the landscape in which we live and concealing paleontological and archaeological treasures of high value for the understanding of the history of earth and mankind.'").

regeneration, nonrenewable.²⁰ Soil is a store of unique genetic resources.²¹ Healthy soil acts as a flood control mechanism, preserves water quality, promotes biodiversity, halts erosion, and is the “single most important processor of waste in the environment.”²² Soil provides the resources needed for most forms of agriculture, both storing and cycling nutrients and supporting plant growth and productivity.²³ Soil also has an “integral role” to play in the global climate, both in supporting the growth of vegetation and in directly sequestering carbon in soil.²⁴ Trees and other plants, and the environmental and aesthetic benefits that they provide,²⁵ rely on healthy soil in which to grow. The amount of common goods that stem from healthy soil (and that can therefore be undermined where soil health is lost) are plentiful. In so many ways, then, “[h]ealthy soils lie at the very foundation of healthy ecosystems”²⁶

One of soil’s most important functions is to support Earth’s wildlife and biodiversity and the associated range of environmental benefits and functions that accompany them. Biodiversity is defined as “[t]he variability among living organisms from all sources including terrestrial, marine, and other aquatic ecosystems and the ecological complexes of which they are part.”²⁷ Diversity of

²⁰ See, e.g., Deyi Hou, Nanthi S. Bolan, Daniel C.W. Tsang, Mary B. Kirkham & David O’Connor, *Sustainable Soil Use and Management: An Interdisciplinary and Systematic Approach*, 729 SCI. TOTAL ENV’T, no.138961, Aug., 2020, at 1.

²¹ See, e.g., *Soil Health, Ecosystem Services and Environmental Health*, AGRIC. VICTORIA, https://vro.agriculture.vic.gov.au/dpi/vro/vrosite.nsf/pages/soil_health_mis7898_6#:~:text=Soil%20provides%20general%20ecological%20functions,habitats%2C%20gardens%20and%20sports%20fields.&text=Soil%20plays%20an%20integral%20role,and%20gaseous%20emissions%20from%20soil [<https://perma.cc/6DU2-9LCM>] (last visited July 29, 2023).

²² *Id.*

²³ *See id.*

²⁴ *See id.*

²⁵ Craig Anthony Arnold, Olivia Odom Green, Daniel DeCaro, Alexandra Chase & Jennifer-Grace Ewa, *The Social-Ecological Resilience of an Eastern Urban-Suburban Watershed: The Anacostia River Basin*, 51 IDAHO L. REV. 29, 84 (2019) (“[U]rban and suburban trees absorb runoff, prevent soil erosion, protect human health by absorbing air pollution and moderating urban heat-island effects, sequester carbon, improve the walkability of streetscapes, increase property values, and improve mental and emotional health.”).

²⁶ *Restoring Soil Health Through Public-Private-Community Action*, IDH (Mar. 22, 2022), <https://www.idhsustainabletrade.com/publication/restoring-soil-health-through-public-private-community-action/> [<https://perma.cc/JY69-KNWM>]; see also THE NATURE CONSERVANCY, *RETHINK SOIL: A ROADMAP TO U.S. SOIL HEALTH 1* <https://www.nature.org/content/dam/tnc/nature/en/documents/rethink-soil-executive-summary.pdf> [<https://perma.cc/L28J-JBQP>] (last visited Aug. 1, 2023) (“Healthy soil is the cornerstone of life on earth, facilitating ecosystem biodiversity, ample food production, effective water filtration and storage, and carbon sequestration.”).

²⁷ *Biodiversity*, INTERGOVERNMENTAL SCI-POL’Y PANEL ON BIODIVERSITY & ECOSYSTEM SERVS. (IPBES), <https://www.ipbes.net/glossary-tag/biodiversity> [<https://perma.cc/PJ3R-JYJD>] (last visited July 29, 2023).

species is critical to the functioning of an ecosystem, including the pollination and growth of crops, pest control, and “the vast array of ecosystem services that critically contribute to human well-being.”²⁸ Soil’s support of biodiversity occurs both above the soil and within it. On top, countless animal and plant species rely on plants that grow in soil, drink water that the soil helps to filter, and benefit from the biodiversity that soil promotes. Within soil live a staggering number of microorganisms. “[One] teaspoon . . . of rich garden soil can hold up to one billion bacteria, several yards of fungal filaments, several thousand protozoa, and scores of nematodes”²⁹ That “total diversity is equal to or greater than any rainforest or coral reef,” making soil “by far the most biologically diverse part of Earth.”³⁰

Soil health is linked to water quality³¹ and retention as well. Soil acts as both a filter and a sponge by absorbing precipitation before it flows into the surface water carrying nutrients or other pollutants.³² Healthy soil retains precipitation, allowing plants to grow and ground water supplies to recharge. Conversely, when soil quality diminishes, its ability to absorb water does as well, with resulting increases in runoff of pollutants into nearby water bodies. Retention of water in soils is also important to mitigate the impacts of extreme weather events. Soil practices to maintain soil health can reduce the potential for flooding and lessen the impacts from drought.³³

Soil is also critical to plant growth. “Healthy soil is rich in organic content, which means it is energy-rich, and thus a valuable resource that provides nutrients and energy for productive and high-quality plant growth.”³⁴ In supporting that plant life, healthy soil feeds the world.³⁵ “Approximately 78% of the average per capita calorie consumption worldwide comes from crops grown directly in soil, and

²⁸ MILLENNIUM ECOSYSTEM ASSESSMENT, WORLD RES. INST., ECOSYSTEMS AND HUMAN WELL-BEING: BIODIVERSITY SYNTHESIS 18 (2005), <https://www.millenniumassessment.org/documents/document.354.aspx.pdf> [<https://perma.cc/6NGW-EB7Y>].

²⁹ Kathy Merrifield, *The Secret Life of Soil*, OR. ST. UNIV. EXTENSION SERV. (Jan. 2010), <https://extension.oregonstate.edu/news/secret-life-soil> [<https://perma.cc/5P77-Q6YV>].

³⁰ Nicholas A. Fromherz, *The Case for A Global Treaty on Soil Conservation, Sustainable Farming, and the Preservation of Agrarian Culture*, 39 *ECOLOGY L.Q.* 57, 69 (2012).

³¹ *Id.* at 68 (“Water isn’t itself without soil, and soil cannot support life in the absence of water.”).

³² Tyler A. Groh, *Grounded in Soil: Water Quality Benefits from Healthy Soils*, PENN STATE EXTENSION (May 11, 2020), <https://extension.psu.edu/grounded-in-soil-water-quality-benefits-from-healthy-soils> [<https://perma.cc/VGJ7-PCMZ>].

³³ See, e.g., Elizabeth Creech, *Soil Health Practices for Mitigating Natural Disasters*, U.S. DEP’T OF AGRIC. (Feb. 28, 2018), <https://www.usda.gov/media/blog/2018/02/28/soil-health-practices-mitigating-natural-disasters> [<https://perma.cc/4DLF-JZBU>].

³⁴ Katherine L. Oaks, *The Public Value of Ecological Agriculture*, 21 *VT. J. ENV’T L.* 544, 560 (2020).

³⁵ See, e.g., FOOD & AGRIC. OR. OF THE U.N., HEALTHY SOILS ARE THE BASIS FOR HEALTHY FOOD PRODUCTION (2015), <https://www.fao.org/documents/card/en/c/645883cd-ba28-4b16-a7b8-34babbb3c505/> [<https://perma.cc/B484-VNEF>].

another nearly 20% comes from terrestrial food sources that rely indirectly on soil.”³⁶

The role in supporting plant life also makes soil a vital part of the conversation about carbon storage. Plants store carbon and convert carbon dioxide to oxygen. It has been estimated, for instance, that forests alone in the United States “sequester 866 million tons of carbon a year,” or roughly sixteen percent of the country’s annual emissions.³⁷ Beyond its role in supporting plants, soil itself is a natural store of carbon.³⁸ There has also been much made of soil’s capacity for carbon storage and its ability to act as a sink for carbon dioxide.³⁹ Regenerative agriculture methods, it has been suggested, could reduce overall emissions of carbon dioxide by essentially farming the carbon back into the soil.⁴⁰

For all those reasons, managing soil use to maximize its health is critical. There are many definitions of soil health, but one that captures its essence is: “the capacity of soil to function as a vital living system, within ecosystem and land-use boundaries, to sustain plant and animal productivity, maintain or enhance water and air quality, and promote plant and animal health.”⁴¹ And while the inputs are complex, best practices for how to achieve soil health are fairly well-understood and consistent across location. “Healthy soils are generally undisturbed with abundant

³⁶ Eric C. Brevik & Lynn C. Burgess, *The Influence of Soils on Human Health*, 5 NAT. EDUC. KNOWLEDGE, no. 12, 2014, at 1, <https://www.nature.com/scitable/knowledge/library/the-influence-of-soils-on-human-health-127878980/> [<https://perma.cc/3PNC-JM2U>].

³⁷ Cheryl Sansonetti, *Comparing Forest Carbon and Direct Air Capture Carbon Credits*, NCX (Jan. 31, 2023), <https://ncx.com/learning-hub/comparing-forest-carbon-and-direct-air-capture-carbon-credits/#:~:text=A%20forest%20carbon%20credit%20incentivizes,the%20typical%20US%20annual%20emissions.> [<https://perma.cc/QWY7-A43Z>].

³⁸ *What Is Carbon Sequestration and How Does It Work?*, CLEAR CTR. (Sept. 20, 2019), <https://clear.ucdavis.edu/explainers/what-carbon-sequestration> [<https://perma.cc/WXU3-SP9N>].

³⁹ Jamie Lutz & Caitlin Welsh, *Soil Carbon Sequestration: Myths, Realities, and the Biden Administrations Proposals*, CSIS (Aug. 26, 2021), <https://www.csis.org/analysis/soil-carbon-sequestration-myths-realities-and-biden-administrations-proposals> [<https://perma.cc/9YYU-NYLV>].

⁴⁰ *What Is Carbon Sequestration?*, AM. U. (June 24, 2020), <https://www.american.edu/sis/centers/carbon-removal/fact-sheet-soil-carbon-sequestration.cfm> [<https://perma.cc/Y656-TVPD>] (“Soil carbon sequestration, also known as ‘carbon farming’ or ‘regenerative agriculture,’ includes various ways of managing land, especially farmland, so that soils absorb and hold more carbon. Increasing soil carbon is accomplished in various ways, including: (1) reducing soil disturbance by switching to low-till or no-till practices or planting perennial crops; (2) changing planting schedules or rotations, such as by planting cover crops or double crops instead of leaving fields fallow; (3) managed grazing of livestock; and (4) applying compost or crop residues to fields. In addition to providing local environmental and economic benefits, these practices can capture carbon dioxide (CO₂) from the atmosphere and store it in soils, making them a form of carbon removal.”).

⁴¹ John W. Doran & Michael R. Zeiss, *Soil Health and Sustainability: Managing the Biotic Component of Soil Quality*, 15 APPLIED SOIL ECOLOGY 3, 4 (2000), <https://www.sciencedirect.com/science/article/pii/S0929139300000676> [<https://perma.cc/D52S-7X3X>].

and diverse life, no compaction and relatively high levels of organic matter and stable aggregates.”⁴² Recommendations for achieving soil health remain relatively consistent in turn, across locations and size of parcel: “minimize soil disturbance, maximize soil cover, maximize biodiversity and maximize the presence of living roots.”⁴³

B. Private Property

In addition to soil’s role as a critical natural resource, it also has the role of making up the land to which our system of real property assigns ownership. In the United States, “[w]e normally think of real property in terms of rights to the land surface,”⁴⁴ including the soil.⁴⁵ As “the thin membrane-like coating that forms over much of the Earth’s continents,”⁴⁶ soil is the literal foundation onto which real property rights are layered. This is true in ways both implicit⁴⁷ and explicit.⁴⁸ Roughly two-thirds of land in the continental United States is in private ownership.⁴⁹ In consequence, the potential impact on soil health from practices by private actors is substantial.⁵⁰

⁴² Creech, *supra* note 33 (quoting Dr. Bianca Moebius-Clune, Soil Health Division Director with the Natural Resources Conservation Service).

⁴³ *Id.*

⁴⁴ JOHN G. SPRANKLING & RAYMOND R. COLETTA, *PROPERTY: A CONTEMPORARY APPROACH* 133 (5th ed. 2021).

⁴⁵ See, e.g., Robert J. Goldstein, *Green Wood in the Bundle of Sticks: Fitting Environmental Ethics and Ecology into Real Property Law*, 25 B.C. ENV’T AFFS. L. REV. 347, 348 (1998) (“Real property refers to ownership of rights in the land or soil, and an estate is the possessory interest in real property. As land or soil, real property is a part of the natural world, part of the biosphere we call Earth, and part of smaller functional units which we call ecosystems. There is a connection between pieces of that land, as all are interconnected. The land may be perceptibly limited to its surface, (as well as some finite below-ground areas, and some airspace, as in the case of buildings) but the soils, runoff, and ground water below, and the airspace above, as well as the flora and fauna which occupy surface, air, and below-ground, are the vectors of the interconnection.” (citation omitted)).

⁴⁶ Timothy E. Crews, *Closing the Gap Between Grasslands and Grain Agriculture*, 26 KAN. J.L. & PUB. POL’Y 274, 277 (2017).

⁴⁷ Kalyani Robbins, *Allocating Property Interests in Ecosystem Services: From Chaos to Flowing Rivers*, 42 HARV. ENV’T L. REV. 197, 202 (2018) (“[I]n some cases the entire economic value of a parcel of real property might depend upon the provision of adequate soil services.”).

⁴⁸ See, e.g., *Ground Rules: How Soil Type Affects AG Land Values*, AGAMERICA (May 4, 2023), <https://agamerica.com/blog/how-soil-type-affects-land-values/> [<https://perma.cc/U6SZ-EXAL>] (noting that at times the quality of soil on a parcel can impact the valuation of that property).

⁴⁹ Jonathan H. Adler, *Money or Nothing: The Adverse Environmental Consequences of Uncompensated Land Use Controls*, 49 B.C. L. REV. 301, 301 (2008).

⁵⁰ Creech, *supra* note 33 (quoting Dr. Bianca Moebius-Clune, Soil Health Division Director with the Natural Resources Conservation Service, as saying “[t]he management

Many uses of private property can harm the shared soil resource. Though there is still much to be learned about soil's interconnections,⁵¹ it is clear that soil management practices have impacts that extend well beyond any given property line. This is true because “[s]oils are dynamic and heterogeneous systems” subject to constant change from both “internal forces . . . and external agents such as land-use change.”⁵² These changes may have negative impacts on the environmental functions that soil is able to provide—and “the loss of one or more soil functions will irreversibly impact the surrounding ecosystem.”⁵³

For example, mycorrhizal networks make up “20%–30% of total soil microbial biomass,” and provide “extensive pathways for carbon and nutrient fluxes through soil, often exceeding tens of meters per gram of soil.”⁵⁴ “[E]stimates are that more than 95% of all plant species and 99% of all plant individuals are mycorrhizal dependent. . . .”⁵⁵ The importance of these connections means that long-term depletion of mycorrhizal fungi may have “long term devastating effects on the environment and the biodiversity.”⁵⁶ These networks can be undermined through

decisions we make across every piece of that land contributes to the impact of those rainfall events that can either recharge the soil and groundwater, or contribute to the next flood.”).

⁵¹ See, e.g., Richard Grant, *Do Trees Talk to Each Other?*, SMITHSONIAN MAG. (Mar. 2018), <https://www.smithsonianmag.com/science-nature/the-whispering-trees-180968084/> [<https://perma.cc/Y627-8XEL>] (quoting Suzanne Simard, professor of forest ecology at the University of British Columbia, as saying: “We don’t ask good questions about the interconnectedness of the forest, because we’re all trained as reductionists. We pick it apart and study one process at a time, even though we know these processes don’t happen in isolation. When I walk into a forest, I feel the spirit of the whole thing, everything working together in harmony, but we don’t have a way to map or measure that. We can’t even map the mycorrhizal networks. One teaspoon of forest soil contains several miles of fungal filaments.”).

⁵² John Clunes, Susana Valle, Jose Dörner, Marco Campos, Jorge Medina, Sarah Zuern & Lorena Lagos, *Changes in Soil Quality of an Urban Wetland as a Result of Anthropogenic Disturbance*, 11 LAND 394, 405 (2022), <https://www.mdpi.com/2073-445X/11/3/394/pdf> [<https://perma.cc/7EAC-YC9U>].

⁵³ *Id.* at 407; see also, e.g., David Eugene Bell, *The 1992 Convention on Biological Diversity: The Continuing Significance of U.S. Objections at the Earth Summit*, 26 GEO. WASH. J. INT’L L. & ECON. 479, 486–87 (1993) (“[T]he loss of a species that obtains water and nutrients for plants in the ecosystem will result in a decrease in the growth rate of those plants. Species and ecosystems are linked networks, the parts of which must be conserved in order to preserve the whole.”).

⁵⁴ Jonathan Leake, David Johnson, Damian Donnelly, Gemma Muckle, Lynne Boddy & David Read, *Networks of Power and Influence: The Role of Mycorrhizal Mycelium in Controlling Plant Communities and Agroecosystem Functioning*, 82 CAN. J. BOTANY 1016, 1016 (2004).

⁵⁵ U.S. EPA, OSWER DIRECTIVE 92857-55, GUIDANCE FOR DEVELOPING ECOLOGICAL SOIL SCREENING LEVELS (ECO-SSLs) attach. 1-2 at 1 (2003), https://www.epa.gov/sites/default/files/2015-09/documents/ecossl_attachment_1-2.pdf [<https://perma.cc/QDF5-4AKF>].

⁵⁶ Taiwo A. Oriola, *The Limits of Regulatory Science in Transnational Governance of Transgenic Plant Agriculture and Food Systems*, 39 N.C. J. INT’L L. & COM. REG. 757, 852 (2014).

private actions such as application of pesticides,⁵⁷ disturbance of soil through development or agriculture, deforestation,⁵⁸ and many others.

Private land use also often results in negative impacts to soil health by contributing to soil loss and erosion.⁵⁹ While these impacts are particularly notable in the agricultural realm,⁶⁰ private actions in many settings can result in similar harms, including soil disturbance from home construction or other actions that tear up and displace soil. Those harms to soil health extend beyond property lines, through contributions to soil erosion and disruption of mycorrhizal networks, weakening other plant and root structures. Individual actions can also have impacts across property lines through the release of carbon to the atmosphere from soil erosion.⁶¹ Ultimately, then, decisions made by individual owners about soil management have impacts for the health of the surrounding soil and broader ecosystem.⁶²

Indeed, private land-use practices may cause extensive social harm, threatening entire civilizations at their extreme. In Jared Diamond's well-known exploration of societal collapse, he details the stories of six past societies—Easter Islanders, Pitcairn and Henderson Islanders, the Anasazi and their neighbors, the Maya, the Vikings, and Norse Greenland—before concluding that soil problems contributed to all of their collapses.⁶³ While the specific details vary by civilization, some archaeologists believe, for instance, that the collapse of the Mayan society can be attributed to “intensive agricultural practices . . . [that] combined with climatic changes over time to drastically alter the hydrology and chemistry of the soils.”⁶⁴

⁵⁷ See, e.g., M. Castaldini, A. Turrini, C. Sbrana, A. Benedetti, M. Marchionni, S. Mocali, A. Fabiani, S. Landi, F. Santomassimo, B. Pietrangeli et al., *Impact of BT Corn on Rhizospheric and Soil Eubacterial Communities and on Beneficial Mycorrhizal Symbiosis in Experimental Microcosms*, 71 APPLIED & ENV'T MICROBIOLOGY 6719, 6719 (2005) (analyzing the impact of Bt corn, an insecticidal toxin, on microbial communities in soil).

⁵⁸ See, e.g., Matthew B. Royer, *Halting Neotropical Deforestation: Do the Forest Principles Have What It Takes?*, 6 DUKE ENV'T L. & POL'Y F. 105, 129 (1996).

⁵⁹ See Crews, *supra* note 46, at 279 (“Not surprisingly the threat of soil erosion and other forms of degradation have been a problem of agriculture since it began.”).

⁶⁰ See *id.* at 295 (“Humans have become reliant on a food-producing ecosystem that is not sustainable. It is not sustainable because it commonly loses soil faster than soil is formed, it loses soil organic matter, it leaks nutrients and other chemicals which pollute water bodies, it invites weeds, pest insects and diseases, it threatens pollinators, and it now relies on vast expenditures of fossil fuels to maintain production.”).

⁶¹ Mark P. Allain, Jr., *Assessing U.S. Soil Law and Policy for an Uncertain Future*, 34 TUL. ENV'T L.J. 169, 171–72 (2021).

⁶² *Id.* at 172; see generally Doran & Zeiss, *supra* note 41, at 5 (explaining that soil management practices impact levels of atmospheric gases like carbon dioxide and, ultimately, “determine . . . plant, animal, and human health”).

⁶³ See generally JARED DIAMOND, *COLLAPSE: HOW SOCIETIES CHOOSE TO FAIL OR SUCCEED* 490 (2005).

⁶⁴ Lacy, *supra* note 12, at 436.

In more recent United States history, private farming practices in the early part of the twentieth century contributed directly to the Dust Bowl⁶⁵ of the 1930s. While the Dust Bowl was caused by many factors, the story starts with low crop prices and high machinery costs that led “submarginal lands [to be] put into production[,]” and caused farmers “to abandon soil conservation practices.”⁶⁶ More specifically, farmers plowed native grasses with deep root systems to make way for wheat crops.⁶⁷ Those actions laid the groundwork for soil erosion which, combined with record drought in parts of the United States, led at one point to the loss of 1.2 billion pounds of soil over 100 million acres in just two years. Overall, the Dust Bowl is estimated to have created \$400 million per year in damage at the time (\$7.4 billion in 2020 dollars).⁶⁸ Though natural conditions were certainly a factor in the overall destruction, at the end of the day the impacts of the Dust Bowl were “caused by people, not nature.”⁶⁹

The impacts of human practices on soil health are not confined to history.⁷⁰ A 2020 report found that “[i]f soil continues to erode at current rates, U.S. farmers could lose a half-inch of topsoil by 2035—more than eight times the amount of topsoil lost during the Dust Bowl.”⁷¹ And while farming practices at a large scale may be prime contributors to that particular indicator of poor soil health, they are not the only private actions to do so. To the contrary, “human impacts on the soil resource are pervasive, and every component of the ecosystems humans live in and depend on is affected in one way or another by the soil resource.”⁷² Indeed, it is

⁶⁵ See, e.g., Allain, *supra* note 61, at 173–74 (“Soil erosion problems on the prairie compounded in the years leading up to the first major windstorm in 1933 as mechanized plows ripped native plants and their roots from the soil. In May of 1934, fields from Montana and Wyoming were shredded by high winds, eroding and accumulating dust in the process. The once wind-resistant prairie had been severely degraded by industrial plowing and prolonged drought. That same year, Chicago saw four pounds of prairie dust dropped on its streets for each of its citizens.” (citation omitted)).

⁶⁶ *The Dust Bowl*, NAT’L DROUGHT MITIGATION CTR., UNIV. OF NEB., <https://drought.unl.edu/dustbowl/> [<https://perma.cc/CL6A-DTRE>] (last visited Aug. 3, 2023).

⁶⁷ MARCIA DELONGE & KAREN PERRY STILLERMAN, *ERODING THE FUTURE: HOW SOIL LOSS THREATENS FARMING AND OUR FOOD SUPPLY* 7 (2020), <https://www.ucsusa.org/sites/default/files/2021-02/eroding-the-future-dec-2020.pdf> [<https://perma.cc/TB7N-RXXL>].

⁶⁸ *Id.* at 3.

⁶⁹ See ERIC T. FREYFOGLE, *AGRARIANISM AND THE GOOD SOCIETY: LAND, CULTURE, CONFLICT, AND HOPE* 97 (Norman Wirzba eds., 2007).

⁷⁰ See, e.g., *National Soil Erosion Rates on Track to Repeat Dust Bowl-Era Losses Eight Times Over*, UNION OF CONCERNED SCIS. (Dec. 16, 2020), <https://www.ucsusa.org/about/news/national-soil-erosion-rates-track-repeat-dust-bowl-era-losses-eight-times-over> [<https://perma.cc/KN5Y-8GJ4>] (“Unhealthy farming practices and more extreme weather spurred by climate change will lead to an increased rate of soil erosion across the United States in the coming decades, according to a study . . . by the Union of Concerned Scientists (UCS).”).

⁷¹ *Id.*

⁷² Lacy, *supra* note 12, at 441.

increasingly clear that soil is a resource negatively impacted in myriad ways, not only by direct application of pollutants in large quantities, or by industrial agricultural practices, but also by the cumulative impacts of small-scale individual activities.⁷³

C. *Soil's Multiple Identities*

Three conclusions follow from the discussion above. First, soil is a shared resource upon which all land-based humans, animals and plants depend for survival, and which depends in turn on interconnection to provide those benefits. Second, much of the soil on Earth is divided into privately owned parcels. Third, and in consequence, health of the shared soil resource depends upon private actions. Any successful effort to improve and maintain soil health must engage with these several identities.

II. THE CURRENT STATE OF SOIL GOVERNANCE

Soil governance frameworks currently in place often fail to account adequately for the multiple identities discussed in Part I. This is due in large part to the two-dimensional way in which the law treats soil. In one dimension are laws attentive to soil quality; these are generally top-down measures in federal or state law that regulate soil health on a parcel-specific basis. Federal environmental hazardous waste statutes lead the way, with state and local laws adding additional levels of protection for soil quality. From the top-down perspective, health of the individual parcel is the relevant data point. Another dimension focuses on surface level indicators over a given area, by looking at quantity of open space and interactions on the surface. This metric falls much more within the core of local authority in the United States. Contemplating the many uses of land across various parcels and their impacts on one another has long been the province of state and local property law as well as local land-use planning.

While these two dimensions are easy to see, their interrelated nature is often not reflected in our current system.⁷⁴ As a result, soil governance in the United States comes from a somewhat flat perspective; there are few mechanisms for thinking about the interactions between quality or health of an individual parcel and its relationship to the overall quantity of healthy soil surrounding it. These divergent legal and regulatory frameworks—and the different jurisdictional regimes that they entail—help to explain the current crisis of soil health in the United States. The following will explain the two dimensions of soil governance as the law stands today.

⁷³ Cf. Eric Biber, *Law in the Anthropocene Epoch*, 106 GEO. L.J. 1, 23 (2017) (describing the significance of individual contributions to environmental harms to air, water, and soil).

⁷⁴ See, e.g., Owley, *supra* note 11, at 342 (“[O]ur public regulations have focused on pollution control and land use without addressing soil health and protection directly.”).

A. Soil Health's First Dimension: Quality of Individual Parcels

Natural resources are, of course, often governed by vast networks of law and regulation. Several of those resources, such as air⁷⁵ and water,⁷⁶ have their own dedicated statutory and regulatory frameworks. Those two resource-focused statutes begin, respectively, with commitments to “protect and enhance the quality of the Nation’s air resources so as to promote the public health and welfare and the productive capacity of its population,”⁷⁷ and to “restore and maintain the chemical, physical, and biological integrity of the Nation’s waters.”⁷⁸ Neither the Clean Air Act nor the Clean Water Act is entirely comprehensive, and both contain a variety of exclusions and exceptions that leave unregulated and unprotected certain aspects of each resource. Without question, however, they are resource-focused statutes—examples of a framework developed to protect, maintain, and improve the health of a specific part of the ecosystem. Soil does not have anything close to that kind of framework. Instead, soil is subject to a highly fragmented governance system that is focused on soil health in specific ways but lacks much of a comprehensive view.

1. Federal

It has been said that “[t]here is no true federal soil law.”⁷⁹ Instead, there are federal statutes that regulate some aspects of soil health or provide incentives for other aspects. Federal solid waste statutes focus on keeping hazardous chemicals out of soil and cleaning up soil pollution where it occurs. The Clean Water Act includes provisions focused on erosion control and wetlands protection, two aspects of soil health that impact water quality. Mining statutes cover soil health related to mining, and the Farm Bill and associated federal statutes and regulations focus on soil as it relates to agricultural productivity. There are also, of course, a number of public lands statutes that cover soil health on public lands.⁸⁰ But beyond these statutory frameworks, “federal agencies usually only consider soils in land-use planning . . . by creating vague and discretionary goals, guidelines, or monitoring requirements.”⁸¹ As described in greater detail below, the sum of these parts is a top-down series of inquiries into the health of particular aspects of soil health for particular parcels.

⁷⁵ Clean Air Act, 42 U.S.C. §§ 7401–7671q.

⁷⁶ Clean Water Act, 33 U.S.C. §§ 1251–1387.

⁷⁷ 42 U.S.C. § 7401(b)(1).

⁷⁸ 33 U.S.C. § 1251.

⁷⁹ See, e.g., Lacy, *supra* note 12, at 441.

⁸⁰ See, e.g., National Forest Management Act, 16 U.S.C. § 1604(g)(3)(E)(i)–(F)(v) (requiring that “timber will be harvested from the National Forest System lands only where soil, slope, or other watershed conditions will not be irreversibly damaged,” and that clear cuts be “carried out in a manner consistent with the protection of soil”).

⁸¹ Lacy, *supra* note 12, at 441.

(a) *Solid Waste Statutes*

Soil is the focus of several federal pollution control statutes. These laws, most notably the Comprehensive Environmental Compensation, Reclamation and Liability Act (“CERCLA”), and the Resource Conservation and Recovery Act (“RCRA”) are intended to prevent, address, and remediate hazardous wastes in soil by tackling the dual problems of existing contaminated sites and ongoing waste disposal practices.⁸² Both statutes focus on the problem of hazardous waste contamination in soil.⁸³ RCRA, for example, was motivated by the understanding that “land is too valuable a national resource to be needlessly polluted by discarded materials,”⁸⁴ and that “inadequate and environmentally unsound practices for the disposal or use of solid waste have created greater amounts of air and water pollution and other problems for the environment and for health,”⁸⁵ including contamination of the soil.

CERCLA was enacted as the backward-looking piece of the puzzle, designed to “create broad civil liability for cleanup of leaking waste disposal sites”⁸⁶ The problems created by these types of sites were dramatized for the general public by the infamous incident at Love Canal, in upstate New York, where toxic chemicals from an industrial waste depository seeped into homes and a school site, causing devastating health impacts and billions of dollars in damages.⁸⁷ This event, combined with several other high profile examples, “increased public awareness about the threat posed by improperly managed hazardous waste.”⁸⁸ In response, CERCLA imposed far-reaching joint, strict, and retroactive liability for contamination to soils from hazardous waste.⁸⁹

RCRA is the forward-looking complement to CERCLA. Originally enacted as the Solid Waste Disposal Act, the statute was amended in 1980 and given its current name.⁹⁰ It is designed to offer “cradle to grave” regulation for hazardous wastes.⁹¹ That life-cycle view is intended to avoid the problems of hazardous waste contamination by tracking waste’s generation and transport, and establishing detailed treatment standards for contaminated soil.⁹² RCRA’s goal is to avoid

⁸² See, e.g., DANIEL A. FARBER, JODY FREEMAN, ANN E. CARLSON & ROGER W. FINDLEY, *CASES AND MATERIALS ON ENVIRONMENTAL LAW* 788 (7th ed. 2006).

⁸³ See, e.g., 40 AM. JUR. 3D *Proof of Facts* § 1 (1997) (explaining that RCRA’s passage “reflected congressional concern that improper handling and disposal of solid and hazardous wastes is a continuing cause of environmental degradation and a danger to human health”).

⁸⁴ 42 U.S.C. § 6901(b)(1).

⁸⁵ *Id.* § 6901(b)(3).

⁸⁶ FARBER ET AL., *supra* note 82, at 841.

⁸⁷ *Id.* at 788–89.

⁸⁸ *Id.* at 842.

⁸⁹ *Id.* at 841–42.

⁹⁰ See, e.g., ROBIN KUNDIS CRAIG, *ENVIRONMENTAL LAW IN CONTEXT: CASES AND MATERIALS* 45 (4th ed. 2016).

⁹¹ FARBER ET AL., *supra* note 82, at 790, 841.

⁹² See, e.g., *Chem. Waste Mgmt. v. EPA*, 869 F.2d 1526, 1530–31 (D.C. Cir. 1989).

problems created by hazardous waste before they result in a situation that would require clean-up and compensation under CERCLA.

(b) *Clean Water Act*

The Clean Water Act (“CWA”) governs connections between soil health and water quality, as the former impacts the latter in a number of ways. Soil erosion in particular poses a threat to water quality. “Erosion is a geological process in which earthen materials . . . are worn away and transported over time by natural forces such as water or wind”⁹³ “Soil erosion refers to the erosion of the top layer of dirt known as topsoil”⁹⁴ This “[s]oil erosion occurs primarily when dirt is left exposed to strong winds, hard rains, and flowing water.”⁹⁵ Activities on land, including activities such as clearing of trees, construction, and farming, can lead to increased erosion.⁹⁶ With erosion comes not only loss of soil productivity but also major impacts on water health. As topsoil erodes, both the soil and any pesticides, fertilizers, or other substances that might have been applied to the soil can wash into nearby waterways, posing a threat to the health of the water as well as the animals, plants, and humans that depend upon it.⁹⁷

Due to these threats to water quality, some provisions and programs under the CWA target soil erosion. For example, the United States Department of Agriculture has been responsible for managing a subsidy program for farmers who take soils vulnerable to erosion out of production.⁹⁸ Soil is also important for water quality because of its filtration function. Indeed, “[o]ne of the most important roles that soils play on the landscape is to . . . act as physical, chemical, and biological filters” for rainwater and snow melt “as it moves from the ground into surface or groundwater.”⁹⁹ That filtration function is particularly important when it comes to the soil in wetlands. For that reason, the CWA has historically regulated any attempts

⁹³ Keith Mulvihill, *Soil Erosion 101*, NRDC (June 1, 2021), <https://www.nrdc.org/stories/soil-erosion-101> [<https://perma.cc/M6YW-CE3W>].

⁹⁴ *Id.*

⁹⁵ *Id.*

⁹⁶ *Id.*

⁹⁷ *Id.*; Mahdi Al-Kaisi, Mark Hanna & Michael Tidman, *Soil Erosion and Water Quality*, IOWA ST. UNIV. EXTENSION & OUTREACH: INTEGRATED CROP MGMT., <https://crops.extension.iastate.edu/encyclopedia/soil-erosion-and-water-quality> [<https://perma.cc/KN4N-RMR7>] (last visited July 30, 2023) (noting that “[s]ediment resulting from soil erosion is a major water quality pollutant in Iowa’s surface water bodies. Increased levels of nitrogen (N) and phosphorus (P) in surface waters are also leading contributors to reduced water quality.”).

⁹⁸ *Clean Water Act Section 404 and Agriculture*, EPA (June 12, 2023), <https://www.epa.gov/cwa-404/clean-water-act-section-404-and-agriculture> [<https://perma.cc/3YYP-B4W3>]; FARM SERV. AGENCY, *Conservation Programs*, U.S. DEPT. OF AGRIC. (Aug. 13, 2023), <https://www.fsa.usda.gov/programs-and-services/conservation-programs/index> [<https://perma.cc/PC8N-C9AB>].

⁹⁹ *Clean Water Act*, SOIL SCI. SOC’Y OF AM., <https://www.soils.org/clean-water-act/> [<https://perma.cc/YPD7-P9DC>] (last visited July 29, 2023).

to “brin[g] a wetland into agricultural production or conver[t] an agricultural wetland to a non-wetland area.”¹⁰⁰ Section 404 of the CWA also makes it “unlawful to discharge dredged or fill material into waters of the United States without first receiving authorization,” unless covered by an exemption.¹⁰¹ Those exemptions are broad and include things like “normal farming” activities.¹⁰²

In 2023, the Supreme Court in *Sackett v. Environmental Protection Agency*¹⁰³ undermined long-standing federal agency practice regarding wetlands. In that decision, the majority eliminated the “significant nexus” test that had been used for decades to determine which wetlands came within federal jurisdiction under the CWA. Instead, the majority decided that the “CWA extends to only those ‘wetlands with a continuous surface connection to bodies that are ‘waters of the United States’ in their own right,’ so that they are ‘indistinguishable’ from those waters.”¹⁰⁴ This decision will result in wetlands formerly subject to federal jurisdiction no longer being subject to federal oversight under the CWA.¹⁰⁵ As a result, gains in soil health linked to wetlands protections and oversight can be expected to decrease as well.

(c) *Surface Mining Control and Reclamation Act*

The Surface Mining Control and Reclamation Act (“SMCRA”)¹⁰⁶ was designed to “establish a nationwide program to protect society and the environment from the adverse effects of surface coal mining operations.”¹⁰⁷ In accordance with that goal, SMCRA sets up an extensive statutory framework for surface coal mining. The statute touches on soil health most notably through its requirements for restoration of mined land “to a condition capable of supporting the uses it could support before mining, or to ‘higher or better uses.’”¹⁰⁸ To meet that standard, SMCRA’s regulatory programs “se[t] forth special environmental protection performance, reclamation, and design standards for surface coal mining and reclamation operations on prime farmland.”¹⁰⁹ As part of that program, SMCRA’s regulatory scheme directs “[t]he U.S. Soil Conservation Service within each State” to “establish specifications for

¹⁰⁰ *Clean Water Act Section 404 and Agriculture*, *supra* note 98.

¹⁰¹ *Id.*

¹⁰² *Id.*

¹⁰³ 143 S. Ct. 1322 (2023).

¹⁰⁴ *Id.* at 1340.

¹⁰⁵ *See, e.g.*, E.A. Crunden, *Post-Sackett, Chaos Erupts for Wetlands Oversight*, E&E NEWS BY POLITICO (June 2, 2023, 1:34 PM), <https://www.eenews.net/articles/post-sackett-chaos-erupts-for-wetlands-oversight/> [<https://perma.cc/NDU7-VW47>].

¹⁰⁶ Surface Mining Control and Reclamation Act, 30 U.S.C. §§ 1201–1328.

¹⁰⁷ *Id.* § 1202(a).

¹⁰⁸ Mark Squillace, *Strip Mining Handbook: A Brief Review of SMCRA*, CITIZENS AGAINST LONG WALL MINING (Aug. 11, 2009) (quoting 30 U.S.C. § 1265(b)(2)), http://www.citizensagainstlongwallmining.org/wp-content/uploads/2017/11/Full_Strip_Mining_Handbook_08_11_09-1.pdf [<https://perma.cc/KX9E-2D6J>].

¹⁰⁹ 30 C.F.R. § 823.1.

prime farmland soil removal, storage, replacement, and reconstruction.”¹¹⁰ Those regulations are further directed, in some instances, to incorporate national soil standards,¹¹¹ and involve very technical barometers for measuring success in soil health protection.¹¹² Prime farmland regulations and others within SMCRA therefore provide another example of a targeted way in which federal law is directed at maintenance of soil health.

(d) Agricultural Statutes

The Soil Conservation and Domestic Allotment Act (“SCDAA”), enacted in 1936, and the Soil and Water Resources Conservation Act (“SWRCA”), passed in 1977, are the closest the United States has come to making a normative commitment to soil as a resource at the federal level. Some have called the SCDAA “the beginning of a national policy of soil conservation.”¹¹³ These beginnings are discernable in the SCDAA’s statement of purpose:

It is recognized that the wastage of soil and moisture resources on farm, grazing, and forest lands of the Nation, resulting from soil erosion, is a menace to the national welfare and that it is declared to be the policy of Congress to provide permanently for the control and prevention of soil erosion to preserve soil, water, and related resources, promote soil and water quality, control floods, prevent impairment of reservoirs, and maintain the navigability of rivers and harbors, protect public health, public lands, and relieve unemployment¹¹⁴

In furtherance of those goals, the statute authorizes the Secretary of Agriculture to, among other things: (1) research and investigate soil erosion, publish the results of that research, and carry out demonstration studies; (2) “carry out preventive measures, including, but not limited to, engineering operations, methods of cultivation, the growing of vegetation, and changes in use of land”; (3) enter into agreements or provide financial support in furtherance of the statute’s goals; and (4)

¹¹⁰ *Id.* § 823.4.

¹¹¹ *See, e.g., id.* § 823.14(a) (“Soil reconstruction specifications established by the U.S. Soil Conservation Service shall be based upon the standards of the National Cooperative Soil Survey and shall include, as a minimum, physical and chemical characteristics of reconstructed soils and soil descriptions containing soil-horizon depths, soil densities, soil pH, and other specifications such that reconstructed soils will have the capability of achieving levels of yield equal to, or higher than, those of nominated prime farmland in the surrounding area.”).

¹¹² *See generally* Nat’l Wildlife Fed’n v. Hodel, 839 F.2d 694, 716 n.23 (D.C. Cir. 1988) (describing many of the prime farmland requirements under SMCRA).

¹¹³ Laurie Ristino & Gabriela Steier, *Losing Ground: A Clarion Call for Farm Bill Reform to Ensure a Food Secure Future*, 42 COLUM. J. ENVTL. L. 59, 82 (2016).

¹¹⁴ 16 U.S.C. § 590a.

“acquire lands, or rights or interests therein, by purchase, gift, condemnation, or otherwise, whenever necessary for the purposes of this chapter.”¹¹⁵

Some of the most important contributions of the SCDA have been to establish the Soil Conservation Service (“SCS”), and to authorize funding to assist in erosion control.¹¹⁶ Under the purview of this Act, the SCS also established a network of soil conservation districts. These districts reflect a high degree of interplay within the federal system, as they are a federal program created under state law and authorized by local vote.¹¹⁷ Once authorized, those soil conservation districts “provide technical assistance to private landowners; help land managers control erosion on farms and public lands through various conservation practices; help protect beaches, streams, and rivers; help with flood control and drought management programs; and help draft and implement conservation and resource management plans in watersheds.”¹¹⁸ The SCDA, then, includes many measures aimed at providing assistance in managing the soil resource on agricultural lands.

The SWRCA came later, and its directives are aimed at “soil and water conservation on the private, tribal, and non-Federal lands of the Nation.”¹¹⁹ It does not, however, establish any kind of mandates or requirements for private action on soil. Instead, it accomplishes its goals through appraisal of soil resources, development of a program for soil conservation, protection, and enhancement, and provision of reports to Congress and the public.¹²⁰ Thus, the statute provides a mostly information-gathering function, coupled with programs designed to “assist landowners and land users, at their request.”¹²¹ It is perhaps “the closest thing to a true soil conservation law on the books.”¹²²

Beyond these two soil-focused statutes, the Farm Bill—“an omnibus, multiyear law that governs an array of agricultural and food programs”¹²³—also includes two major programs aimed at soil protection: (1) the Conservation Compliance program, including the Sodbuster and Swampbuster programs, and (2) the Conservation Reserve Program.¹²⁴ The Sodbuster and Swampbuster programs make ineligible for certain federal benefits those farmers that fail to put in place a conservation plan for highly erodible soils (Sodbuster) or convert wetlands to farm production (Swampbuster).¹²⁵ The Conservation Reserve Program offers compensation to

¹¹⁵ *Id.*

¹¹⁶ *See Lacy, supra* note 12, at 443.

¹¹⁷ *Id.* at 445.

¹¹⁸ *Id.*

¹¹⁹ *See* 16 U.S.C. § 2005(a).

¹²⁰ *See id.* § 2003(c).

¹²¹ *See id.* § 2005.

¹²² *Lacy, supra* note 12, at 445.

¹²³ RENÉE JOHNSON & JIM MONKE, CONG. RSCH. SERV., IF12047, FARM BILL PRIMER: WHAT IS THE FARM BILL? 5 (2023), <https://crsreports.congress.gov/product/pdf/IF/IF12047> [<https://perma.cc/VSW7-DUYW>].

¹²⁴ *Allain, supra* note 61, at 177.

¹²⁵ *U.S. Conservation Programs*, U.S. SUSTAINABILITY ALL., <https://thesustainability>

farmers to remove certain land from agricultural production and plant environmentally-beneficial species for a term of ten to fifteen years, with a long-term goal of (among other things) preventing soil erosion.¹²⁶ Collectively, these programs offer various carrots and sticks for implementing agricultural practices aimed at soil health. Again, however, they do not operate beyond parcel lines to capture interactions with or provide protections for the broader soil resource.¹²⁷

(e) *Miscellaneous*

Other federal statutes impact soil as a resource in various ways as well. For instance, the National Environmental Policy Act,¹²⁸ which requires federal agencies to consider the environmental impacts of major federal actions, includes impacts on soil quality as a relevant category.¹²⁹ Statutes like the Endangered Species Act can have soil conservation effects, given the kinds of habitat protection measures that may be put in place under its purview. Programs such as federal tax breaks for conservation easements¹³⁰ could provide soil benefits in theory,¹³¹ by helping to incentivize the maintenance of open land—though parts of the federal program have

alliance.us/u-s-conservation-programs/ [https://perma.cc/P4TR-LU9L] (last visited Jul. 29, 2023).

¹²⁶ FARM SERV. AGENCY, *About the Conservation Reserve Program (CRP)*, U.S. DEP'T OF AGRIC., <https://www.fsa.usda.gov/programs-and-services/conservation-programs/conservation-reserve-program/> [https://perma.cc/MB4S-VH4E] (last visited Jul. 29, 2023).

¹²⁷ See, e.g., J. William Futrell, *New Action for Soil Protection*, 39 ENV'T L. REP. (NEWS & ANALYSIS) 10077, 10077 (2009) (“Congress and the conservation community’s approach to [the soil erosion] crisis over the last 25 years has been a system of subsidies paying farmers to take fragile, highly erodible soils out of production. This approach has worked to some degree, but is not sufficient.”).

¹²⁸ National Environmental Policy Act, 42 U.S.C. §§ 4321–4370.

¹²⁹ See generally, e.g., Lauren Giles Wishnie, *NEPA for a New Century: Climate Change & the Reform of the National Environmental Policy Act*, 16 N.Y.U. ENV'T L.J. 628, 640 (2008) (citing “impacts on soil quality” as one of the typical types of federal actions that fall within NEPA’s purview).

¹³⁰ See, e.g., *Tax Deductions for Conservation Easements of Property*, TURBOTAX (Dec. 1, 2022, 8:39 AM), <https://turbotax.intuit.com/tax-tips/home-ownership/tax-deductions-for-conservation-easements-of-property/L8jRT8xAy> [https://perma.cc/NGK2-2576] (“A property owner creates a deductible conservation easement by donating some or all property rights to a qualified party. . . . For a conservation easement to be eligible for a tax deduction, the property rights must be donated for conservation purposes to what the tax code calls a ‘qualified conservation organization.’ . . . Further, the organization receiving the easement has to have the resources to enforce its restrictions and demonstrate a commitment to enforcement. Also, an easement can be deductible only if the easement’s conservation purpose is protect ‘in perpetuity’—meaning forever.”).

¹³¹ See, e.g., Laurie Ristino, *Conservation Easements in an Ecosystem Services Age*, 24 NAT. RESOURCES & ENV'T 56, 57 (2010).

been criticized as open to abuse.¹³² And 2022's Inflation Reduction Act includes \$18 billion for the United States Department of Agriculture's farm conservation programs, much of which is supposed to go directly to farmers implementing measures for soil conservation, as well as to fund technical support for those measures.¹³³ Combined, these efforts offer support for soil conservation in a variety of ways. They do not, however, establish any kind of federal mandate for such practices, or meaningful measures of the health of soil in a comprehensive way.

2. State and Local

State and local governments too are heavily involved in natural resource management, including soil. For instance, both levels of government regulate a wide variety of soil issues, including chemical and hazardous waste contamination and remediation;¹³⁴ soil erosion;¹³⁵ soil removal;¹³⁶ underground storage tanks;¹³⁷

¹³² See Peter Elkind, *The IRS Tried to Crack Down on Rich People Using an "Abusive" Tax Deduction. It Hasn't Gone So Well.*, PROPUBLICA (Jan. 3, 2020, 5:00 AM), <https://www.propublica.org/article/the-irs-tried-to-crack-down-on-rich-people-using-an-abusive-tax-deduction-it-hasnt-gone-so-well> [<https://perma.cc/QVF3-G5U3>].

¹³³ See Tim Alexander, *New Climate Law Injects Billions into Agriculture Conservation Programs*, ILL. NEWSROOM (Sept. 16, 2022), <https://illinoisnewsroom.org/new-climate-law-injects-billions-into-agriculture-conservation-programs/> [<https://perma.cc/V575-VUJH>].

¹³⁴ See generally WIS. STAT. § 292.11 (2017) (describing remedial action for hazardous substance spills); *Hazardous Waste Management Regulations*, CONN. DEP'T OF ENERGY & ENV'T PROT., (Feb. 3, 2020), <https://portal.ct.gov/DEEP/Waste-Management-and-Disposal/Hazardous-Waste-Regs/Hazardous-Waste-Regulations> [<https://perma.cc/ZD2C-NQHR>] (describing state incorporation of federal hazardous waste regulations); *Citizens' Env't Coal. v. N.Y. State Dep't of Env't Conservation*, No. 504881, 57 A.D.3d 1279, slip op. at 1 (N.Y. App. Div. Dec. 24, 2008) (describing state agency's implementation of Act encouraging cleanup of hazardous waste sites); *Ball v. Randolph Cnty. Bd. of Adjustment*, 498 S.E.2d 833, 835 (N.C. Ct. App. 1998) (stating that the state regulates soil remediation); *Anderson v. Douglas Cnty.*, 4 F.3d 574, 576 (8th Cir. 1993) (describing state agency and local government involvement in "thinspreading" petroleum-contaminated soil into healthy soil); Tripp Baltz, *States Eclipse Feds in Cleaning 'Forever Chemicals' in Soil (I)*, BLOOMBERG NEWS (Nov. 10, 2021, 11:01 AM), <https://news.bloomberglaw.com/environment-and-energy/states-eclipse-feds-in-cleaning-up-forever-chemicals-in-soil> [<https://perma.cc/CRX2-P4C7>].

¹³⁵ E.g., CONN. GEN. STAT. § 22a-326; N.J. REV. STAT. § 4:24-40.

¹³⁶ See, e.g., *Kress v. Sahara Dev.*, No. CA 5510, 1981 WL 6355, at *2 (Ohio Ct. App. July 15, 1981); *Twp. of Casco v. E. Brame Trucking Co.*, 191 N.W.2d 506, 507 (Mich. App. 1971); *Wulster v. Borough of Upper Saddle River*, 124 A.2d 323, 327 (N.J. Super. Ct. App. Div. 1956); *Butler v. Town of E. Bridgewater*, 10 N.E.2d 922, 923-24 (Mass. 1953); *Fred v. Mayor of Borough of Old Tappan*, 85 A.2d 317, 317-18 (N.J. Super. Ct. Law Div. 1951), *aff'd*, 10 N.J. 515, 92 A.2d 473 (1952); *Lizza & Sons, Inc. v. Town of N. Hempstead*, 272 A.D. 921 (N.Y. App. Div. 1947).

¹³⁷ See, e.g., *Kronon Motor Sales, Inc. v. Ill. Pollution Control Bd.*, 609 N.E.2d 678, 681 (Ill. App. Ct. 1992).

septic¹³⁸ or soil absorption systems;¹³⁹ and many more. These rules offer additional levels of governance aimed at preventing pollution of or on particular parcels.

In recent years, a number of states have also begun to consider soil health directly.¹⁴⁰ In 2019, New Mexico passed its Healthy Soil Act, designed to “promote and support farming and ranching systems and other forms of land management that increase soil organic matter, aggregate stability, microbiology and water retention to improve the health, yield and profitability of the soils of the state.”¹⁴¹ Similar measures exist in Massachusetts,¹⁴² California,¹⁴³ and a number of other states. These programs generally provide technical expertise coupled with various forms of financial assistance to farmers and land managers interested in implementing better soil practices. Some states, such as Montana, have constitutional protections for agriculture that could arguably be used to expand soil protections;¹⁴⁴ others mandate protection of soil and other natural resources through requirements for conservation in comprehensive planning.¹⁴⁵ And some go well beyond that. New York, for instance, charges its Department of Agriculture with holistic management of soil in a way that accounts for its value as a resource and requires coordination with state environmental departments.¹⁴⁶ Overall, however, the many laws discussed in this subsection are primarily focused on controlling for particular metrics of soil health on individual parcels of land.

¹³⁸ See, e.g., *Lloyd v. Spokane Reg’l Health Dist.*, No. 20518-5-III., 2002 WL 31501916 (Wash. Ct. App., Nov. 12, 2002).

¹³⁹ See, e.g., 310 MASS. CODE REGS. 15.213 (2023).

¹⁴⁰ See Ben Lilliston, *State Soil Health Initiatives Respond to Climate Change*, INST. FOR AGRIC. & TRADE POL’Y (Feb. 18, 2019), <https://www.iatp.org/blog/201902/state-soil-health-initiatives-respond-climate-change> [<https://perma.cc/SC79-9VQ2>].

¹⁴¹ Healthy Soil Act, N.M. STAT. § 76-25-3.

¹⁴² See MASS. CHAPTER, *New State Program to Build Healthy Soils, Climate Resilience*, NE. ORGANIC FARMING ASS’N (Feb. 2, 2021), <https://www.nofamass.org/articles/2021/02/new-state-program-to-build-healthy-soils-climate-resilience/> [<https://perma.cc/SSP5-WAC7>].

¹⁴³ See *California’s Healthy Soils Initiative*, CAL. DEP’T OF FOOD & AGRIC., <https://www.cdfa.ca.gov/healthysoils/> [<https://perma.cc/D7QA-UV22>] (last visited July 29, 2023).

¹⁴⁴ See MONT. CONST. ART. IX, § 12; see LAND USE CLINIC, UNIV. OF MONT. SCH. OF L., *AGRICULTURAL PROTECTION IN MONTANA: LOCAL PLANNING, REGULATION, AND INCENTIVES 8–9* (Land Use Clinic Univ. of Mont. Sch. of L. ed., 2012).

¹⁴⁵ See, e.g., AM. PLANNING ASSOC., *GROWING SMART LEGISLATIVE GUIDEBOOK 7-135* (Stuart Meck ed., 2002 ed.) (citing a Florida conservation element to its comprehensive planning requirement, which “mandates a ‘conservation element’ in the local comprehensive plan for the ‘conservation, use, and protection of natural resources in the areas, including . . . soils’”).

¹⁴⁶ See N.Y. AGRIC. & MKTS. LAW § 151-m (McKinney).

B. Soil Health's Second Dimension: Interconnectivity

Individual parcels of land do not, of course, exist in a vacuum. Because soil is so interconnected, it is critical that lawmakers account for relationships among and between parcels. For soil, these accounting mechanisms exist primarily at the state and local level in property and land-use doctrines. Property ownership is shaped, protected, and constrained by laws at many levels, from the United States Constitution¹⁴⁷ to a multitude of state and local laws. Generally, property rights and land use are managed in a fairly bottom-up way in the United States. State laws set the contours of property ownership within their respective borders, and local governments are generally responsible for carrying out land-use planning within theirs. The federal government does not loom as large in the private land-use space as other actors. While federal policies are felt in a variety of ways, efforts to create a more centralized federal land-use planning program have largely failed. In consequence, the contours of property ownership vary meaningfully from one jurisdiction to another.

Across the country, property rights are constrained to some degree due to impacts on other property owners or the community at large.¹⁴⁸ Generally speaking, such restrictions embody a principle that “your land is yours to do with as you wish, so long as you do not use it to harm or intrude on others’ rights.”¹⁴⁹ There is little question overall that, in order to conserve the quality of natural resources, including soil, “the State may justifiably limit the use which some owners may make of their property.”¹⁵⁰

In many places, restrictions on property rights take the form of comprehensive land-use planning as a requirement, and widespread zoning restrictions. Local governments have primary responsibility for these forms of land-use planning in the United States. Comprehensive planning at the state level is rare,¹⁵¹ but most states require their local governments to create plans that “provide a framework for the physical design and development of a community over a long-term planning horizon.”¹⁵² In addition, these plans can “address social, economic, and

¹⁴⁷ See U.S. CONST. amends. III, IV.

¹⁴⁸ See, e.g., Keith H. Hirokawa, *Property Pieces in Compensation Statutes: Law's Eulogy for Oregon's Measure 37*, 38 ENV'T L. 1111, 1132 (2008) (noting that “limitations, and the relativity of right among competing property owners and the common welfare, is the very project of property”).

¹⁴⁹ Joseph L. Sax, *Ownership, Property, and Sustainability*, 31 UTAH ENV'T L. REV. 1, 3 (2011).

¹⁵⁰ See, e.g., *In re Spring Valley Dev.*, 300 A.2d 736, 746 (Me. 1973) (noting further that “[o]ur law has long recognized that a landowner holds his property subject to the limitation that he may not use it to the serious disadvantage of the public.”).

¹⁵¹ JULIAN CONRAD JUERGENSMAYER & THOMAS E. ROBERTS, *LAND USE PLANNING AND DEVELOPMENT REGULATION LAW* § 13:7, at 553 (3d ed. 2013).

¹⁵² FEMA, U.S. DEP'T OF HOMELAND SEC., *INTEGRATING HAZARD MITIGATION INTO THE LOCAL COMPREHENSIVE PLAN* (Jan. 1, 2013), <https://www.fema.gov/sites/default/files/2020-07/integrating-hazard-mitigation-local-plan.pdf> [<https://perma.cc/2EGS-B7LD>].

environmental issues by the manner in which they guide overall growth and development.”¹⁵³ Zoning ordinances at the local level are generally required to be made in accordance with the comprehensive plan.¹⁵⁴ At its core, zoning regulates the relationships between private parcels and the surrounding community by dictating where and what types of land uses are allowed in a given place. Thus, “[s]tripped to its essentials, the local land-use system starts with the adoption of a comprehensive plan, moves to zoning that conforms to and implements that plan, and supplements these with land development regulations that can protect the environment.”¹⁵⁵ That system allows for broad ability to control for environmental and other impacts of one parcel on another. While some communities have started to experiment with zoning for soil health,¹⁵⁶ that resource has not historically been a major factor in local land-use decision-making.

Interestingly, state and local governments also have some structural elements in place specifically aimed at managing soil as a resource. As described above, the Dust Bowl of the 1930s devastated large parts of the central United States, resulting in soil erosion on a vast scale and uprooting thousands of families.¹⁵⁷ Following the Dust Bowl, the federal government engaged in a variety of initiatives to guard against any similar national emergency in the future. As part of that effort, then-President Franklin Delano Roosevelt urged passage at the state level of the Standard State Soil Conservation Districts Law. That model law “sought to ‘decentralize’ the federal government’s soil erosion control efforts by authorizing the creation of local Soil and Water Conservation Districts (“SWCDs”).”¹⁵⁸

His efforts were successful: “[U]nder authorization of the Soil Erosion Act of 1935, every state has created soil conservation districts to address soil erosion at the local level.”¹⁵⁹ However, the versions of the laws passed at the state level differed in important aspects from the model legislation. Most notably, the original plan for the SWCDs were that they would be focused on soil and water resources and would be

¹⁵³ *Id.*

¹⁵⁴ See, e.g., John R. Nolon, *Comprehensive Land Use Planning: Learning How and Where to Grow*, 13 PACE L. REV. 351, 351 (1993) (“The law of most states stipulates that zoning is valid only if it is in accordance with a comprehensive land use plan.”).

¹⁵⁵ John R. Nolon, *An Environmental Understanding of the Local Land Use System*, 45 ENV’T L. REP. (NEWS & ANALYSIS) 10215, 10215 (2015).

¹⁵⁶ Local governments have, for instance, “implemented zoning and land use planning schemes to prevent development of lands that have productive soils or offered tradable development rights to preserve prime soils.” Keith H. Hirokawa, *The New Law of Geology: Rights, Responsibilities, and Geosystem Services*, 52 ENV’T L. REP. 10380, 10403 (2022).

¹⁵⁷ See generally NAT’L DROUGHT MITIGATION CTR., *supra* note 66.

¹⁵⁸ Jess Phelps, *A Vision of the New Deal Unfulfilled? Soil and Water Conservation Districts and Land Use Regulation*, 11 DRAKE J. AGRIC. L. 353, 354 (2006).

¹⁵⁹ Geoffrey Heal, Gretchen C. Daily, Paul Ehrlich, James Salzman, Carol Boggs, Jessica Hellmann, Jennifer Hughes, Claire Kremen & Taylor Ricketts, *Protecting Natural Capital Through Ecosystem Service Districts*, 20 STAN. ENV’T L. J. 333, 354 (2001); see also, e.g., Jerrold A. Long, *Making ‘Conservation’ Work for the 21st Century: Enabling Resilient Place*, 4 WASH. J. ENV’T L. & POL’Y 359, 401 (2015) (“At some point, all fifty states adopted legislation creating soil conservation districts.”).

vested with regulatory authority to carry out their mission. The regulatory power was “an essential component of the original district concept.”¹⁶⁰ But many states elected to create the districts without any delegation of authority, and where authority was delegated, exercise of that regulatory authority has been rare.¹⁶¹ Even today, “SWCDs continue to ignore the potential environmental benefits that regulatory authority could provide.”¹⁶²

Thus, although statutory and regulatory structures that recognize the relationship between private actions and soil health do exist, they are underutilized. But the presence of property doctrines, planning frameworks and others at the state and local level shows the ability—if not the obligation—to incorporate broader social concerns into policy decisions about land. These efforts and others offer windows into how we might be more successful in taking account of comprehensive soil health and the changes in law and land use it may require.

III. TOWARD THREE-DIMENSIONAL SOIL GOVERNANCE

Fragmented governance structures like the ones described in Part II are common features of soil programs around the world. Indeed, the seminal report to date on sustainable soils from the United Nations found in its survey of existing laws that the “dominant characteristic[s]” of national soil law were that “soil legislation is very much overshadowed by the physical problems that arise from land use (i.e. there is too much private interest and insufficient public interest),” that few laws referred to the “ecological features or needs of soil, or its role in the conservation of biological diversity,” and that where legislative frameworks had been developed “to manage a number of distinct soil and land-use problems,” they “generally lack[ed] a linking or coordinating mechanism.”¹⁶³

These fractured frameworks also share the common theme of not working particularly well to protect soil. This Part explains the problems of a two-dimensional approach to soil governance and suggests a path forward with a dynamic three-dimensional approach to address soil’s health in the United States.

A. The Problem with Two-Dimensional Soil Governance

In the siloed approach to soil governance currently used, no single actor has the responsibility to monitor the cumulative impacts of soil-degrading actions such as agricultural activities, removal of natural vegetation, overgrazing, or industrial

¹⁶⁰ Phelps, *supra* note 158, at 356.

¹⁶¹ *Id.*; see also Kevin C. Rigdon, *Stop the Planting! The 1985 Farm Bill, Conservation Compliance, and America’s Agricultural Conservation Failure*, 16 DRAKE J. AGRIC. L. 487, 500 (2011) (“As a result of both external and self-imposed restrictions, exercise of the SWCD regulatory power is quite rare throughout the country.”).

¹⁶² Phelps, *supra* note 158, at 356.

¹⁶³ HANNAM & BOER, *supra* note 7, at xiv.

processes.¹⁶⁴ The consequences have been dramatic, yet unsurprising.¹⁶⁵ In December 2022, for instance, researchers published a new study showing the rate of soil erosion in the Midwestern United States to be ten to one thousand times greater than pre-agricultural erosion rates.¹⁶⁶ And a March 2022 letter from the United Nations Intergovernmental Panel on Soil Health identified “soil sealing,” or covering soil with hard surfaces that cannot be easily removed, as a major threat to food production, biodiversity, and water management worldwide.¹⁶⁷ This is particularly concerning given that soil health is thought to be both critical in adapting to impacts from climate change¹⁶⁸ and likely to be negatively impacted by climate change.¹⁶⁹ As such, the environmental changes that the Earth is going through now, and those it will continue to face over the coming decades, require reexamination of how the legal system interacts with environmental resources and property rights.¹⁷⁰

Like air and water protection programs in their early stages, soil governance in its current state tends to be reactive, focused only on specific harms rather than the health of the resource as a whole.¹⁷¹ But the beneficial functions of soil listed above—including biodiversity, food generation, water quality, and carbon sequestration—depend on the overall health of the soil. Those complex benefits are part of an ecological web that relies on interconnection. Though soil does not contain natural boundaries that fall along private property lines, it is overwhelmingly subject

¹⁶⁴ *See id.*

¹⁶⁵ Carol M. Rose, *Surprising Commons*, 2014 BYU L. REV. 1257, 1260 (2014) (“In short, according to this well-known and lugubrious caricature, commons tragedies are built into the nature of collective action. They should not be a surprise to anyone. But in fact, commons tragedies *are* a surprise. We have one example after another of how astonished people are by commons problems, including commons problems that degrade physical resources, which one would think we would notice. We are surprised, first, that we have a commons problem at all, and second, that the problem has something to do with open access to resources.”).

¹⁶⁶ Caroline L. Quarrier, *Pre-agricultural Soil Erosion Rates in the Midwestern United States* (May 2022) (M.S. thesis, Univ. of Mass. Amherst) (on file with ScholarWorks@UMass Amherst).

¹⁶⁷ FOOD & AGRIC. ORG. OF THE U.N., INTERGOVERNMENTAL TECH. PANEL ON SOILS, SOIL LETTERS 5, URBANISATION AND SOIL SEALING (Mar. 2022), <https://www.fao.org/3/cb8617en/cb8617en.pdf> [<https://perma.cc/LX2C-4DUY>].

¹⁶⁸ *See* Carol Clark, *Soil Quality Critical to Help Some U.S. Crops Weather Heat Stress from Climate Change*, EMORY UNIV. (July 14, 2022), https://news.emory.edu/stories/2022/07/esc_soil_capacity_heat_stress_14-07-2022/story.html [<https://perma.cc/8S44-H27V>] (“Keeping soil healthy is a key component needed to adapt to the climate crisis.”).

¹⁶⁹ *See generally* Lennart Olsson, Humberto Barbosa, Suruchi Bhadwal, Annette Cowie, Kenel Delusca, Dulce Flores-Renteria, Kathleen Hermans, Esteban Jobbagy, Werner Kurz & Diqiang Li et al., *Land Degradation*, in SPECIAL REPORT: CLIMATE CHANGE AND LAND ch. 4 (P.R. Shukla et al. eds., 2019), <https://www.ipcc.ch/srccl/chapter/chapter-4/> [perma.cc/5QMC-FS2D].

¹⁷⁰ *See, e.g.*, John G. Sprankling, *Property Law for the Anthropocene Era*, 59 ARIZ. L. REV. 737, 738 (2017) (calling for a “shift from a property law system premised on stability to a more dynamic system that accommodates large-scale change”).

¹⁷¹ *See* Futrell, *supra* note 127, at 10078.

to private ownership. In consequence, soil practices on private land impact the common resource, but those negative impacts are not necessarily internalized by the property owner.

It may well be true that “[t]here is an ethical reason—a reason of patriotism—why the individual landowner should take the initiative” regarding maintenance of soil health.¹⁷² But long experience has shown that private property regimes on their own often “do not guarantee effective or efficient environmental protection.”¹⁷³ Many natural resources are similar in that their common benefits operate at a much broader scale than individual property entitlements. Where that is the case, the resource often degrades because individual owners are not incentivized to act for the common good. Such situations pose the risk that “even people who would like to do better do not think they can change things,”¹⁷⁴ and therefore do not engage in sufficiently protective behaviors. In that kind of environment, effective legal structures will be the means that respond to and capture the impacts between common benefits and private ownership.¹⁷⁵ Helpfully, there is an area of the law—to date not widely theorized with regard to soil—that can help to shape thinking around better soil governance.

B. Soil Health’s Third Dimension: Soil as Common Resource

Management of common resources has been extensively discussed and theorized, taking on questions about what it means for resources to be commonly held or commonly accessible, as well as how to solve problems that arise with those resources. Land, and the life that grows upon it, has been at the heart of commons theory. Despite the centrality of land to the commons conversation—and the vast amount of writing on commons—soil as a common resource has not to date played a prominent role in such discussions. Applying the commons lens to soil can provide a vocabulary for the interconnected nature of the soil resource and soil’s multiple realities. Beyond that, thinking about soil from a commons perspective is

¹⁷² See generally John H. Davidson, *Protecting the Still Functioning Ecosystem: The Case of the Prairie Pothole Wetlands*, 9 WASH. U. J.L. & POL’Y 123, 123 (2002) (quoting H.S. PERSON, E. JOHNSTON COIL & ROBERT T. BEALL, *LITTLE WATERS* 46–45 (1935)); *Id.* (“If we would preserve our democracy of ownership of private property, then ownership must meet its responsibilities as well as enjoy its privileges.”).

¹⁷³ DANIEL H. COLE, *POLLUTION & PROPERTY: COMPARING OWNERSHIP INSTITUTIONS FOR ENVIRONMENTAL PROTECTION* 178 (2002).

¹⁷⁴ Rose, *supra* note 165, at 1260.

¹⁷⁵ See, e.g., Sprankling, *supra* note 170, at 742–43 (“Activities on a piece of land may cause or contribute to cross-border physical changes that substantially harm other parcels, in either a direct or cumulative sense. This negative-externality scenario might arise from activities such as deforestation, air or water pollution, flooding, or uncontrolled fires. In this scenario, it will be necessary to develop innovative techniques to restrict and potentially prohibit certain land uses to prevent or mitigate off-site impacts, even if this impairs traditional property rights.”).

substantively useful because it helps to clarify and support the kinds of changes in governance that may better protect the resource.

The commons analysis often starts with Garrett Hardin. Hardin's famously tragic commons, where "too many owners waste a common resource,"¹⁷⁶ was a tale about cows in an open-access pasture. If all comers have access to a pasture, so the story goes, there is no disincentive to continuously adding cows, until the pasture is overgrazed, and all the cows (and their owners) suffer. Hardin's simplistic example has been broadly critiqued and is now lauded mainly for the catchiness of the ideas that it imparted.¹⁷⁷ Nonetheless, the story of Hardin's commons helps to convey a basic truth about use of land and other natural resources: it often presents situations where the ratio of personal gain to group harm skews in favor of the latter to an eventually self-destructive extent.¹⁷⁸

Many theorists since Hardin have given nuance to the commons discussion. Elinor Ostrom's work added important distinctions between the truly open-access pasture suggested by Hardin and the many "commons" areas that involve shared property interests but retain an element of exclusion against the outside world. In such situations, a combination of exclusion and governance can allow for long-term sustainable management of a resource.¹⁷⁹ Other theorists have added more detailed understanding involving the anticommons¹⁸⁰ and the semicommons,¹⁸¹ unpacking questions of scale and access in the commons discussion. Conveying the full breadth of the commons literature is beyond the scope of this Article, but its flexibility in acknowledging the complexity of modern life and property entitlements, and helping to reconceptualize those relationships, is useful.¹⁸² All of the commons frameworks mentioned are best thought of not as separate systems, but as different "lens for apprehending a single core," which is the need of resource systems to "accommodate

¹⁷⁶ See Hanoch Dagan & Michael A. Heller, *The Liberal Commons*, 110 YALE L.J. 549, 551 (2001) (citing Garrett Hardin, *The Tragedy of the Commons*, 162 SCI. 1243, 1244–45 (1968)).

¹⁷⁷ See, e.g., Rose *supra* note 165, at 1258; See generally Henry E. Smith, *Governing Water: The Semicommons of Fluid Property Rights*, 50 ARIZ. L. REV. 445, 451 n.25 (2008) (citing Garrett Hardin, *The Tragedy of the Commons*, 162 SCI. 1243, 1244 (1968)).

¹⁷⁸ See, e.g., Irma S. Russell, *A Common Tragedy: The Breach of Promises to Benefit the Public Commons and the Enforceability Problem*, 11 TEX. WESLEYAN L. REV. 557, 563 (2005) (describing commons problems in terms of both waste disposal and overuse as resulting in situations where "[t]he ratio of individual gain to group loss will result in use of the commons by polluters to externalize the costs of production represented by the disposition of waste into the public commons . . . Thus, the individual's self-interest is self-destructive in the long run.").

¹⁷⁹ See, e.g., Rose, *supra* note 165, at 1262; see also, Smith, *supra* note 177, at 450–51.

¹⁸⁰ See generally Lee Anne Fennell, *Commons, Anticommons, Semicommons* 1, 9–10 (Univ. of Chi. L. Sch. Pub. L. & Legal Theory Working Paper, Paper No. 261, 2009), https://chicagounbound.uchicago.edu/cgi/viewcontent.cgi?article=1065&context=public_la_w_and_legal_theory [<https://perma.cc/8NZV-ZURW>].

¹⁸¹ See generally Smith, *supra* note 177, at 449.

¹⁸² See, e.g., Dagan & Heller, *supra* note 176, at 622–23.

multiple uses . . . at different scales.”¹⁸³ That lens helps to reveal the competing uses and interests in play, as well as possible ways to mediate between them.

Like land, soil’s dual identities as environment and property make it a natural fit for consideration as a commons.¹⁸⁴ On the one hand, the environmental significance of the common, interconnected soil biome is hard to overstate.¹⁸⁵ Those same features, however, mean that soil lacks the easy enclosure and exclusion remedies that have long put land at the center of the commons conversation. In that way, soil is perhaps more of a Hardin-style open-access resource than an Ostrom-style commons¹⁸⁶—but it is one that shares with other environmental resources a lack of clear boundaries. Less fugitive perhaps than water or air, soil’s interconnections nonetheless defy attempts to be corralled into tidy property parcel-sized packages. In this way, it rests somewhat outside the core commons discussion, at the “nexus of resources that are individually owned (i.e., private property) and resources that are unowned,” and that “cannot be addressed by fencing.”¹⁸⁷

As noted, much of soil is already in private ownership. According to some commons theory, that rights allocation should be sufficient to make property owners internalize their externalities and arrive at a protective level of resource management and protection. But “[t]he effectiveness of property systems as a resource management tool depends on the accuracy of an assumption that most of the impacts of an individual property owner’s decisions are felt by that property owner.”¹⁸⁸ This logic has failed for any number of environmental goods, and it fails for soil as well. Currently, the diffuse nature of impacts from soil alteration and disturbance means that, in most cases, no one property owner is likely to feel and internalize the impacts of those activities.¹⁸⁹ In consequence, allocation of property rights to disparate parts of the interconnected soil resource has not solved the crises of soil health.

The “semicommons” variation on commons theory deals more directly with this idea of scale mismatch between resource and property rights. The term semicommons has been applied to resources that are “covered by both common and

¹⁸³ Fennell, *supra* note 180, at 1.

¹⁸⁴ See, e.g., Sheila R. Foster & Christian Iaione, *The City as a Commons*, 34 *YALE L. & POL’Y REV.* 281, 285 (2016) (describing property and environmental law as the “traditional” commons fields).

¹⁸⁵ JENNIFER KENDZIOR, DYLAN WARREN RAFFA & ANNE BOGDANSKI, *FOOD & AGRIC. ORG. OF THE U.N., REVIEW OF THE IMPACTS OF CROP PRODUCTION ON THE SOIL BIOME* (Mar. 2022), <https://www.fao.org/3/cb8698en/cb8698en.pdf> [<https://perma.cc/4EB6-67RF>].

¹⁸⁶ See Rose, *supra* note 165, at 1262. To be sure, certain commonly owned areas might involve questions of soil health; where true, commons theory would suggest different results.

¹⁸⁷ Rashmi Dyal-Chand, *Sharing the Climate*, 122 *COLUM. L. REV.* 581, 612 (2022).

¹⁸⁸ Biber, *supra* note 73, at 47–48.

¹⁸⁹ Cf. Dyal-Chand, *supra* note 187, at 597 (citing Kenneth E. Boulding, *Spaceship Earth Revisited*, in *VALUING THE EARTH: ECONOMICS, ECOLOGY, ETHICS* 311, 311–12, (Herman E. Daly & Kenneth N. Townsend eds., 1993) (deeming “highly questionable,” in light of the ongoing climate crisis, the “assumption that individual ownership of resources avoids resource depletion better than commons ownership, thus leading to greater overall social welfare,” as it “has been grounded in our ability to produce externalities without having to internalize them.”).

private property” systems that interact. The semicommons framework describes, most classically, scenarios where the same resource is subject to different scales of use and ownership. For example, Henry Smith described the prototypical example of a semicommons as a plot of land allocated in individual parcels for farming but opened up more broadly for grazing.¹⁹⁰

Soil is currently an imperfect fit for the semicommons conversation in an important respect: there are few existing property entitlements that touch on the interconnections between soil health of individual parcels.¹⁹¹ One could imagine, perhaps, a homeowner’s association or governmental entity that holds title to the soil within a community for purposes of managing it as a natural resource, but where the private owner holds title to the soil for the purposes of supporting her enjoyment of her home or business within approved parameters. Such a situation would bring us closer to a true soil semicommons. But the interconnected nature of the soil resource and its failure to come to a natural end at the boundaries of the association’s common property would still make exclusion difficult. Given these physical realities of soil, semicommons theory suggests the need for heavy reliance on governance rules to manage the common resource.¹⁹²

Thus, applying a commons framework to soil—even if it is an imperfect fit—help demonstrate that solutions to the current insufficiently protective systems are likely to lie in the following: changes to property entitlements, and, necessarily, changes to governance rules.¹⁹³ Such measures would not come without controversy. Carol Rose framed the likely progression of the conversation about soil several decades ago.¹⁹⁴ She explained that with early property regimes in land, “[l]andowners bec[a]me accustomed to regarding their land as their property, but they simultaneously regard[ed] the adjacent air, water, and wildlife as goods that are free for the taking—unowned goods that they can ‘piggyback’ onto their own land uses.”¹⁹⁵ As those resources become pressured and the law responds with new forms of property and regulatory programs, “such regulatory initiatives may outrage landowners, who may think that their ‘piggybacked’ uses of adjacent shared resources are a matter of right.”¹⁹⁶ Property owners can be expected to have a

¹⁹⁰ Smith, *supra* note 177, at 475.

¹⁹¹ It is, of course, the work of ecosystems services scholars to change this conversation and reality. *See generally, e.g.,* Robbins, *supra* note 47, at 207 (discussing ways in which private landowners’ control over ecosystem services can impact broader communities); Keith H. Hirokawa, *Sustaining Ecosystem Services Through Local Environmental Law*, 28 PACE ENV’T L. REV. 760 (2011); J.B. Ruhl, *Ecosystem Services and the Common Law of “The Fragile Land System,”* 20 NAT. RES. & ENV’T 3 (2005).

¹⁹² *See, e.g.,* Smith, *supra* note 177, at 477.

¹⁹³ Lee Ann Fennell, *Ostrom’s Law: Property Rights in the Commons*, INT’L J. COMMONS, Feb. 2011, at 9, <https://www.thecommonsjournal.org/article/10.18352/ijc.252/> [<https://perma.cc/5FNA-R5CP>].

¹⁹⁴ Carol M. Rose, *The Several Futures of Property: Of Cyberspace and Folk Tales, Emission Trades and Ecosystems*, 83 MINN. L. REV. 129, 136 (1998).

¹⁹⁵ *Id.* at 137.

¹⁹⁶ *Id.* at 137–38.

similarly strong sense of entitlement to use of soil, as it is not just adjacent to land but coextensive with it.

Changing property interests or governmental controls regarding soil are likely to meet with strong resistance “because such an effort runs against the enshrined view of soil as land, as a thing, a piece of property whose use by the landowner is not to be impeded.”¹⁹⁷ There is often strong resistance to restrictions on private property rights in the United States, particularly when it comes to land ownership.¹⁹⁸ Such attitudes tend to be rooted in a mythology that holds that property rights began in a state of unbounded freedom that has slowly been chipped away by modern regulations.¹⁹⁹ That mythology is not historically accurate,²⁰⁰ but is reflected in calls to treat property as a “fully private and privatizable space,”²⁰¹ or “a place that is unqualifiedly one’s own.”²⁰² In reality, private property has been bounded across culture, time, and legal traditions by the impacts of that property use on others. There are, and always have been, many restrictions on property in the United States.²⁰³ The interconnections and impacts between and among parcels form the basis for a third dimension to soil that justifies new contours of soil ownership.

Questions about shared resources and their overlay on privately owned land are ones that our legal system often struggles to ask or answer.²⁰⁴ Thinking about soil as a commons, however, offers a way to better understand and evolve our relationships with soil as property and for governmental controls to step in to control private uses.

¹⁹⁷ See Futrell, *supra* note 127, at 10079; see also Rigdon, *supra* note 161, at 500 (“Utilizing the regulatory power to compel private landowners to implement a conservation scheme has simply been regarded as contrary to the historical concept of the American farmer.”).

¹⁹⁸ See, e.g., Neil D. Hamilton, *Needed: A New Commitment to Soil Conservation—Can Addressing Soil Health and Climate Change Re-Energize This Work?*, 52 U. PAC. L. REV. 599, 614 (2021) (“It is risky to tell any dues-paying member of a farm organization that land cannot be sold for housing lots. The story is no different with the federal farm program payments and crop insurance subsidies handed out by the billions, with few questions asked. The public’s bargain in providing taxpayer support is a commitment that landowners will comply with soil conservation rules; but drive any country road in the spring or check local USDA office enforcement records to see if the promise of conservation compliance is empty or real.”).

¹⁹⁹ See, e.g., Eric T. Freyfogle, *Eight Principles for Property Rights in the Anti-Sprawl Age*, 23 WM. & MARY ENV’T. L. & POL’Y REV. 777, 784 (1999).

²⁰⁰ Jill M. Fraley, *Climate Change, Sustainability, and the Failure of Modern Property Theory*, 104 MARQ. L. REV. 93, 120 (2020).

²⁰¹ Sax, *supra* note 149, at 9.

²⁰² *Id.* at 3.

²⁰³ See, e.g., Freyfogle, *supra* note 199, at 784 (detailing evolution of property law over time to account for changing uses and impacts on the property of others).

²⁰⁴ See Sax, *supra* note 149, at 10.

Broadening the soil discussion to include its interconnections would direct soil governance to a place more suited to current conditions and needs.²⁰⁵

IV. RETHINKING SOIL GOVERNANCE AND PRIVATE PROPERTY

The United States needs a more intentional approach to soil governance. The discussion in Parts II–III supports a transition to a system that better accounts for that third dimension of soil health—the interconnections inherent in and to the soil resource. Such a system will require shifts in both substance and structure to unite the law’s treatment of soil as resource and property. Henry Smith previously observed that, in the context of semicommons, where multiple uses are important and exclusion is difficult, “it becomes worthwhile to . . . expend more delineation effort on a governance strategy, which prescribes proper use. Governance rules can range from contractual (e.g., covenants) to off-the-rack common law (nuisance) to statutes and regulations (e.g., zoning and pollution control).”²⁰⁶ In arriving at the right kind of strategy for soil, all of those options are potentially in play.²⁰⁷ As discussed in Sections IV.A–IV.B, changes to property law that alter ownership rights to reflect soil’s interconnections would be a powerful part of better protecting the soil resource. In the absence of a full-scale property revolution, however, government controls in the form of land-use regulations are likely to be just as important at this time. That focus on land-use controls is intertwined with the Article’s main structural point, which is that local governments are well-positioned to take the lead on soil health.

A. Substantive Soil Governance: Private Property and Environmental Controls

As described in Section III.A, a key reason that our current soil governance methods are not working particularly well is that they fail to capture the near-constant externalities imposed through use of the soil resource.²⁰⁸ A sustainable system of soil governance is one that can ensure “the use of soil in a manner that preserves the balance between the processes of soil formation and soil degradation, while maintaining the ecological functions and needs of soil.”²⁰⁹ To get there, soil governance must be guided by those processes, and lawmakers must acknowledge their complexity and interconnectedness. And that will likely require legal structures

²⁰⁵ *Id.* at 16 (“[W]e are still very far from seeing land as part of a natural economy. Until we get beyond that mental and legal block, we will not be able effectively to come to terms with the plethora of interests that are now discussed under the broad mantle of sustainability.”).

²⁰⁶ Smith, *supra* note 177, at 446.

²⁰⁷ See, e.g., Owley, *supra* note 11.

²⁰⁸ See, e.g., Dyal-Chand, *supra* note 187, at 583 (“A property law that is responsive to the climate crisis and that prioritizes the diffusion of this crisis must grapple deeply with the connection between individual ownership and large-scale—indeed systemic—externalities and the harms they produce.”).

²⁰⁹ HANNAM & BOER, *supra* note 7, at xiii.

that are proactive rather than reactive, and that emphasize obligations rather than private entitlements.

1. Property Law

There is no dividing line between soil as a resource and soil as property.²¹⁰ Given the high percentage of privately owned land in the United States, attempts to improve and maintain soil health will necessarily involve grappling with private ownership. As explained above, the health of the soil on the whole depends on the health of the soil in individual parcels.²¹¹ But despite the known impacts of private actions on soil, there is currently little in the way of obligations on the part of property owners to limit harm to the soil resource, or to promote or maintain its health. Modern property theorists are currently grappling with how to balance the individual autonomy that marks so much of property theory in the United States with the need to account for the realities of environmental crises created by a near-constant flow of negative externalities.²¹² As Rashmi Dyal-Chand has observed:

What is required . . . is a conceptual and doctrinal framework that recognizes the need to manage resources owned both exclusively and in common in such a way as to protect the long-term value and integrity of those resources as well as the infrastructure that enables their continued enjoyment²¹³

As it becomes increasingly clear that all of our well-being is “dependent on our ongoing access to [common] resources,”²¹⁴ it will also become necessary to make changes to ownership obligations and norms.²¹⁵ This reasoning applies to soil as

²¹⁰ *Cf.* Long, *supra* note 159, at 361 (noting how the author uses conservation in “multiple ways, with the common theme across those uses being the relationship between humans and their natural environment and the recognition that these are not two different systems”).

²¹¹ *Cf.* Sax, *supra* note 149, at 9 (“To the extent we want the benefit of natural services (to stanch the decline of biodiversity, to benefit from the role of forests in controlling warming, to rely on seashore dunes to protect uplands, and to facilitate renewable energies like solar), the role played by those services has to be accounted for on the land everywhere, including the great majority of land held as private property.”).

²¹² *See, e.g.*, Dyal-Chand, *supra* note 187, at 589.

²¹³ *Id.* at 611.

²¹⁴ *See id.* at 589.

²¹⁵ Fennell, *supra* note 193, at 17 (noting that “[p]roperty theory . . . largely boils down to intelligently confronting (and, as necessary, adjusting) the interface between individual and collective entitlements.”); *see generally* Dagan & Heller, *supra* note 176, at 602 (“[m]odern property law is a story of introducing and refining new liberal commons types”); *see also, e.g., id.* at 583 (“[t]his Article argues that it is imperative for property law to develop durable, systemic responses to the climate crisis”); Fraley, *supra* note 200, at 120; Sprankling, *supra* note 170, at 738; Holly Doremus, *Climate Change and the Evolution of Property Rights*, 1 U.C. IRVINE L. REV. 1091 (2011).

well, and there are a variety of ways that property doctrine could shift to bridge the disconnect between private ownership and public resource. Many types of property reforms have been suggested as ways to capture the broader connections between property owners and the natural world. For instance, recent scholarship has involved calls for property interests in ecosystem services,²¹⁶ changes to doctrines of nuisance²¹⁷ and waste,²¹⁸ creation of new, severable estates in natural resources,²¹⁹ and greater reliance on homeowners' associations for common property management.²²⁰ Soil as an ecosystem resource is already reflected explicitly in some of these discussions²²¹ and could be incorporated easily into others. Taking up some or all of these property reform suggestions would push the limits of what it means to own property in the United States and help incorporate greater notions of interconnectedness. These suggestions for change also have in common an underlying belief in the need to change the way that we view property rights in the United States. Connections in the soil resource, like so many natural connections, support a transition to property that considers those interdependencies.²²² A changing baseline focused more on use rights than absolute ownership²²³ is critical in developing a layered approach to soil and other resources that does not rely solely on top-down controls.²²⁴

Commons theory also makes clear, however, the necessity of governmental controls to protect common resources. Such controls are particularly needed where drawing boundaries around the resource is difficult, and where multiple uses are prevalent and prioritized, as with soil. Further, many facets of law in the United States are currently under sway of a property rights movement that is diametrically

²¹⁶ See, e.g., Robbins, *supra* note 47, at 197 (arguing for ecosystem services to be regulated as property rights).

²¹⁷ See Hirokawa, *supra* note 156, at 10407; J.B. Ruhl, *Making Nuisance Ecological*, 58 CASE W. RESV. L. REV. 753 (2008).

²¹⁸ Tara K. Righetti & Joseph A. Schremmer, *Waste and the Governance of Private and Public Property*, 93 U. COLO. L. REV. 609, 659 (2022).

²¹⁹ Alan J. Alexander, *The Texas Wind Estate: Wind as a Natural Resource and a Severable Property Interest*, 44 U. MICH. J.L. REFORM 429, 433 (2011).

²²⁰ See Dyal-Chand, *supra* note 187, at 618–19.

²²¹ See, e.g., Robbins, *supra* note 47, at 202 (discussing property interests in ecosystem services and the interconnected role of soil services); see also Hirokawa, *supra* note 156, at 10383.

²²² See, e.g., Eric T. Freyfogle, *Context and Accommodation in Modern Property Law*, 41 STAN. L. REV. 1529, 1552 (1989) (explaining and exploring shifts in water law and noting that “property rights in water differ little from property rights in land and other resources. All resource uses are context-dependent, particularly as crowding brings users closer together. All resource users can promote community interests by accommodating the needs of their neighbors.”).

²²³ *Id.*

²²⁴ See, e.g., Righetti & Schremmer, *supra* note 218, at 659 (arguing that the “modern turn away from reliance on the waste principle—and the common law more generally—has contributed to the law’s seeming inability to address society’s pressing resource-scale problems.”).

opposed to recognizing limitations on private use based on social and natural interdependency.²²⁵ Thus, while important, property law reforms are best seen as part of a two-pronged strategy, where shifts in understanding of what it means to own property could pave the way for new environmental regulations.²²⁶ And in the meantime, it is worth looking to other paths forward for better protection of the soil resource.

2. *Shifts in Governmental Controls*

The above discussion in subsection IV.A.1 suggests shifts in and modifications to existing property rights, but not their obliteration. And as explained above, even if property norms were altered, and more common property rights were recognized regarding soil, semicommons theory suggests that a mix of incentives and governmental controls will still be necessary to account for the difficulty of exclusion and the number of actors in a vast, interconnected resource like soil. This subsection, then, will focus on substantive shifts in soil governance in the form of governmental controls. The possible paths for better soil governance are, as with resource management more generally, likely federal and state environmental laws, or state and local land-use laws.

²²⁵ The Supreme Court's decision in *Cedar Point Nursery v. Hassid*, 121 S.Ct. 2063 (2021), is a recent prominent example of the current Supreme Court's deference to private property rights. In *Cedar Point*, the Court disrupted longstanding takings doctrine to find that a statute requiring temporary physical access for union organizers on private property constituted a taking. *Cedar Point*'s full impact is not yet known, and it has been criticized for blurring the line between physical and regulatory takings. Its legacy seems likely, however, to be further disruptions in understanding of takings law in favor of private property interests. See, e.g., Aziz Z. Huq, *Property Against Legality: Takings After Cedar Point*, 109 VA. L. REV. 233, 282 (2023) (“[private property rights] interest groups likely will find an increasingly sympathetic ear for arguments that the category of regulatory takings should be subsumed within the broader reach of an ‘appropriation’ standard to the benefit of present property owners, and to the detriment of those who experience property’s negative externalities.”); see also, e.g., Erin Ryan, *Privatization, Public Commons, and the Takingsification of Environmental Law*, 171 U. PA. L. REV. 617, 643–44 (2023) (internal citations omitted) (“In recent decades, courts’ enthusiastic application of these rules has resulted in what we might call the ‘takingsification’ of American property, land use, and environmental law focusing attention on private interests to the exclusion of all other considerations. Moreover, the federal Takings Clause is partnered with analogs in state constitutions, some even more protective of private property than the federal constitution, and corresponding state legislation that bolsters the legal protection of private over public interests. The resulting shift of regulatory power toward the protection of private rights at the expense of the public has raised eyebrows among jurists and property scholars around the world.”).

²²⁶ Fraley, *supra* note 200, at 120.

(a) *Environmental Law*

As noted, several natural resources in the United States have been the subject of targeted national legislation. The nation’s waters, for instance, benefited immensely from the 1972 amendments to the Federal Water Pollution Control Act of 1948 that gave the country the CWA.²²⁷ That statute transformed water management by, among many other things, giving the United States Environmental Protection Agency authority to “implement pollution control programs such as setting wastewater standards for industry; [m]aintain[ing] existing requirements to set water quality standards for all contaminants in surface waters; [and making] it unlawful for any person to discharge any pollutant from a point source into navigable waters, unless a permit was obtained under its provisions.”²²⁸ In a similar way, the CAA required EPA to “establish national ambient air quality standards for certain common and widespread [air] pollutants based on the latest science,” and required states to develop their own plans for coming into compliance with those standards.²²⁹ These statutes are far from perfect, and environmental law in the United States has been broadly critiqued for its siloed view of resources and its failure to treat the environment as an interconnected whole.²³⁰ Those critiques reflect the difficulty in moving the natural resource conversation from a pollution control focus to one oriented around ecosystem management.²³¹ Nonetheless, the important role of federal environmental statutes in promoting environmental health following years of fragmented and under-protective management is broadly recognized.

As a thought experiment, we can imagine soil getting the same kind of federal treatment as air and water—let’s call it the Healthy Soils Act. In this Act, Congress could impose certain standards for national soil governance, including metrics for soil health that must be met. The Healthy Soils Act, like other major federal statutes, could incorporate strong components of environmental federalism that relies heavily on state and local participation. In fact, as described above, states already have SWCDs that could potentially be delegated federal authority to carry out the Healthy Soil Act’s provisions.

Congress could also incorporate mechanisms from other environmental statutes that allow for coordination across property lines. For example, Section 303(d) of the Clean Water Act requires a watershed-based approach to water management in implementing its Total Maximum Daily Load (“TMDL”) program. Put briefly, the

²²⁷ *History of the Clean Water Act*, U.S. ENV’T PROT. AGENCY (June 22, 2023), <https://www.epa.gov/laws-regulations/history-clean-water-act> [<https://perma.cc/R6ZA-UADJ>].

²²⁸ *Id.*

²²⁹ *Clean Air Act Requirements and History*, U.S. ENV’T PROT. AGENCY (Aug. 10, 2022), <https://www.epa.gov/clean-air-act-overview/clean-air-act-requirements-and-history> [<https://perma.cc/Y6KF-HRZN>].

²³⁰ See, e.g., Cinnamon P. Carlane, *Climate Courage: Remaking Environmental Law*, 41 STAN. ENV’T L.J. 125, 139 (2022); Richard B. Stewart, *A New Generation of Environmental Regulation?*, 29 CAP. U. L. REV. 21, 29 (2001).

²³¹ See, e.g., Ruhl, *supra* note 191, at 7.

TMDL program requires states to list waters of the state according to their different uses (recreation, fishing, swimming, and so on), and to set watershed-based standards for pollution limits that will allow those uses to take place. To attain overall watershed health requires breaking that pollution limit into individual maximum amounts of pollutants. Overall, using these mechanisms makes it arguably difficult to “escape accounting for all harms which are contributing to violations of [statutory] standards.”²³² The TMDL provisions have been subject to plenty of criticism for failing to live up to their potential for ecosystem management in implementation. And to be sure, Section 303(d) has not solved the problem of water pollution and quality. However, the TMDL program does represent an attempt to think more holistically about the environment, and for that reason could be useful as a model for soil governance. Including similar provisions that account for metrics of soil health within a particular area could help the Healthy Soils Act achieve governance of all three of soil’s dimensions.

In theory, a federal statutory framework could be designed to do this work. In reality, it is extremely unlikely to have support of the public or to be politically viable. It would also likely be met with extreme judicial skepticism upon review. The most controversial pieces of the federal environmental statutes are often those instances where federal law is seen to be intruding upon private property. For instance, the most contentious aspects of the CWA have long been its provisions involving wetlands. Indeed, in the *Sackett v. EPA* case described above, Justice Alito, writing for the majority, emphasized the majority’s deference to rights of private property owners.²³³ And the CWA is not alone in engendering massive amounts of litigation or opposition when it comes to the impacts on privately held land. The Endangered Species Act is another federal statute that has been particularly controversial because of the restrictions it can impose on private property.²³⁴ Moreover, while soil’s interconnections could support congressional authority under the Commerce Clause in theory, such an assertion of jurisdiction should be expected to be met with skepticism by a majority of the current United States Supreme Court.²³⁵ Beyond that, the United States Congress has not enacted a major piece of environmental legislation in several decades.²³⁶ For all these reasons,

²³² Michael M. Wenig, *How “Total” Are “Total Maximum Daily Loads”?*—*Legal Issues Regarding the Scope of Watershed-Based Pollution Control Under the Clean Water Act*, 12 TUL. ENV’T L.J. 87, 161 (1998).

²³³ See *Sackett v. Env’t Prot. Agency*, 143 S. Ct. 1322, 1341 (2023).

²³⁴ Michael C. Blumm & George Kimbrell, *Flies, Spiders, Toads, Wolves, and the Constitutionality of the Endangered Species Act’s Take Provision*, 34 ENV’T L. 309 (2004).

²³⁵ See, e.g., Ariane de Vogue, *Supreme Court Justices Skeptical of EPA’s Authority to Protect Wetlands from Pollution*, CNN (Oct. 3, 2022, 2:16 PM), <https://www.cnn.com/2022/10/03/politics/waters-of-the-us-supreme-court-epa-ketanji-brown-jackson/index.html> [<https://perma.cc/LV94-L2HS>] (discussing history of Clean Water Act litigation over EPA’s jurisdictional authority).

²³⁶ See generally Richard Lazarus, *Environmental Law Without Congress*, 30 J. LAND USE & ENV’T L. 15, 27 (2014). The 2022 Inflation Reduction Act, while hugely significant

sweeping national legislation to address soil health is currently so unlikely as to make it an unrealistic part of any discussion of soil governance planning.²³⁷

Shifts in state law to incorporate soil health are a more serious prospect than federal law. As described above, many states in recent years have adopted Healthy Soil Acts.²³⁸ Thus far, however, they have all been composed of education, research, and incentives for agriculture, forests, and land managers. None of them include mandatory provisions regarding soil health, and none of them go beyond those large holders of land. To be sure, there is good reason to focus on those categories, and the acts are a promising addition to the soil health conversation. They do not, however, satisfy in their current form the governance needs—as advanced by commons theorists—for heterogeneous physical resources like soil. As discussed, such resources present commons problems that are not solved simply, or by incentives alone. Instead, they likely require a mix of governance elements, “with opportunities for mutual education, voting, horse trades, overt disagreement, and even exit, along with a certain degree of external prodding from governmental entities.”²³⁹

(b) *Land-Use Law*

There is, of course, another area of the law concerned with the interactions of humans and the environment—that of land-use law. Through comprehensive plans and corresponding zoning ordinances, local governments shape their communities, including through mandates and requirements.²⁴⁰ The power to engage in land-use planning is shared, to one degree or another, by nearly all general-purpose local governments in the country. Generally speaking, that power is exercised as part of a grant of the general police power to pass laws in support of health, safety, and general welfare. Local governments go through comprehensive planning processes and enact zoning ordinances and building codes that regulate many aspects of how private property rights are exercised. For instance, zoning ordinances regularly specify where certain buildings may be built, and building codes often use required

in its spending provisions directed to renewable energies and other carbon reduction activities, is not a substantive environmental statute.

²³⁷ Cf. *id.* at 34.

²³⁸ See *State Healthy Soil Policy Map*, NERDS FOR EARTH, <https://nerdsforearth.com/state-healthy-soils-policy/> [<https://perma.cc/RAT6-7U9X>] (last visited July 29, 2023).

²³⁹ Rose, *supra* note 165, at 1280.

²⁴⁰ Cf. Futrell, *supra* note 127, at 1078 (“A weak point in the erosion control effort has been its dependence on voluntary action. Thus, those who are conservation-minded from the outset tend to participate, while those with erosion-prone land and disinclination toward conservation remain untouched. The latter group has the clear majority.” (quoting John H. Davidson, *Sustainable Development and Agriculture in the United States*, 32 ENV’T L. REV. (NEWS & ANALYSIS) 10543, 10556 (2002))); John H. Davidson, *Conservation Agriculture: An Old New Idea*, NAT. RES. & ENV’T, Winter 1995, at 20, 22 [hereinafter Davidson, *Conservation Agriculture*] (noting failures of relying on voluntary measures alone for soil conservation).

setbacks to control where on a particular parcel a structure may be erected. Most local governments are currently not using their land-use powers broadly to promote soil health. But communities could, for instance, create zones with particular development requirements based on soil type or needs, along with metrics for assessing overall soil impacts from new development.

To suggest the potential for use of zoning in support of soil health is not to ignore the ugly history of zoning and planning in the United States.²⁴¹ Zoning has been used for nearly a century now in ways that are racist and classist, sometimes implicitly and often explicitly.²⁴² Critiques of zoning include its racist origins, motivations and impacts; its rigidity as a policy tool; its separation of uses, to the detriment of the environment and communities; and many others.²⁴³ All of these are well-earned and yet, zoning still represents a system of intact rules, procedures and expertise in how land in our communities is used. If done well—if done better—it has the potential to offer important values such as creation of community stability and allocation of costs of growth.²⁴⁴ It is true that choices regarding community stability often “represent[] a normative tradeoff between people who benefit from the character and those whom that goal necessarily excludes”²⁴⁵ And environmental improvements do have the potential to result in exclusion from a community.²⁴⁶ Overall, however, applying zoning tools with soil health as a lodestar has the potential to address some of the commons problems suggested above by providing a set of governance rules regarding how land—and the soil that makes it up—may be used. With the addition of local bodies versed in soil health and soil science, this kind of land-use lens could further more comprehensive work toward ensuring soil health.

As described in commons terminology, soil may be best thought of as a quasi-semicommons. Like the more classic semicommons of the European open-field system described by Henry Smith,²⁴⁷ soil involves both private and more broadly

²⁴¹ Christopher Serkin, *A Case for Zoning*, 96 NOTRE DAME L. REV. 749, 754 (2020).

²⁴² *Id.* at 752, 754.

²⁴³ Christopher Serkin, *The Wicked Problem of Zoning*, 73 VAND. L. REV. 1879, 1879–80 (2020) (“Zoning is under vigorous and sustained attack from all sides. Conservatives have long decried regulatory interference with private development rights. More recently, progressive housing advocates have begun to criticize zoning for making thriving cities unaffordable and for exacerbating racial segregation. Environmentalists argue that zoning is responsible for urban sprawl and for increasing carbon emissions. Economists blame zoning for restricting residential mobility, which limits fluidity in labor markets and thereby reduces the agglomeration surplus that thriving places like New York and San Francisco should be producing.”(citations omitted)).

²⁴⁴ Serkin, *supra* note 241, at 770.

²⁴⁵ *Id.* at 775.

²⁴⁶ See generally Sarah Fox, *Environmental Gentrification*, 90 U. COLO. L. REV. 803, 806 (2019).

²⁴⁷ See, e.g., Henry E. Smith, *Semicommon Property Rights and Scattering in the Open Fields*, 29 J. LEGAL STUD. 131, 132 (2000).

held “elements of value.”²⁴⁸ Unlike Smith’s classic example, however, soil has very formal private elements while its common values, as described above, are underrecognized. This means that, much like other suggested semicommons such as housing,²⁴⁹ soil lacks the protections against strategic behavior that Smith suggested could avoid overexploitation of the resource.²⁵⁰ In Smith’s example of privately owned land for crops and communal grazing, interspersing privately owned plots around the grazing area in ways that made it hard to tell one plot from another avoided incentives to overgraze another’s plot or strategically position sheep to trample the another’s crops. The under recognition given to soil’s common benefits means that explicit rules surrounding protection of the soil resource will be needed.

This may take the form of protecting soil health by preventing its overconsumption²⁵¹ or by steering or restricting development. For instance, local governments can use exactions to make development better bear its own costs; they can also “use zoning to push development to locations where it will impose fewer [environmental] costs”²⁵² Communities could use zoning restrictions to limit the amount of development that can take place in areas of high-quality soil,²⁵³ or mandate consideration of impacts to soil when deciding whether to approve a permit for new development.²⁵⁴ Other actions could indirectly benefit the soil resource by, for instance, removing code barriers to composting in agricultural, residential, and commercial districts;²⁵⁵ creating standards to mitigate loss of agricultural land to

²⁴⁸ See Lee Anne Fennell, *Homeownership 2.0* 52 (Univ. of Chi. L. Sch, John M. Olin L. & Econ. Working Paper No. 366, 2007), https://chicagounbound.uchicago.edu/cgi/viewcontent.cgi?article=1236&context=law_and_economics [https://perma.cc/E66D-BMQY] (explaining elements of value in semicommons).

²⁴⁹ *Id.*

²⁵⁰ *Id.* (noting Smith’s argument that semicommons lack protection against strategic behavior).

²⁵¹ See Serkin, *supra* note 241, at 773.

²⁵² *Id.* at 782.

²⁵³ See Bryce Colonia-Hughes, *Development Restrictions to Protect Prime Soils*, SUSTAINABLE DEV. CODE, <https://sustainablecitycode.org/brief/development-restrictions-to-protect-prime-soils> [https://perma.cc/47TC-NLZS] (last visited July 29, 2023) (citing and describing examples of communities that have these kinds of restrictions in place).

²⁵⁴ See, e.g., NATHAN STONE, MICHAEL BYBEE, ZAAL RAMHORMOZ & BRAD DICKERSON, AGRICULTURAL PROTECTION IN MONTANA: LOCAL PLANNING, REGULATION, AND INCENTIVES 21–26 (2012), <https://www.umt.edu/law/files/academics/Ag%20Report%2009.10.12.pdf> [https://perma.cc/J3SB-UYMS] (describing agricultural mitigation measures).

²⁵⁵ See Bradley Adams, *Composting in Agricultural, Residential, and Commercial Districts*, SUSTAINABLE DEV. CODE, <https://sustainablecitycode.org/brief/composting-in-agricultural-residential-and-commercial-districts-4/> [https://perma.cc/S2G3-NBRM] (last visited July 29, 2023).

development,²⁵⁶ encouraging or allowing shared driveways,²⁵⁷ or eliminating parking minimums. The ability to use tools already in place to help preserve the soil resource likely makes zoning worthy of attention in advancing better soil practices.²⁵⁸

Planning and zoning decisions will necessarily also vary by place. For instance, while urban areas are often lacking in large amounts of open land, the importance of urban soils has been increasingly recognized.²⁵⁹ Urban “stormwater management, mitigation of urban heat island impacts, recreational spaces, and even habitat for the conservation of plants and animals”²⁶⁰ are all dependent on soil health. Urban settings are increasingly part of the conversation about biodiversity, and urban soils are the site of tremendous diversity in organisms at the soil level.²⁶¹ In shrinking cities, where demolition of structures has resulted in open space, many have advocated in favor of using that newly open space for green infrastructure, parks, and urban agriculture.²⁶² The poor quality of the soil in many places, however, has hampered some of those efforts.²⁶³ Reconditioning soil to return it to a healthier state may be necessary in order to realize these environmental aims. In consequence, urban soil governance is likely to focus heavily on individual practices and restrictions, as well as on rules surrounding the reuse of sites and soil remediation.

²⁵⁶ See Nicole L. Byrne, *Offsetting Agricultural Land Loss Stemming from New Development*, SUSTAINABLE DEV. CODE, <https://sustainablecitycode.org/brief/offsetting-agricultural-land-loss-stemming-from-new-development/> [<https://perma.cc/KU6G-ZNYH>] (last visited July 29, 2023).

²⁵⁷ See Alec LeSher, *Shared Driveways to Avoid Fragmentation of Habitat*, SUSTAINABLE DEV. CODE, <https://sustainablecitycode.org/brief/shared-driveways-to-avoid-fragmentation-of-habitat-3/> [<https://perma.cc/5DTD-WWP8>] (last visited July 29, 2023).

²⁵⁸ See, e.g., Kellen Zale, *Inholdings*, 46 HARV. ENV'T L. REV. 439, 501 (2022) (noting the “straightforward advantage of high implementation potential” when it comes to local governments and land use in the context of inholdings on federal land).

²⁵⁹ See generally, e.g., Roisin O’Riordan, Jess Davies, Carly Stevens, John N. Quinton & Christopher Boyko, *The Ecosystem Services of Urban Soils: A Review*, 365 GEODERMA, no. 115076, Aug. 2021, at 1.

²⁶⁰ *Urban Soils, Ecosystem Services, and the Application of Green Infrastructure Practices*, U.S. ENV’T PROT. AGENCY (Jan. 9, 2023), <https://www.epa.gov/water-research/urban-soils-ecosystem-services-and-application-green-infrastructure-practices> [<https://perma.cc/6JU2-WCD2>].

²⁶¹ See, e.g., Kelly S. Ramirez, Jonathan W. Leff, Albert Barberán, Scott Thomas Bates, Jason Betley, Thomas W. Crowther, Eugene F. Kelly, Emily E. Oldfield, E. Ashley Shaw, Christopher Steenbock et al., *Biogeographic Patterns in Below-Ground Diversity in New York City’s Central Park Are Similar to Those Observed Globally*, 281 PROC. ROYAL SOC’Y B, no. 1795, Nov. 2014, at 1, 5 (finding microbial diversity in soil in Central Park “similar to that found across the world including in arctic, tropical and desert soils”).

²⁶² See, e.g., U.S. ENV’T PROT. AGENCY, EPA PUB. NO. 905R1103, EVALUATION OF URBAN SOILS: SUITABILITY FOR GREEN INFRASTRUCTURE OR URBAN AGRICULTURE (December 2011).

²⁶³ *Id.*

Suburban soil health is likely to involve slightly larger parcels of land. In many parts of the country, suburban plots are still the site of greenfield construction. On a broad scale, limiting greenfield construction and promoting infill development could help preserve the soil resource. And on a parcel-specific basis, construction will result in damage to the soil on that specific site.²⁶⁴ Thus, suburban soil governance could be oriented to the same kinds of individual practices and prohibitions as for urban soils but should also likely focus on preservation and on development limits.

Similarly, more rural parts of the country have large plots of land that are often under significant development pressures. Rural areas also often have the added factor of being agricultural sites. And healthy soil, of course, “is the foundation of productive, sustainable agriculture.”²⁶⁵ Maintaining soil health in rural areas is likely to be focused more on erosion controls and best practices regarding large tracts in use for agricultural purposes, as well as the kinds of development controls and restrictions suggested above. The context-specific, community-oriented processes that zoning involves would allow for a new focus on measures of soil health as part of this existing planning process.

Beyond general planning and zoning authority, SWCDs already exist in many states. These Districts are both a substantive and structural element of soil governance. Here, they are included to suggest the potential for an exercise of limited regulatory authority at the local level over soil health.²⁶⁶ By creating or authorizing these kinds of districts where needed—and vesting them with authority, including taxing power and land-use regulatory authority where appropriate—state and local governments could potentially take on the challenges of soil regulation in meaningful ways.²⁶⁷ As special purpose versus general local governments, these districts might represent gains in authority and jurisdictional flexibility but losses in terms of some of the community expertise and trust-building values discussed below.²⁶⁸ As such, they would need to be organized in conscientious ways. However,

²⁶⁴ Jim Chatfield, *Dealing with Damaged Suburban Soils: Part 1*, AMERINURSERY (June 1, 2011), <https://www.amerinursery.com/growing/dealing-with-damaged-suburban-soils-part-1/> [<https://perma.cc/7VTT-QPAM>].

²⁶⁵ *Soil Health*, U.S. DEP’T OF AGRIC., <https://www.farmers.gov/conservation/soil-health> [<https://perma.cc/3A4J-PFCE>] (last visited July 29, 2023).

²⁶⁶ See, e.g., Phelps, *supra* note 158, at 370 (“The regulatory authority of local SWCDs continues to be largely under utilized.”); see also Davidson, *Conservation Agriculture*, *supra* note 240, at 22 (“Soil conservation districts . . . were organized along county lines and without police power authority. These districts today are faced with the unenviable task of encouraging voluntary adoption of conservation practices, but without the substantial federal subsidies, without police power authority, and without the organizational logic of the watershed.”).

²⁶⁷ Long, *supra* note 159, at 362 (stating that the “basic practical or actionable argument of this article is that state and local governments should authorize and encourage the creation of local conservation districts with taxing and land-use authority that can focus on the restoration and preservation of natural systems”).

²⁶⁸ I plan to explore this question of general purpose versus special purpose governments in soil governance in future works.

such entities raise the interesting potential of taking on the task of measuring and mandating soil quality across parcels.

3. *The Problem of Takings*

If the local actions described above are implemented on a large scale, they could be transformative in promoting the health of soil as a resource. To say that law could accommodate these kinds of shifts is not, however, to say that it will do so without question or controversy. Property theorists are advancing exciting ideas about property rights and obligations regarding environmental systems while the United States Supreme Court appears increasingly skeptical of encroachment on private property rights.²⁶⁹ These two realities defy easy reconciliation.

The Takings Clause of the Fifth Amendment of the U.S. Constitution states “[n]or shall private property be taken for public use, without just compensation.”²⁷⁰ Government actions can implicate the Takings Clause in varied—and seemingly growing—ways. Regulatory takings doctrine is of greatest relevance to this conversation. The Supreme Court has articulated four types of regulatory takings for which just compensation must be paid: “(1) regulations that cause a physical invasion of land; (2) regulations that deprive a landowner of all economically beneficial use of land; (3) regulations that result in a partial taking; and (4) land-use exactions.”²⁷¹ Where local regulations protect soil health by restricting action on private property, they could potentially implicate those regulatory takings categories.

The Supreme Court’s regulatory takings jurisprudence is notoriously difficult to derive general principles from, but in broad strokes, whether a governmental action will be deemed a regulatory taking is based on a balancing test derived from *Penn Central Transportation Co. v. New York City*²⁷² that looks at (1) the economic impact of the regulation on the claimant; (2) the extent to which the regulation has interfered with distinct investment-backed expectations; and (3) the character of the governmental action.²⁷³ Defenses to governmental actions alleged to be regulatory takings normally lie, then, in articulating why each of the factors mentioned above does not support a taking. Importantly, however, the recent case of *Cedar Point Nursery v. Hassid*,²⁷⁴ decided by the U.S. Supreme Court in 2021, declared that whenever a governmental regulation results in a physical appropriation of property, a *per se* taking has occurred, and the *Penn Central* factors do not apply.

Even in the case of *per se* takings, background principles of property law can offer a defense against finding a regulatory taking. According to *Lucas v. South*

²⁶⁹ See, e.g., *Cedar Point Nursery v. Hassid*, 141 S.Ct. 2063 (2021); *Sackett v. EPA*, No.21-454, slip op. at 22 (U.S. May 25, 2023).

²⁷⁰ U.S. CONST. amend. V.

²⁷¹ MICHAEL A. ZIZKA, TIMOTHY S. HOLLISTER, MARCELLA LARSEN & PATRICIA E. CURTIN, *STATE AND LOCAL GOVERNMENT LAND USE* 12–18 (2021).

²⁷² *Penn Cent. Transp. Co. v. New York City*, 438 U.S. 104, 124 (1978).

²⁷³ SPRANKLING & COLETTA, *supra* note 44, at 895.

²⁷⁴ *Cedar Point Nursery*, 141 S.Ct. 2072.

Carolina Coastal Council, a government action that prohibits all economically beneficial use of land can escape being deemed an unconstitutional taking where the restrictions “inhere in the title itself, in the restrictions that background principles of the State’s law of property and nuisance already place upon land ownership,”²⁷⁵ or where it falls under the public necessity defense, where state actions “forestall other grave threats to the lives and property of others.”²⁷⁶

There are certainly arguments that could be made for why government actions to protect soil health are designed to address behaviors that constitute a nuisance, or are being taken out of public necessity.²⁷⁷ Along similar lines, some theorists have offered hope that as climate change and other environmental challenges become more broadly known and understood, courts will find that climate knowledge alters expectations enough that buyers should be on notice of the likelihood of increased property restrictions.²⁷⁸ That kind of judicial shift would undermine regulatory takings claims as well. But while those arguments make a great deal of sense in the face of environmental crisis, that may be somewhat beside the point. Ultimately, strict adherence to takings doctrine is the direct manifestation of a strong allegiance to private property anathema to management of soil as a common resource.

Cedar Point does not convert all of the governmental actions suggested herein into *per se* takings, but it does represent something important about how the U.S. Supreme Court in its current makeup views and interprets takings doctrine. In explaining *Cedar Point* and the overall trajectory of the takings framework, Lee Anne Fennell has adopted the metaphor of an escape room, where the conservative wing of the Supreme Court has created a variety of takings traps oriented toward “maintenance of the status quo in general, and its distribution of property wealth in particular.”²⁷⁹ Those traps allow the Court to dial scrutiny of governmental action up and down, as “[t]hreats to the status quo can come not only from government-imposed burdens on private property, but also from any weakening of the vast regulatory matrix through which the government protects existing property wealth.”²⁸⁰ Seen through that lens, the question is not whether an action can be characterized as countering a nuisance, or being taken by public necessity—certainly there are arguments that many governmental actions taken in the face of crises of soil health and climate change would meet that definition—instead, the

²⁷⁵ 505 U.S. 1003, 1029 (1992).

²⁷⁶ *Id.* at 1029 n.16.

²⁷⁷ Emily Guimont, *Land Use Regulations, Climate Change, and Regulatory Takings*, 52 ENV’T L. 279, 304 (2022).

²⁷⁸ See, e.g., Sprankling, *supra* note 170, at 770 (“As government responds to the cascading impacts of the Anthropocene era, it seems likely that virtually all owners will reasonably anticipate that the nature and scope of their property rights will be limited by future laws, regulations, and decisions. In particular, owners who purchase their properties after widespread Anthropocene impacts become apparent may not be successful in claiming that they had any reasonable expectation of avoiding future legal controls.”).

²⁷⁹ Lee Anne Fennell, *Escape Room: Implicit Takings After Cedar Point Nursery*, 17 DUKE J. CONST. L. & PUB. POL’Y 1, 45 (2022) [hereinafter Fennell, *Escape Room*].

²⁸⁰ *Id.* at 3.

question is whether it is the kind of action that a reviewing court (and, ultimately, the Supreme Court) wants to allow. It would therefore be incorrect to suggest that shifts in soil governance that implicate shifts to current property ownership have an easy road ahead.²⁸¹

Ultimately, surviving a takings challenge for many of the actions suggested herein will require finding courts willing to “address claims of regulatory takings with clarity and a broad sense of the stakes.”²⁸² Shy of that, it may be that local governments need to consider the creation of non-conforming uses, or grandfathering in, certain existing property owners and their soil use. Those non-conforming uses can then eventually be terminated upon sale or upon abandonment (some jurisdictions may also allow for an amortization, or phase-out, of such uses).²⁸³ Local governments also always have the choice, of course, of taking the “exit” to the escape room—that of paying just compensation for the taking of a property right.²⁸⁴ Questions about how and whether they might be positioned to do so will be taken up in future work.²⁸⁵

B. Structural Soil Governance: Focusing on the Local

Setting aside the realities of the Takings Clause for a moment, how is it that new forms of soil governance might be carried out? If it turns out that land use is the most plausible path forward on soil protection right now, it makes sense to look at who is doing land-use planning. That inquiry directs the discussion to the local level. As discussed in this Section, there are a number of ways in which local governments, in all their multitude and variability, could take on the task of regulating for soil health. When it comes to management of common resources, there are many reasons to incorporate principles of subsidiarity, or “delegating authority to the smallest jurisdictional unit that is competent to handle it.”²⁸⁶ This has particular resonance in the soil context, as local governments are uniquely competent to handle management of the soil resource, both from a property and governmental control perspective. Local actors can add critical local knowledge and context, support formation of the trust likely needed to accomplish major social transformations, and, importantly, support experimentation and risk-spreading functions.²⁸⁷

²⁸¹ Cf. Gregory S. Alexander, *The Social-Obligation Norm in American Property Law*, 94 CORNELL L. REV. 745, 752 (2009) (“[O]ne reason why American takings law is so murky is that American courts have failed to openly acknowledge, let alone rigorously develop, the social-obligation dimension of the constitutional idea of property.”).

²⁸² Dyal-Chand, *supra* note 187, at 622.

²⁸³ See SPRANKLING & COLETTA, *supra* note 44, at 763–64.

²⁸⁴ Fennell, *Escape Room*, *supra* note 279, at 59.

²⁸⁵ For instance, there are interesting questions about the availability of federal funds to pay for takings by local governments.

²⁸⁶ Fennell, *supra* note 193, at 20.

²⁸⁷ See, e.g., Sarah Fox, *Localizing Environmental Federalism*, 54 U.C. DAVIS L. REV. 133 (2020) (detailing the benefits provided by local involvement in environmental

To date, the major resource protection frameworks in the United States have employed a top-down model, with sweeping national legislation that sparked transformations in environmental law. Such an approach can offer uniformity, funding, expertise, and avoid the problem of creating a race to the bottom in terms of lowered environmental standards. Soil's inextricability with private property rights, and local governments' long expertise in land use, makes the top-down approach arguably fit less well here. Beyond that, the current political feasibility of any kind of major federal soil statute appears low to nonexistent. Notably, for instance, federal carbon law is currently undergoing a historic turn away from command-and-control regulation toward an incentives-based approach in the Inflation Reduction Act.²⁸⁸ The time does not seem auspicious for a major federal or, in many cases, state role to play in soil regulation.

For many reasons, then, this Article suggests a turn to the multitude of local governments in the United States to take the lead on forging a newly three-dimensional form of soil governance. This approach will lack uniformity, to be sure. But the other benefits of a top-down approach—namely, funding, expertise, and avoidance of a race to the bottom—could potentially be added by other actors in an optimal soil federalism regime. While local governments are well-positioned to take the lead on governance, the federal government still has a major role to play in providing funding, guidance, and information, including sharing of soil data, potential development of model local policies, and supporting the continued cooperation of federal actors already involved in soil management. State governments in turn could help to promote soil health by enacting their own legislation that provides a floor, though not a ceiling, for local measures on soil health. State governments also have a role to play in ensuring that local governments have sufficient authority to take on the soil question.

The discussion in subsection IV.B.1 will make the case for why it makes sense to look to local governments to advance soil governance, along with the essential roles that federal and state actors would play in supporting that local leadership. In this new type of soil federalism, local governments have the potential to provide robust protection to and management of our common soil common resource.

policymaking); *see also, e.g.*, Rigdon, *supra* note 161, at 504 (noting that “the localization of conservation enforcement and criteria construction would truly utilize states as laboratories for conservation practices”).

²⁸⁸ Vanessa Glavinskas, *The Inflation Reduction Act Is a Victory for the Climate. Here's What Comes Next.*, ENV'T DEFENSE FUND (Sept. 6, 2022), <https://www.edf.org/article/inflation-reduction-act-victory-climate-heres-what-comes-next> [<https://perma.cc/7URH-JU7G>].

1. Local Governments as Soil Resource Managers

Decisions about land have long been made principally at the local level.²⁸⁹ And it turns out that, upon examination, the local expertise and context-specific nature of land-use planning already occurring makes the local level a possible fit for tackling soil governance in the United States. Local soil governance will come with high degrees of variation and will have drawbacks as well as benefits. The goal here is not perfection, but to find ways of managing the conflict between public resources and private rights “that, under the circumstances, are least likely to fail or are likely to fail the least.”²⁹⁰ Local governments can offer experience, local knowledge, and a connection to community that can best achieve the bridging of those private interest and public resource needs to create real change in our methods for soil governance.

(a) Expertise in Process and Place

As described above, local governments are the level in the United States most intimately connected to land-use planning.²⁹¹ The long history of reliance on local actors to take on these challenges means that local governments have a great deal of familiarity with these processes.²⁹² Beyond expertise in process, local governments are also experts of place. Representatives within local governments may be better able to act from a place of deep knowledge, connection, and sense of place than those in other levels of government.²⁹³ As the government most directly responsive to citizens, local governments are the most entwined with local concerns and perceptions. That expertise is likely to be critical in arriving at soil governance outcomes palatable to those living with new restrictions.²⁹⁴ The potential for community involvement and responsiveness is also important in making sure that outcomes in soil governance do not implicate environmental justice concerns or create broader equity issues.²⁹⁵

²⁸⁹ John R. Nolon, *In Praise of Parochialism: The Advent of Local Environmental Law*, 23 PACE ENV'T L. REV. 705, 714 (2006) (“It is widely understood that local governments have been given a key, if not the principal, role in land use regulation.”).

²⁹⁰ See COLE, *supra* note 173, at 179.

²⁹¹ See Nolon, *supra* note 289.

²⁹² Hirokawa, *supra* note 191, at 787; Nolon, *supra* note 289.

²⁹³ Long, *supra* note 159, at 409–11 (“While the primary benefits of enabling local conservation efforts to restore degraded stream systems might be ecological, aesthetic, or economic, there are equally important social, cultural, and legal benefits. Regulatory or other institutional systems function best when the individuals asked to constrain their options are closely connected to the benefits that justify the constraints.”).

²⁹⁴ Long, *supra* note 159, at 419–20 (“Because local conservation districts emerge from the regulated communities, they are more likely to reflect the cultural understandings of those communities.”).

²⁹⁵ Local governments can be sites of minority empowerment. See, e.g., Heather K. Gerken, *Abandoning Bad Ideas and Disregarding Good Ones for the Right Reasons: Reflections on a Festschrift*, 48 TULSA L. REV. 535, 536 (2013).

Expertise in local conditions also makes it more likely that decisions about soil will have the appropriate context. Context matters, of course, in both property and government.²⁹⁶ New forms of soil governance must take into account the different types of soil, climate conditions, and development patterns that matter in different areas. They must also reflect local values and decisions about how to prioritize the soil resource they are tasked with managing. For instance, as noted, urban, suburban, and rural areas have very different soil types and needs, and very different measures will make sense for promoting soil health. Those differences mean, necessarily, variations in soil governance to reflect differences in place and needs.

(b) *Building Trust*

As property and environmental law scholars stare down the specter of the climate crisis and the changes in property and environmental systems that it will require, one theme stands out—the fundamental shifts that are coming will require a great deal of trust²⁹⁷ and local self-knowledge.²⁹⁸ Recognizing that property rights and environmental benefits “fundamentally and deeply depend on each other”²⁹⁹ means that connections between and among communities will be increasingly important if we are trying to get to less self-serving ways of exercising rights and planning processes.

Planning processes currently are far from ideal. They have been shown in many ways to prioritize certain voices—namely those who are older, whiter, and more likely to be homeowners than voters in their broader communities.³⁰⁰ This is due to mismatched incentives to participate and structural problems preferencing those who can show up to hearings.³⁰¹ Certainly, many reforms are needed to make that process better reflective of communities and their diverse interests. Acknowledging the need for change, it is also important to recognize what they can provide: a forum for presenting changes in land use and planning to the community. Without overly glorifying these systems, it is possible to point out their importance, even in all their often-maddening, biased, inefficient ways. Community planning processes are

²⁹⁶ See Fennell, *supra* note 193, at 11 (noting that one of Elinor Ostrom’s major insights was that “details matter,” and citing as particularly important “congruence with the local ecology,” “congruence with the local culture,” and “congruence between benefits and costs”).

²⁹⁷ See Dyal-Chand, *supra* note 187, at 634.

²⁹⁸ Hirokawa, *supra* note 191, at 771 (“Self-searching and self-knowledge, in the local government arena, can be as compelling as any scientific insight. As such, in many ways, ‘local government regulation is more appropriate to handle the more nuanced, specifically local externalities that buildings force onto their local communities.’”).

²⁹⁹ See generally Dyal-Chand, *supra* note 187, at 634.

³⁰⁰ See Katherine Levine Einstein, David Glick, Luisa Godinez Puig & Maxell Palmer, *Still Muted: The Limited Participatory Democracy of Zoom Public Meetings*, 59 URB. AFFS. REV. 1279, 1281 (2023).

³⁰¹ See KATHERINE LEVINE EINSTEIN, DAVID M. GLICK & MAXELL PALMER, *NEIGHBORHOOD DEFENDERS: PARTICIPATORY POLITICS AND AMERICA’S HOUSING CRISIS*, 95–114 (2020).

currently one of the only physical spaces for public discourse regarding the places we live and the environment we are in. If, as a society, we care about building trust and consensus around the changes that are coming, local governments offer some starting points. Focusing on land-use decisions by local governments as a way to shift soil governance likely means that community involvement—for better and for worse—is a given. And if trust in the process can be created and earned, then perhaps collective participation could itself prove to be a trust-building exercise. Collaborative action at the local level could be part of creating the kinds of relationships needed to “ten[d] the planet (and whichever communities it will sustain), even as global surface temperatures continue to rise.”³⁰²

(c) *Experimentation*

New forms of soil governance will not be implemented in one fell swoop across the country. That lack of uniformity is both a bug and feature of reliance on local actors. While inefficient, it also means that many different types of soil governance can be tried out at the local level. Generally speaking, policy experimentation is one of the benefits that local governments provide within the federal system.³⁰³ Some of this experimentation regarding soil health and other aims can already be seen around the country,³⁰⁴ particularly when it comes to voluntary initiatives.³⁰⁵ Given the novel, and potentially dramatic, ways that soil governance will need to shift in the coming years, having a variety of actors experimenting in different ways simultaneously could be useful in trying out a number of policy options.

(d) *Risk Spreading*

Finally, and in some ways most importantly, local governments offer the benefit of spreading risk of both policy inaction and of legal vulnerability. The

³⁰² Sarah Krakoff, *Planetary Identity Formation and the Relocalization of Environmental Law*, 64 FLA. L. REV. 87, 139 (2012).

³⁰³ See, e.g., Annie Decker, *Preemption Conflation: Dividing the Local from the State in Congressional Decision Making*, 30 YALE L. & POL’Y REV. 321, 362 (2012) (“Perhaps no feature of subfederal governance is lauded more frequently than its association with innovation. Local regulation often is considered more innovative than state regulation . . . whether because the sheer number of local governments increases the chances of a good idea emerging or because it is relatively easier to get a local law enacted and tested out in practice.” (citation omitted)).

³⁰⁴ Long, *supra* note 159, at 370–71 (“[L]ocal communities across the country have decided that the development of private lands must consider aesthetic, ecological, and other non-economic resources.”).

³⁰⁵ See, e.g., *Clean Soil Bank*, NYC OFF. OF ENV’T REMEDIATION, <https://www.nyc.gov/site/oer/safe-land/clean-soil-bank.page> [https://perma.cc/EXC9-QC6E] (last visited July 29, 2023) (explaining the Clean Soil Bank initiative in New York City, which “recovers clean, native soil from deep excavations at construction sites and redirects it to the City’s Forbell stockpile and to NYC construction sites, both public and private, and to community and school gardens”).

United States has experienced huge swings in political control at the federal level over the past decades, and these trends will likely continue into the future. The country is dramatically polarized, with environmental and property rights resonating very differently with different segments of the population. Moreover, even with a progressive administration in place, the prospects of any kind of sweeping national legislation on soil appear slim.³⁰⁶ In practice, that means that while an administration so inclined could in theory offer a framework for soil governance via executive order, such an order would be quite vulnerable to reversal based on election outcomes.³⁰⁷

Beyond that, without legislation from Congress detailing a national soil policy, federal action on soil would need to be taken by agencies under the auspices of existing statutes. As noted above, those tend to be subject-specific, covering aspects of soil health such as hazardous waste and water. Pushing the boundaries of those statutory mandates would open any action to potential litigation and reversal on grounds like takings and the reach of the Commerce Clause, as described above, as well as major questions doctrine grounds. The current Supreme Court appears enamored with the prospect of reviving the major questions doctrine to limit agency action. For instance, in *West Virginia v. EPA*, the Supreme Court invalidated the Obama Administration's Clean Power Plan—which had never been in effect—on the grounds that its approach exceeded the bounds of congressional authority granted by the Clean Air Act.³⁰⁸ As noted, there is no federal statute on soil that would provide anything close to the kinds of sweeping normative commitment to air quality found in the Clean Air Act, or to the vast regulatory structure that it creates and authorizes. While there are plenty of reasons to be skeptical of the Supreme Court's current major questions doctrine interpretation, its implications for federal action cannot be ignored.

“From a resilience perspective . . . concentrating governance authority and management of resources into a single large entity comes with substantial risk of catastrophe and collapse if a single centralized approach fails or if the sole decision-making authority is ‘captured’ by special interests.”³⁰⁹ In that way, local involvement is a risk-spreading exercise. Local leadership on soil will necessarily lack the kind of uniformity and mustering of resources that federal or state legislation would offer. But it offers something even more critical, perhaps—the spreading of possibility for action from one or fifty sources to literally thousands. Local governments are already playing an important gap-filling function in many areas of environmental law.³¹⁰ Along with the experimentation function and the fact that a local approach is likely to be more tailored to local conditions, the prospect of soil governance moving forward may become more of a reality. Indeed, there is a reason

³⁰⁶ Cf. Lazarus, *supra* note 236, at 34.

³⁰⁷ The story of the Obama Administration's Clean Power Plan can serve as a cautionary tale.

³⁰⁸ See *West Virginia v. EPA*, No. 20-1530 (U.S. June 30, 2022).

³⁰⁹ Craig Anthony Arnold, *Resilient Cities and Adaptive Law*, 50 IDAHO L. REV. 245, 254 (2014).

³¹⁰ Fox, *supra* note 287, at 181.

why “many of the stories of ecosystem services—successes, explanations, and illustrations—take place in local governments and in community decision-making.”³¹¹

2. *Federal Involvement in Soil Governance*

While this Article calls upon local governments to lead in soil governance, there are important roles for the federal and state governments as well. Local governance will reach its fullest potential only with active engagement by both these other levels of government. Federal programs currently in existence, such as those involving hazardous waste and agriculture, provide expertise and resources in areas where it would be difficult for local governments to reach. Unlike land-use planning, for instance, agricultural programs have long been the purview of the federal government, in collaboration with state and local actors. That agricultural realm benefits from federal experience, expertise, and resources, particularly given the size of the land holdings and the monetary interests involved. Some have pointed to past shifts in federal focus away from soil conservation as being responsible for the abandonment of conservation measures by agricultural interests.³¹² A renewed focus on—and funding for³¹³—promotion of healthy soil in those programs could be extremely impactful.

The fact that many of the federal programs rely on protections of limited duration dictates a continuing role for federal agencies as well. Large quantities of land previously protected, for example, by the Conservation Reserve Program, are due to come out of retirement in coming years.³¹⁴ As that happens, federal agencies have the power to encourage good soil practices to “ensure any built soil is not squandered while lessening erosion and increasing carbon capture.”³¹⁵ For those sections of the United States Department of Agriculture tasked with soil conservation, then, doubling down on engagement with participants is a necessary part of building a strong system of soil federalism.

More generally, federal funding, along with generation and sharing of data, can be powerful tools for the federal government to use in helping local governments achieve their governance potential.³¹⁶ Federal funding can serve as an important motivator, and a powerful incentive to take—or not to take—certain actions for both

³¹¹ Hirokawa, *supra* note 191, at 762.

³¹² Davidson, *Conservation Agriculture*, *supra* note 240, at 21 (“It has been argued . . . and with some considerable proof, that a primary reason for agriculture’s general abandonment of soil-conserving practice is that the lead federal agency—the SCS—shifted its emphasis from soil erosion control to production enhancement.”).

³¹³ See *id.* for a discussion of agriculture provisions in the Inflation Reduction Act of 2022.

³¹⁴ See Allain, *supra* note 61, at 186.

³¹⁵ *Id.*

³¹⁶ See Sarah Fox, *How the Biden Administration Can Empower Local Climate Action*, 50 URB. LAW. 203, 204–05 (2021) (listing federal funding and data generation and dissemination as ways for the federal government to give assistance to local governments).

private actors and local governments.³¹⁷ As noted, the 2022 Inflation Reduction Act is set to flush billions of dollars into agricultural programs. Funding soil conservation research and programs at the local level, as well as using federal resources to consolidate data on soil science and best governance techniques could all be extremely useful to local governments taking the soil governance helm.

This role melds well with priorities of the current federal administration. For example, the federal government has committed to protecting at least thirty percent of the land in the United States by 2030. Shortly after taking office, President Joseph Biden issued an Executive Order expressing his administration's commitment to conserving at least thirty percent of the nation's land and waters by 2030.³¹⁸ That commitment—part of an international movement to enact similar levels of protection around the world³¹⁹—was made because of the mounting consensus that preservation of land is an important part of combatting the worst impacts of climate change and addressing other environmental issues. It reflects an appreciation of the interconnected web of environmental benefits that stem from land and soil, and the insufficiency of a piecemeal approach to securing soil health and preservation of open space. To achieve the 30x30 goals, however, “will require coordination among multiple federal agencies, states, tribes, and communities.”³²⁰ Federal support for a new soil governance mindset at the local level could help to achieve these national goals. Together with the many federal programs and laws already in place, federal resources have a critical role to play in moving toward new modes of soil management.

3. State Involvement in Soil Governance

States too will be a fundamental part of any soil governance system going forward. With any call for local governance, questions of state law are implicated from the outset. Local governments in the United States act under grants of authority from their respective states. This is true both for general purpose local governments as well as special purpose local governments. While questions of local authority over soil governance—and the relative merits of general versus special purpose units taking on that role—are beyond the scope of this Article,³²¹ it is sufficient to say that

³¹⁷ See Rigdon, *supra* note 161, at 505 (2011).

³¹⁸ Exec. Order No. 14,008, 86 Fed. Reg. 7619 (Jan. 27, 2021), <https://www.whitehouse.gov/briefing-room/presidential-actions/2021/01/27/executive-order-on-tackling-the-climate-crisis-at-home-and-abroad/> [<https://perma.cc/VD4C-K6GC>].

³¹⁹ See Statement, Brian O'Donnell, Dir., Campaign for Nat., *Global Agreement Reached to Protect and Conserve at Least 30% of World's Land and Ocean by 2030*, CAMPAIGN FOR NAT. (Dec. 19, 2022), <https://www.campaignfornature.org/cop15-statementsfinal-statement> [<https://perma.cc/786X-MFMS>].

³²⁰ Alison Chase, Zak Smith, Helen O'Shea & Kate Poole, *Biden's Historic Action on 30x30*, NAT. RES. DEF. COUNCIL (Jan. 27, 2021), <https://www.nrdc.org/experts/alison-chase/bidens-historic-action-30x30> [<https://perma.cc/2CJH-CZU4>].

³²¹ I intend to address these questions of local authority in a future Article.

states will continue to play a large role in shaping the ability of local governments within their boundaries to take on soil governance measures.

As with the federal government, many state actors are already engaged in certain soil protection and conservation measures.³²² In addition, states could play a profound role providing promoting better soil governance by offering guidance and funding to local governments, and by changing substantive state law to promote better soil practices. State funding, of course, could go a long way toward ensuring that (often resource-strapped) local governments are able to carry out their soil programs. States could, for instance, generate data on the soils within the state in terms of needs, current impacts, and suggested practices, likely to enormous effect. And substantive changes to state laws that relate to soil could be impactful as well. For instance, in many states, land appraisal is a matter of state law. By adjusting appraisal rules to incentivize healthy soils, state law could complement local initiatives.

State laws also have a powerful role in providing regulatory floors for local soil governance measures. They could, for instance, set out certain standards for local governments to use in zoning or planning, or could set out minimum protection standards for certain types of soil. Providing such standards could help to overcome local reluctance that is likely to exist in some places and ensure that soil governance meets certain minimum standards. Importantly, in this context, state laws would be providing regulatory floors, not ceilings; that is, local governments would still be free to go beyond the state standards to tailor the soil governance regimes to their own particular jurisdictions.³²³ While having state minimum requirements does cut into the expertise rationale for local control, it does so in a way that can hopefully balance the prospect of local parochialism and the promise of locally tailored rules.³²⁴

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Ultimately, of course, the political realities and feasibility of the changes suggested in this Article are highly context specific.³²⁵ And there are countless shifts

³²² NERDS FOR EARTH, *supra* note 238; WARNER ET AL., *supra* note 6, at 6–14.

³²³ See, e.g., MICHELE HUGHES, 3 N.Y. JUR. 2D *Agric. & Crops* § 27 (describing New York State’s Environmental Management Program and explaining that “[n]othing in the statute precludes a local government from exercising any of its powers to enact, administer, or enforce local laws or ordinances that are consistent with the AEM statute and do not unreasonably restrict planning, practices, structures, projects, or other measures conducted or implemented in relation to the participation of a farm owner or operator in the AEM program.”).

³²⁴ See, Nestor M. Davidson, *The Dilemma of Localism in an Era of Polarization*, 128 YALE L.J. 954, 984 (2019) (calling for normative considerations to help mediate between local autonomy and parochial tendencies).

³²⁵ Craig Anthony Arnold, *Fourth-Generation Environmental Law: Integrationist and Multimodal*, 35 WM. & MARY ENV’T L. & POL’Y REV. 771, 881 (2011) (stating a “multitude of forces . . . may shape the adoption, mutation, or non-adoption of [any] proposal.”).

in local authority and incentives that would need to happen in order to make strong local soil governance plausible. I plan to explore in future work the realities of local soil governance, the many obstacles that it might face (including issues of local authority and capacity, parochialism, and preemption by the state), and what strategies might be needed to make such a local system workable. The goal here is to demonstrate why the local role in land-use planning, and local governments' connection to their communities, may make a shift in soil governance more possible and palatable. At a time when environmental problems such as soil decline can often feel intractable, focusing on the local possibilities may offer a path forward.

CONCLUSION

The suggestions in this Article are at once relatively modest and potentially enormous. At its core, what is suggested is that local governments center soil health when engaging in land-use planning. As detailed above, that basic idea fits well within the contours of what local governments across the United States routinely do when it comes to land-use planning. In some ways, the analysis here may seem counterintuitive. It singles out one thread in the tapestry of ecosystem health while suggesting that what is needed is a holistic approach. It talks of interconnection while suggesting that the level of government best situated to take on the challenge is local and, therefore, arguably the most fragmented. Both are true. And yet, the history of local involvement with land and property makes local governments a natural fit for taking on the difficult conversations surrounding our relationship to and use of soil. If local governments were to take on the challenge of balancing soil health against private property demands in a meaningful way, the results could be to shift the ways in which private property rights are viewed in the United States.

In his extensive writing on land, Eric Freyfogle has observed that “[i]n describing our interactions with the land, our languages have troubling gaps. We have many words that break nature into parts and treat it as a collection of resources, but few words to portray it as a seamless web.”³²⁶ For too long, both our conversations and laws surrounding soil have done just that—split it into parcels, or into resources versus property. But those divisions did not and do not reflect the reality of the soil resource, which contains enormous amounts of interconnections that promote the health of soil and the billions of living things that depend on it. As we learn more about soil and its importance as a resource, the law must also begin to change.³²⁷ Shifting from a two-dimensional governance framework to one focused on soil's interconnectivity can better reflect soil's reality. And adding in soil's third

³²⁶ Eric T. Freyfogle, *The Ethical Strands of Environmental Law*, 1994 U. ILL. L. REV. 819, 845 (1994).

³²⁷ See, e.g., Cinnamon P. Carlarne, *Climate Creep*, 52 ENV'T L. REP. 10374, 10376 (2022) (noting that the law “evolves to accommodate changing social norms, changing political and economic conditions, changing physical and ecological realities” and describing this evolution in the context of climate change).

dimension to acknowledge soil as a common resource can help to make our private property and governance systems a necessary part of that shift.³²⁸

As noted, many crucial questions have been left unexplored regarding local assumption of the soil governance mantle, including, in no particular order: the local authority required to take on these kinds of actions; local lack of capacity and preemption;³²⁹ local motivation or deterrents to taking on this kind of work; and the procedural and substantive realities of what local soil governance would look like. Subsequent articles by the author will explore in much greater detail what this local role as soil resource manager would look like.

For now, it will have to suffice to tee up the prospect of thinking in transformative ways about soil governance by relying on those local mechanisms and actors. Drawing on existing local, state, and federal tools to reflect new appreciation of the soil resource and its many interconnections is a sweeping project, but not an impossible one. And it is a critical step toward managing the impacts of human development on the planet, and ensuring the survival of our species and the billions of others that rely on the health of soil as a resource.

³²⁸ See Sanne H. Knudsen, *Remedying the Misuse of Nature*, 2012 UTAH L. REV. 141, 153 (“Constructing a framework to remedy the misuse of nature that ignores limits on private land use would fail the most basic challenge of respecting land as an interconnected whole.”).

³²⁹ I intend to address in future work, for instance, the fact that lack of federal law may create opportunities for local engagement in the absence of federal or state action. Local action on clean air and clean water is vulnerable to preemption by federal statutes and the state laws that implement them. The same is likely much less true of local action regarding soil.