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NEGATIVE-VALUE PROPERTY

BRUCE R. HUBER*

ABSTRACT

Ownership is commonly regarded as a powerful tool for environmental protection and an essential solution to the tragedy of the commons. But conventional property analysis downplays the possibility of negative-value property, a category which includes contaminated, depleted, or derelict sites. Owners have little incentive to retain or restore negative-value property and much incentive to alienate it. Although the law formally prohibits the abandonment of real property, avenues remain by which owners may functionally abandon negative-value property, as demonstrated recently by busts in certain coal and oil & gas markets. When negative-value property is abandoned, whether formally or functionally, the rehabilitation of such property typically requires public expenditure—an externality which cuts against property's general and salutary tendency to internalize spillovers at a low social cost. The existence of negative-value property, as well as its increasing abundance, reveals an underdeveloped aspect of property theory and a pressing need to fortify legal mechanisms that prevent abandonment and enforce owners' financial responsibility for severely degraded property.

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INTRODUCTION

Property rights are often regarded as a boon for environmental protection and the conservation of natural resources.¹ By linking owners to assets, property law incentivizes owners to preserve and protect those assets.² Imposing ownership on unowned domains can thus help prevent wasteful tragedies of the commons.³ And perhaps best of all, property law is largely

1. Some approaches go so far as to place private resource ownership at the very center of environmental policy. *See, e.g.*, TERRY L. ANDERSON & DONALD R. LEAL, *FREE MARKET ENVIRONMENTALISM* (1991) (advocating broadly for increased private land ownership on the premise that private owners will steward and conserve land more effectively than government because of owners' interests in maintaining land value). Although most environmental scholars place far more emphasis on regulatory efforts, the importance of property institutions to environmental protection is broadly recognized. For a comprehensive account, see DANIEL H. COLE, *POLLUTION & PROPERTY: COMPARING OWNERSHIP INSTITUTIONS FOR ENVIRONMENTAL PROTECTION* (2002).

2. *See, e.g.*, Robert C. Ellickson, *Property in Land*, 102 *YALE L.J.* 1315, 1368 (1993) (noting that "the preeminent advantage of an infinite land interest is that it is a low-transaction cost device for inducing a mortal landowner to conserve natural resources for future generations."). Needless to say, there also are ample noneconomic justifications for resource conservation.

3. Garrett Hardin, *The Tragedy of the Commons*, 162 *SCIENCE* 1243, 1245, 1247 (1968) (discussing privatization as one possible solution to commons tragedies). Hardin and others have been

self-effectuating; it does its work with relatively little government involvement.⁴

This cheery view of property, however, is built on the assumption that property will generally maintain a positive value. When property has a negative value—as with, say, a parcel contaminated by toxic waste—everything changes. Many landowners would prefer to abandon such a parcel than to rehabilitate it.⁵ Indeed, vast numbers of contaminated or degraded sites, in every American era and locale, have been abandoned by their previous owners.⁶ Lawmakers have enacted extensive legislation and created elaborate bureaucracies to clean up such sites and to prevent further dereliction in the future. Resource conservation in such instances is anything but self-effectuating. Enormous public resources, both budgetary and bureaucratic, are required at every turn.⁷

For the most part, the concept of negative-value property is absent from the literature of property law.⁸ That literature dwells predominantly (and appropriately) on law's treatment of things of positive value, for property rights are generally a function of the scarcity of sought-after goods.⁹ But this Article suggests that negative-value property is the dark matter of the

criticized, however, for assuming that owners will not knowingly overexploit resources. *See* COLE, *supra* note 1, at 16, 85–109.

4. Governments define and enforce property rights and contracted exchange, but the property strategy requires little more from the state precisely because owners are incentivized to monitor and protect their holdings themselves. *See* Ellickson, *supra* note 2, at 1327–1330; *see also* Harold Demsetz, *Toward a Theory of Property Rights*, 57 AM. ECON. REV. 347, 354–57 (1967) (noting that individual land ownership reduces vastly the costs of negotiation over externalities).

5. As will be discussed herein, the abandonment of title to land is formally disallowed, though functionally possible. *See, e.g.*, Pocono Springs Civic Ass'n v. MacKenzie, 667 A.2d 233 (Pa. Super. Ct. 1995).

6. *See infra* Part II. The COVID-19 pandemic may accelerate abandonment in certain areas of economic life. *See, e.g.*, Heather Richards, *Coronavirus Could Drive 'Mass Abandonment' of Oil Wells*, E&E NEWS (May 5, 2020), <https://www.eenews.net/stories/1063049965> [<https://perma.cc/3MHE-RA5X>].

7. As only one example, the GAO has reported that from 1998 to 2007, four federal agencies spent no less than \$2.6 billion to reclaim abandoned hardrock mines. ROBIN M. NAZZARO, U.S. GOV'T ACCOUNTABILITY OFF., GAO-08-574T, *HARDROCK MINING: INFORMATION ON ABANDONED MINES AND VALUE AND COVERAGE OF FINANCIAL ASSURANCES ON BLM LAND 9* (2008).

8. References to negative-value property are uncommon, although the concept has appeared in several recent articles. *See* Lee Anne Fennell, *Forcings*, 114 COLUM. L. REV. 1297, 1325, 1332 (2014) (addressing the law of unwanted ownership, with frequent references to property with an objectively negative value); Nadav Shoked, *The Duty to Maintain*, 64 DUKE L.J. 437, 440–42 (2014) (arguing that the existence of negative-value property—exemplified by stagnant real estate listings in Detroit offering properties for one dollar—implies a set of affirmative duties to maintain property); Lior Jacob Strahilevitz, *The Right to Abandon*, 158 U. PA. L. REV. 355, 405–07 (2010) (discussing the right to abandon negative-value personal property).

9. Although ownership today serves as the basis for various social obligations (e.g., the payment of taxes), the language of property generally emphasizes rights and entitlements rather than duties. *Cf.* Gregory S. Alexander, Eduardo M. Peñalver, Joseph William Singer & Laura S. Underkuffler, *A Statement of Progressive Property*, 94 CORNELL L. REV. 743 (2009) (urging an augmentation of the conventional conception of property to incorporate a broad range of social values).

property universe.¹⁰ We are surrounded by it. Negative-value property is property which not only has no positive market value, but which cannot practically be alienated or discarded without improving it, bundling it with other property, or making an additional side payment.¹¹ As to personal property, the category is enormous. Within your place of residence—if not within your immediate reach—there are almost certainly items which you would rather not own; which would attract no willing buyer; and the disposal of which will require your time, your money, or both. Such property is likely only a minor annoyance to you, but in the aggregate, it represents a problem that is far from trivial: great effort is invested into creating and enforcing policies that divert such property from, say, roadsides and open spaces (“No Dumping!”) and towards landfills, recycling facilities, or other users.¹²

As to real property, the category of negative-value property is less obvious but just as important, and it is here that this Article principally dwells. Examples include lands that are contaminated or that otherwise carry binding liabilities in excess of any residual positive market value. Toxic waste sites, depleted and unreclaimed mines, defunct landfills, and unplugged and unproductive oil and gas wells often fit this description.¹³ No less conspicuous are properties with derelict or dangerous structures, such as obsolete plants that cannot economically be converted for other uses. For example, many decommissioned power plants are characterized by serious contamination risks, deteriorating structures, and a range of ongoing liabilities that exceed any residual site value.¹⁴ Absent complicated

10. Scientists posit the existence of invisible “dark matter” to account for observations suggesting that the universe has a great deal more mass than can be visually observed. Some leading cosmological models hypothesize that dark matter may constitute the majority of the total mass of the universe. *See generally* Lee Billings, *In the Dark About Dark Matter*, SCI. AM., Oct. 1, 2016, at 15.

11. Negative value property is to be distinguished both from zero-value property and from positive-value property that is nonetheless highly illiquid because of transaction or search costs. Abandonment of such property generally does not impose serious economic or environmental burdens upon society. Although property values fluctuate and are often difficult to ascertain, this Article’s focus is on property with a discernible, stable, and substantial negative value.

12. Perhaps the most interesting of such efforts are those that attempt to reduce the usually prohibitive transaction and search costs associated with the transfer of unique or illiquid goods. Craigslist and eBay are the best-known, allowing owners to easily broadcast to mass audiences the availability of even low-value items that might otherwise be disposed. *See, e.g.*, Strahilevitz, *supra* note 8, at 356–57 (describing “free stuff” listings on Craigslist).

13. Often, but by no means always: many such sites have a net positive value despite their liabilities, cleanup costs, or both. *See, e.g.*, Josh Jacobs, *Europe’s Half a Million Landfill Sites Potentially Worth a Fortune*, FIN. TIMES (Jan. 7, 2018), <https://www.ft.com/content/0bf645dc-d8f1-11e7-9504-59efdb70e12f> [<https://perma.cc/N66N-EBKK>].

14. Some such facilities will require active monitoring and management far into the future. *See generally* DANIEL RAIMI, RESOURCES FOR THE FUTURE, DECOMMISSIONING US POWER PLANTS: DECISIONS, COSTS, AND KEY ISSUES (2017).

legal interventions, or a wild swing in market conditions, no buyer is likely to appear for such properties.

The danger of negative-value real property is that those who damage or contaminate land may be unable to restore it or may walk away from it, leaving it to others to clean up their mess.¹⁵ Formally, the law does not readily allow such abandonment;¹⁶ indeed, modern law often requires firms to post bonds or otherwise assure the government that they are capable of bearing the potential costs of cleanup associated with their enterprises.¹⁷ But such policies are far from foolproof. To the contrary, owners display boundless creativity in finding ways to evade or diminish cleanup requirements. Sometimes their tactics simply delay the performance of cleanup obligations.¹⁸ In many instances, however, owners escape such obligations altogether via a kind of functional abandonment, leaving taxpayers on the hook for the restoration of negative-value property.¹⁹ Each year, billions of taxpayer dollars are spent cleaning up contaminated or abandoned sites.²⁰ There are public funds to pay for abandoned mines,²¹ abandoned oil wells,²² abandoned underground storage tanks,²³ abandoned waste sites,²⁴ and much else—not to mention the vast public funds devoted to more generic brownfield redevelopment.²⁵

15. At least, this is the danger associated with negative-value real estate in private ownership. There is a great deal of negative-value land in public ownership also, and the principal danger here is analogous: that government actors will foist cleanup costs onto future taxpayers, and not themselves bear the costs of harmful activities.

16. The most developed discussion of this issue can be found in Strahilevitz, *supra* note 8, and a response by Professor Peñalver. Eduardo M. Peñalver, *The Illusory Right to Abandon*, 109 MICH. L. REV. 191 (2010).

17. See generally James Boyd, *Financial Responsibility for Environmental Obligations: Are Bonding and Assurance Rules Fulfilling Their Promise?* (Res. for the Future, Discussion Paper No. 01-42, 2001).

18. Delays benefit responsible parties by virtue of discounting. See, e.g., Gordon C. Rausser, Leo K. Simon & Jinhua Zhao, *Information Asymmetries, Uncertainties, and Cleanup Delays at Superfund Sites*, 35 J. ENV'T ECON. & MGMT. 48, 49 (1998) (noting that the substantial cost savings provided by discounting can incentivize parties to delay cleanup).

19. Examples of functional abandonment are described in Part II, *infra*.

20. See, e.g., ROBIN M. NAZZARO, U.S. GOV'T ACCOUNTABILITY OFF., *supra* note 7 (describing the estimated \$2.6 billion federal agencies spent over nearly a decade to reclaim abandoned hardrock mines).

21. See, e.g., 30 U.S.C. § 1231(a) (creating the "Abandoned Mine Reclamation Fund").

22. Every oil and gas producing state has a program to address orphaned and abandoned wells. See, e.g., KAN. STAT. ANN. § 55-192(a) (2019) (establishing the "abandoned oil and gas well fund").

23. See, e.g., 26 U.S.C. § 9508(a) (creating the "Leaking Underground Storage Tank Trust Fund").

24. See, e.g., I.R.C. § 9507 (creating the "Superfund" to pay for, inter alia, abandoned hazardous waste disposal sites).

25. Brownfield land is land which has been previously developed but is presently not in use, or for which redevelopment is complicated, due to concerns about land contamination. Such land is not necessarily abandoned, yet its owner may lack the wherewithal to clean or develop it. Absent publicly

These public payments represent an important and often overlooked externality—a kind of temporal spillover, an externality foisted across time rather than space.²⁶ Permanent land ownership is commonly thought to keep the incidence of temporal spillovers to a minimum,²⁷ and in many instances it may indeed do so, at least when the value of land is positive. But humankind’s ability to create lasting harms to land has increased exponentially over the last century.²⁸ When land is seriously degraded, the incentive to abandon replaces the incentive to conserve. In land use sectors regularly associated with negative-value property, we should expect to see sophisticated efforts to abandon land and liability, and as such efforts succeed, we should expect a further decline in other similarly situated owners’ efforts to maintain positive land values.²⁹ In these sectors, permanent land ownership, standing alone, predictably fails to deliver on its promise of resource conservation. Moreover, the bulk of the public expenditure required to address negative-value property lies ahead of us, not behind. Our nation’s most vexing decommissioning and cleanup efforts—those involving offshore oil rigs or nuclear power plants, for example—are

funded remediation, much brownfield land is negative-value property. There are myriad brownfield redevelopment programs at the state and federal level. For an overview, see *Types of EPA Brownfield Grant Funding*, EPA (last updated Nov. 18, 2020), <https://www.epa.gov/brownfields/types-brownfields-grant-funding> [<https://perma.cc/9HA3-KNLC>].

26. See generally Bruce R. Huber, *Temporal Spillovers*, in ENVIRONMENTAL LAW AND ECONOMICS 43–57 (Klaus Mathis & Bruce R. Huber eds., 2017). Most externalities are conceived in spatial terms, where an activity in one parcel affects parties elsewhere (as with air pollution from a factory, for example). Temporal externalities, by contrast, manifest only after the passage of time and may affect later owners of the same parcel (as when an owner discovers hidden waste, attributable to a prior owner, yet lacks recourse against that owner). Temporal spillovers do not feature prominently in the literature. Exceptions include Lee Anne Fennell, *Fee Simple Obsolete*, 91 N.Y.U. L. REV. 1457, 1468–70 (2016) (noting that the current structure of property law addresses temporal spillovers at the expense of other externalities that now typify urban land use); Sarah Jacobson, *Temporal Spillovers in Land Conservation*, 107 J. ECON. BEHAV. & ORG. 366 (2014) (modeling post-contract externalities associated with the U.S. Conservation Reserve Program); and Richard A. Epstein, *Property Rights, State of Nature Theory, and Environmental Protection*, 4 N.Y.U. J.L. & LIBERTY 1, 7–10 (2009) (discussing the relationship between security of possession and “temporal externalities”).

27. See, e.g., Fennell, *supra* note 26, at 1479–82. Fennell recognizes that temporal spillovers are not “perfectly solved even by the fee simple” as when owners “avoid taking responsibility for negative-value properties.” *Id.* at 1482.

28. An enormous literature could be cited here. Rachel Carson’s *SILENT SPRING* (1962), for example, was one of the first (and remains one of the most famous) scientific works to discuss at length the alarming emergent environmental ills that often accompany technological development. The book focuses on the harms associated with synthetic pesticides in general and DDT in particular.

29. There remain strong moral, legal, and environmental rationales for land conservation. Some owners of negative-value property are motivated to rehabilitate it, and of these, some have the means to carry it out. The emphasis of this Article, however, is on the economic incentives created by negative-value property, as demonstrated by real-world activity in sectors typified by such property. See *infra* Part II.

in their infancy.³⁰ The track record of government, in the many regulatory programs established to manage site closure and land restoration, is not encouraging.³¹ It is possible that, with sufficient political will, lawmakers could design and implement more effective rules. But the broader lesson is that negative-value property is endemic to American property law and the incentives it creates. It is, so to speak, a bug in the system, and not one that can be easily corrected.

This Article proceeds as follows. Part I will provide some theoretical background in order to explain why negative-value property is important to property theory. Part II describes the extent of negative-value property (and the policies developed to address it) across various domains and lays out a set of examples to provide fodder for the analysis that follows. Although numerous examples are provided, the discussion focuses at length on recent busts in the coal and oil and gas sectors, since these busts allow a close inspection of very recent tactics employed by owners of negative-value property. Part III then moves into analysis, drawing out recurrent legal, political, and economic dynamics in the treatment of negative-value property, and positing some paths forward. The Article ends with a brief Conclusion.

I. A BRIEF THEORETICAL OVERVIEW

Why is negative-value property important? This Part aims to locate the concept of negative-value property in property theory. In short, the current literature places substantial weight on property's tendency to direct owners' incentives towards resource conservation, but it seldom discusses the temporal spillovers that arise in connection with negative-value property. Part II will examine the incidence of such spillovers, but for the moment, the crucial point is that they cut against the incentive to conserve land. Let's explore this.

A core function of property law is to protect rights to scarce and desirable things. Our intuitions about ownership, visible from the moment a child cries "mine!" over a favorite toy, tend to match the Blackstonian picture of "sole and despotic dominion" exercised over physical things, "in total

30. See Boyd, *supra* note 17, at 67 ("[I]t should be noted that many of the most significant environmental obligations guaranteed by assurance mechanisms have yet to come due. Long-tailed hazards associated with landfills, for example, will not reveal themselves for decades."). Of the U.S. fleet of nuclear power plants, only ten have been successfully decommissioned. Marta M. Gospodarczyk & Jacob Kincer, *Decommissioning Nuclear Reactors Is a Long-Term and Costly Process*, U.S. ENERGY INFO. ADMIN.: TODAY IN ENERGY, (Nov. 17, 2017), <https://www.eia.gov/todayinenergy/detail.php?id=33792> [<https://perma.cc/9T6P-YAS7>].

31. See *infra* Part II.

exclusion of the right of any other individual in the universe.³² To own something is to do with it as one pleases. Property law puts the power of the state behind this understanding. In a common law system, the task of property law is to develop and refine the appropriate bases for and parameters of property rights—to sort out illegitimate claims from legitimate ones, and then to stand ready to protect justified possession.

Yet there is much more to the logic of property than merely protecting settled rights to possession. Harold Demsetz famously posited that “[a] primary function of property rights is that of guiding incentives to achieve a greater internalization of externalities.”³³ In contemporary usage, we often assume externalities to be negative, but here Demsetz had in mind positive externalities as well. Property rights will tend to emerge, Demsetz argued, when the gains from internalization exceed the costs.³⁴ In his example, aboriginals on the Labrador Peninsula recognized private rights to land when the exploding fur trade made it worth their while to do so. Property rights allowed them to capture (internalize) the benefits of husbanding fur-bearing animals, thus addressing what would otherwise have been a deleterious externality: the overhunting of those animals that would have resulted if hunting families could not exclude others from their territory.³⁵

Building on Demsetz, many other scholars have expanded upon the benefits of this internalization function of property rights, explaining why it reduces harmful land uses and encourages beneficial ones.³⁶ As to the latter, property rights allow owners to capture the benefits of improvements to land or resources that would otherwise be lost, so long as the scale of the right encompasses the scale of the improvement in both space and time.³⁷ Landowners who feel secure in the permanence of their rights, across sufficient space and time, will be more likely to steward their property carefully for their own benefit, and perhaps even for the benefit of their offspring or successors in interest.³⁸ This feature of property rights has led

32. 2 William Blackstone, Commentaries *2.

33. Demsetz, *supra* note 4, at 348.

34. *Id.* at 350 (“[P]roperty rights develop to internalize externalities when the gains of internalization become larger than the cost of internalization.”).

35. *Id.* at 351–53. The same economic logic was described also by Blackstone, who noted that “no man would be at the trouble to provide either [habitation or raiment], so long as he had only an usufructuary property in them, which was to cease the instant that he quitted possession.” BLACKSTONE, *supra* note 31, at *4. Similar reasoning is at work in arguments positing property rights as a solution to tragedies of the commons. See, e.g., Robert J. Smith, *Resolving the Tragedy of the Commons by Creating Private Property Rights in Wildlife*, 1 CATO J. 439, 444 (1981) (arguing that private ownership leads to sustainable yields, whereas public ownership leads to overuse and depletion).

36. See generally Ellickson, *supra* note 2; Richard A. Epstein, *supra* note 26; Carol M. Rose, *Possession as the Origin of Property*, 52 U. CHI. L. REV. 73, 81–82 (1985).

37. See Ellickson, *supra* note 2, at 1323–32.

38. *Id.* at 1369 (noting that perpetual property rights induce even elderly and self-interested owners to adopt “an infinite planning horizon”).

many to regard private ownership as a critical component of an environmental protection policy.³⁹

As to harmful uses of land, economic logic suggests that property rights reduce their incidence in several respects. If an owner's use of a parcel adversely affects that parcel, the owner suffers the consequences by way of the diminished market value of the parcel. If the adverse effects spread beyond the immediate parcel, individual property rights will help to mitigate even those effects, because individual ownership reduces the transaction costs involved in negotiating a solution.⁴⁰ When property rights are weak, communal, or ill-defined, an adversely affected landowner may have to negotiate with many parties to extinguish an unwanted externality, if it is even possible at all. But when an adverse effect can be clearly attributed to the land use of a single owner, the difficulty of negotiation is vastly reduced and the parties are more likely to agree to a mutually preferable arrangement.⁴¹

So far, so good: property rights help guide owners' incentives towards land stewardship and resource conservation, and even help address the instances in which harms cross from one plot of land to another. This understanding may match our experience and intuition for a range of modern land uses. But are there categories of property for which owners' incentives are different than those suggested thus far?

Consider a rural land parcel, abundant in some valuable mineral resource yet otherwise unremarkable in its location and setting. For such a parcel, the value of the resource (separated from the land) may well dwarf any residual value of the land without the resource. An owner could rationally choose to extract and sell the resource, leaving the land in a damaged and unsaleable (i.e. negative-value) condition.⁴² In most jurisdictions today, of course, mineral extraction activities are regulated: rules would likely exist both to direct the extractive process and to establish standards for the reclamation of the land after extraction. These rules are necessary precisely because economic incentives alone would not likely guide owners towards long-

39. See, e.g., Epstein, *supra* note 26; COLE, *supra* note 1; ANDERSON & LEAL, *supra* note 1; cf. Terry L. Anderson & P.J. Hill, *The Evolution of Property Rights: A Study of the American West*, 18 J.L. & ECON. 163, 176–78 (1975) (describing the changing regulation of water in the west in response to western water scarcity).

40. See Demsetz, *supra* note 4, at 349, 356–57. Here Demsetz is obviously building upon Ronald Coase's famous article, *The Problem of Social Cost*, 3 J.L. & ECON. 1 (1960), and its emergent theory of transaction cost economics. Demsetz, *supra* note 4, at 349 n.1.

41. Demsetz, *supra* note 4, at 356–57; see Ellickson, *supra* note 2, at 1327–30.

42. For those unfamiliar with the long-term land harms associated with mining activity, they will be summarized in Part II, *infra*. For the moment, suffice it to say that mined land generally requires significant post-closure treatment and remediation in order to be made usable for other purposes.

term land care, at least for nonrenewable resources.⁴³ Yet even with such regulations in place, we would not be surprised to find that owners' decisions are shaped far more by the resource market than by the market for the depleted land. The latter may be little more than a rounding error as compared to the former.

Keeping this example in mind, let us look again at a leading and now-conventional view of property rights, using Yale law professor Robert Ellickson as our guide. In a memorable passage in one of his leading articles, Ellickson writes:

Although the assertion may seem counterintuitive, the key to land conservation is to bestow upon living persons property rights that extend perpetually into the future. The current market value of a fee in Blackacre is the discounted present value of the eternal stream of rights and duties that attach to Blackacre. A rational and self-interested fee owner therefore adopts an infinite planning horizon when considering how to use his parcel, and is spurred to install cost-justified permanent improvements and to avoid premature exploitation of resources. The fee simple in land cleverly harnesses human selfishness to the cause of altruism toward the unborn, a group not noted for its political clout or bargaining power.

An illustration may help convince the skeptical. Suppose that Mae, a selfish 80-year-old without a bequest motive, owns a house in the Hollywood Hills in fee simple. Mae is considering installing a screening room that would last, with luck, for centuries. In making her decision, would Mae consider the room's benefits that would accrue after her death? . . . She might well be able to find a younger buyer, such as Rock, who could enjoy the screening room for several decades. When considering the purchase, Rock would recognize that this room would be a sales asset when it came time for *him* to unload the house, say to Demi (someone still younger). . . . In short, benefits and costs from here to eternity are capitalized into Rock's bid.⁴⁴

43. Indeed, many such rules were imposed after resource booms had played out, and legislators became aware of their consequences. *See, e.g.*, *Robinson Twp. v. Commonwealth*, 83 A.3d 901, 960–63, 976 (Pa. 2013); *Pa. Env't Def. Found. v. Commonwealth*, 161 A.3d 911, 916–19 (Pa. 2017) (both cases together describe the harmful effects of coal, oil, and gas extraction in Pennsylvania and the environmental legislation that resulted).

Many have noted that secure, permanent rights to renewable resources, such as timber, incentivize owners to harvest those resources in such a way as to protect and enhance renewal of the resource. *See, e.g.*, Epstein *supra* note 26, at 10 (noting that “[c]ommercial firms have a built-in incentive to clear-cut on public lands because they do not own the long-term interest and any reduction in land value falls on the public at large”).

44. Ellickson, *supra* note 2, at 1369 (emphasis in original) (footnotes omitted).

All true. But if we substitute a copper lode for the Hollywood Hills home, and a mining operation for the screening room, the outcome may not so easily be described as “altruistic toward the unborn.”⁴⁵ The owner’s incentives point to land *depletion*, not land *protection*. If the value of the depleted land approaches the value of the copper, perhaps Ellickson’s logic will hold, but as those values diverge, land conservation may well be sacrificed for resource revenue.⁴⁶ In other words, if there is a good chance that the mined land will be valuable after mining is complete, we would expect the owner to “install cost-justified permanent improvements”⁴⁷ and otherwise take steps to protect or enhance the land’s value. But if the owner expects the land to have a negative-value—that is, if the damage is such that the expected cost of reclamation exceeds the estimated land value after reclamation—he or she will be unlikely to regard reclamation as cost-justified.

For mineral lands, then, we see a somewhat different logic at work than that depicted by Demsetz and Ellickson. The incentives created by the mere fact of perpetual private ownership, standing alone, seem less likely to lead to long-term land conservation or resource protection. Regulation or some other external social force will probably be required to induce an owner to rehabilitate mined land. In fact, some external force may be necessary even to prevent the owner from abandoning such land. Not only does ownership fail to induce land conservation; the resource extraction motive *actually cuts against long-term ownership*. A rational owner would abandon the depleted property if allowed to do so—and, as Part II will explore, rational actors did and continue to do precisely this. If the land effectively has no residual value, any incentive to continue owning that land expires upon the exhaustion of its mineral supply.

When land is abandoned, the costs of its rehabilitation are externalized. Any remediation that occurs will be at the expense of some future owner or manager, someone other than the party responsible for the damage. Throughout American history, abandoned lands—resource extraction sites in particular—have necessitated enormous public expenditures.⁴⁸ These are not spatial externalities, but temporal ones. The potential for severe temporal externalities of this sort highlights the importance of rules against

45. *Id.*

46. The efficient timing of resource extraction and sale—i.e., how an owner can maximize resource revenue—is a separate and complicated issue that has interested economists at least since Harold Hotelling, *The Economics of Exhaustible Resources*, 39 J. POL. ECON. 137 (1931).

47. Ellickson, *supra* note 2, at 1369.

48. See *supra* notes 7, 21–24.

abandonment. Such rules are a first-cut and relatively low-cost way of trying to keep landowners “on the hook” for repairing damage to land.⁴⁹

By themselves, rules against abandonment do little to incentivize an owner to pursue land remediation. An owner of an exhausted mine, barred from abandoning that land, could simply choose to hold the land indefinitely without ever cleaning it up. Although the land may represent an ongoing liability to its owner (say, by way of tax obligations or potential tort claims), the owner may nonetheless find that her exposure is far less than the cost of cleanup.⁵⁰ So why not simply hold the land into perpetuity?⁵¹

To assure the remediation of land in such a scenario, something more is needed than unaided property rights and a rule against abandonment.⁵² Many jurisdictions have concluded that only an affirmative obligation imposed by public law will get the job done. Note that when such obligations exist, we can more robustly employ the label of negative-value property: land that can be abandoned, or simply held indefinitely without remediation, might be considered zero-value rather than negative-value. But land that carries binding, enforceable legal obligations, in excess of its expected value after cleanup, can only be considered negative-value. No market will exist for such land.

The imposition of affirmative cleanup duties, which is now commonplace in a variety of land use contexts, creates several noteworthy dynamics. First, note that reclamation duties may actually increase the

49. For a discussion of the rationale behind rules against abandonment, see Peñalver, *supra* note 16. Although the common law typically allows the abandonment of chattels, Peñalver notes that this right is “highly qualified, almost to the point of irrelevance,” by the prohibition of the abandonment of land. *Id.* at 206. This is because one seeking to abandon chattels must find someone willing to accept them. *Id.* The bar against land abandonment, in turn, finds its roots in the law’s reluctance to allow landowners to evade the duties of ownership. *Id.* at 208–14. Although certain interests in land can lawfully be abandoned, such interests “are carefully defined to exclude affirmative obligations.” *Id.* at 200.

50. Again, there is a great deal of evidence that this is often the case, based on actual landowner behavior. *See infra* Part II.

51. Even if the owner intends to pursue cleanup at some point, delay reduces the present value of cleanup—possibly to a substantial degree. *See* FRANÇOIS LÉVÊQUE, *THE ECONOMICS AND UNCERTAINTIES OF NUCLEAR POWER* 23–34 (2015) (noting that the discounted cost of nuclear power plant decommissioning pales in comparison to construction costs, due to the long time horizon). The deferral of an expenditure alone reduces the present value of that expenditure simply by way of discounting, but it is also possible that new technologies will emerge that could reduce the cost even further. Of course, these possible reductions must be considered against factors cutting in the opposite direction: cleanup costs may rise if the harm spreads or increases, or if cleanup standards are tightened. *See infra* Section IV.B.

52. The claim here is not that land remediation is necessarily desirable or cost-effective in every circumstance, let alone that laws requiring cleanup are always normatively desirable. One might argue, for example, that market forces will ultimately induce landowners to rehabilitate land once the benefits from doing so exceed the costs. Perhaps it is inefficient to require an owner to rehabilitate land before sufficient demand exists for that land. For now, the point is merely that if a polity seeks to ensure that degraded land is remediated, property rights alone are not sufficient to the task.

incentive to abandon. Without such obligations, owners may be content to simply hold land indefinitely as noted above. Thus, as we will see, reclamation laws are undergirded by rules against abandonment and stress the importance of such rules. Second, cleanup obligations, if well enforced, can in theory incentivize owners to make cost-effective improvements to the extraction process (and land use practices in general) in order to reduce the total cost of compliance. If landowners expect to be able to abandon land or otherwise shirk these obligations, that incentive disappears; if they expect to be able to delay the obligations significantly, that incentive is diminished. What we might expect to see, then, is sophisticated efforts to abandon or alienate damaged land or, failing this, to postpone cleanup obligations as long as possible. Part II will offer some evidence that these efforts are in fact widespread.

Notice how far we have come. The conventional view regards ownership of property as an inducement to conservation. Yet for at least some types of land, we see that ownership alone does not incentivize conservation and that without positive legal obligations, owners could rationally conclude that conservation measures are not cost-effective. This is not to say that the conventional view is incorrect; its logic undoubtedly holds for a great many ownership scenarios. The point is simply that the conventional view directs our attention away from the temporal spillovers that arise in connection with negative-value property. As Lee Anne Fennell has noted, property law “simply ignores many positive and negative externalities. This is as it should be; internalizing externalities is costly, and not always worth doing.”⁵³ So in order to assess this dimension of property law—to understand whether internalizing temporal externalities is “worth doing”—we need to understand better the incidence of negative-value property, the magnitude of the accompanying spillovers, and the cost of internalizing them. To this assessment we now turn.

II. EXAMPLES OF NEGATIVE-VALUE PROPERTY

This section will examine several paradigmatic categories of negative-value property. Before we launch into specific examples, a brief clarification is in order. We have said that negative-value property is property which has no positive market value, and which cannot practically be alienated or discarded without improvement or a side payment of money or other property. But assessing property’s economic value is a tricky business for a number of reasons. The task of valuation often depends on subjective assessments: as the saying goes, one man’s trash is another man’s

53. Fennell, *supra* note 26, at 1467.

treasure. And values change. Today's trash might well be tomorrow's treasure.⁵⁴ It is also worth noting that value depends on size and scale. Specific valuations are inextricably linked to specific demarcations of property's boundaries, whether such boundaries are spatial or temporal, surface or subsurface, physical or abstract. An abandoned, negative-value mine, for example, might be "hiding" within a larger, positive-value parcel.⁵⁵

These difficulties will be confronted directly in Part III. For now, this Part will simply provide examples in which the law imposes sizeable liabilities or duties on landowners—obligations that, over an extended time, are likely to exceed whatever residual value a unit of land would bear without them.⁵⁶ It is in such instances that the danger of costly externalities looms largest. As we will see, there are numerous cases of this sort, more than enough to warrant our attention, quite apart from whatever other examples one might find among closer or more ambiguous cases.

What are the principal types of negative-value property? The most obvious includes sites contaminated by toxic waste or other dangerous materials. Two other and somewhat related forms of negative-value real property are also of extraordinary public policy concern. First, as suggested by the previous section, many negative-value properties are sites where natural resource deposits have been extracted. Though some resources can be extracted without leaving behind long-term land harms—timber, for example⁵⁷—many other resource extraction sites are unusable for other purposes without extensive remediation. The second category consists of derelict structures: retired power plants, industrial sites, or other facilities that have high cleanup and dismantling costs but low salvage and site value.

54. For example, coalbed methane was regarded as a noxious and dangerous byproduct of coal mining until methods were developed to capture and market it as fuel. *See Amoco Prod. Co. v. S. Ute Indian Tribe*, 526 U.S. 865, 875–77 (1999). Many now regard landfills, and especially those containing electronic waste, as an important source of certain metals. *See, e.g., Jacobs, supra* note 13.

55. Indeed, as we will soon see, negative-value property is often bundled with positive-value property to create a single, positive-value unit. This is an important mechanism for addressing negative-value property.

56. In several instances in this section, the reader will note that the relevant property is not yet negative-value, but is likely to become so in the near future. For example, a mine may retain a positive value before it has been substantially depleted, even if its cleanup obligations will probably render it negative-value property upon closure. Examples of this sort are included here to give a better sense of the scale of the problem of negative-value property.

57. Modern silvicultural practices do not typically create durable land harms of the sort that lead to extensive liability. Renewable resource sites in general retain a positive value due to the inevitability of resource renewal. Nonetheless, cut-over timberland land may be unwanted in the short term. During westward expansion, for example, it was not uncommon for owners to allow forested property to revert to state ownership for nonpayment of property taxes. *See generally* F.P. Struhsaker, *Land Use Problems in Michigan*, 21 J. FARM ECON. 287 (1939) (describing economic difficulties in Michigan associated with abandoned forest land).

This section discusses these categories. It focuses most thoroughly on two specific forms of negative-value property: depleted coal mines and idled oil and gas wells. The reason for this focus is that segments of both the coal and the oil and gas industry have suffered recent economic downturns. These market busts make it possible to examine closely, under the light of current law, the strategies that businesses and landowners employed to deal with negative-value property during troubled times. The remaining examples will be described in less detail.⁵⁸ Finally, the section will end with a brief word about negative-value personal property.

A. Depleted Resource Extraction Sites

Just outside Butte, Montana—a town once dubbed “the richest hill on earth”⁵⁹—sits a defunct pit mine called the Berkeley Pit. For those unfamiliar with modern pit mining operations, the Pit’s scale is difficult to comprehend. One mile wide, a half-mile long, and over a third of a mile deep, the Pit yielded millions of tons of copper for its owner, the Anaconda Company, between 1954 and the mid-1980s.⁶⁰ But today, the Pit is filled with green-orange water so toxic that multiple systems are in place to frighten away birds that might otherwise rest on the water’s surface.⁶¹ These systems were put in place after 342 migrating snow geese died at the Pit in November 1995, their throats burned by the acidic water.⁶² Groundwater has been slowly filling the Pit since 1982, when mining activities ceased

58. Like the initial, lengthier cases, many of these examples are drawn from the energy sector. The sector is highly dependent on natural resources; its infrastructure is everywhere; and it is subject to sudden changes in markets and technologies. Together, these factors cause negative-value property to emerge with regularity, and across a wide geographic area.

59. Richard I. Gibson, *Is Butte Really “The Richest Hill on Earth?” You’d Better Believe It*, MONT. STANDARD (last updated Feb. 7, 2017), https://mtstandard.com/news/local/is-butte-really-the-richest-hill-on-earth-you-d-better-believe-it/article_3f4fe398-208d-5158-8ed8-29674e4930a1.html [<https://perma.cc/X664-MFKD>].

60. See generally PIT WATCH, <https://pitwatch.org/> (last visited Feb. 20, 2021) (comprehensive website describing the history, science, and current management of the Pit).

61. A waterfowl mitigation plan, established pursuant to EPA’s oversight of the remediation efforts underway at the Berkeley Pit, was approved and finalized in May 1998. Gunfire and electronic noisemakers are first used to frighten birds away from the water and a house boat is deployed to “haze” any remaining birds. See *Season Bird Mitigation Efforts Ongoing*, PIT WATCH (Jul. 5, 2009), <https://pitwatch.org/seasonal-bird-mitigation-efforts-ongoing/> [<https://perma.cc/GZ7Y-AUX8>]. These measures are far from foolproof: at least 3,000 geese were killed in the fall of 2016 after a snow storm blew them off their typical migration route. *At Least 3,000 Geese Killed by Toxic Water from Former Montana Copper Mine*, GUARDIAN (Jan. 23, 2017), <https://www.theguardian.com/us-news/2017/jan/23/geese-die-montana-toxic-mine-epa> [<https://perma.cc/QL56-DC56>].

62. Susan Dunlap, *Perils of the Pit: 342 Geese Dead After Fateful Landing 20 Years Ago*, MISSOULIAN (last updated Dec. 1, 2016), https://missoulian.com/news/state-and-regional/perils-of-the-pit-342-geese-dead-after-fateful-landing-20-years-ago/article_16b0e55b-d962-5a3c-928f-b88d2f9ea71c.html [<https://perma.cc/CGQ9-ZQ2N>].

and operators switched off the pumps that had prevented its inundation.⁶³ The City of Butte now charges visitors two dollars to take in the spectacle from an observation deck,⁶⁴ but make no mistake: the Pit is an environmental disaster. The water within is roughly as acidic as battery acid.⁶⁵ An extensive water treatment system at the site removes and purifies enough of the rising waters to prevent them from overflowing their geologic barriers and contaminating local water supplies.⁶⁶ The system will be required at the Pit forever, or until such time as a different remedial system is designed.

The Berkeley Pit is a prime example of negative-value property. Its copper resources exhausted, the site that remains is an extraordinary liability. Not only are its maintenance costs sizeable, but the liability associated with the failure of the various safety and treatment systems is enormous. Importantly, however, the pit has not been abandoned by its owner, currently the Atlantic Richfield company.⁶⁷ The Pit is part of a large Superfund site, and the company has entered into consent decrees with the U.S. Environmental Protection Agency (EPA) regarding the payment of cleanup and water treatment costs at the site.⁶⁸

The Pit exemplifies an important category of negative-value property. Natural resource extraction often entails substantial land degradation. Mining activities can entirely reshape an area's topography and cause a wide range of surface damages; oil and gas drilling creates a web of surface and subsurface impacts. Extracted resources are often processed at the site of extraction, leaving behind a host of unwelcome byproducts. Over the years, scores of extraction sites have, unlike the Berkeley Pit, simply been abandoned by their operators.⁶⁹ The toll of this pattern eventually led lawmakers to experiment with policies intended to compel firms to bear

63. *Water and the Berkeley Pit*, PITWATCH, <https://pitwatch.org/water/> [<https://perma.cc/2FBG-58A4>].

64. *Berkeley Pit*, MONT., <https://www.visitmt.com/listings/general/landmark/berkeley-pit.html> [<https://perma.cc/CKL6-4GV5>].

65. See generally TIMOTHY J. LECAIN, MASS DESTRUCTION: THE MEN AND GIANT MINES THAT WIRED AMERICA AND SCARRED THE PLANET 15–23 (2009).

66. See *Berkeley Pit Superfund*, PITWATCH, <https://pitwatch.org/superfund/> [<https://perma.cc/9NVJ-9F96>].

67. Atlantic Richfield acquired the Pit from the Anaconda Copper Company. See LECAIN, *supra* note 65.

68. The Pit was added to the Silver Bow Creek Superfund Site in 1987. See 52 Fed. Reg. 27,620, 27,627 (July 22, 1987) (to be codified at 40 C.F.R. pt. 300); see also *Mine Flooding Consent Decree Signed by Federal Judge*, PITWATCH (Aug. 13, 2002), <https://pitwatch.org/mine-flooding-consent-decree-signed-by-federal-judge/> [<https://perma.cc/4A6U-BW3V>].

69. See, e.g., JARED DIAMOND, COLLAPSE: HOW SOCIETIES CHOOSE TO FAIL OR SUCCEED 36 (2005) (“In Montana there are about 20,000 abandoned mines, some of them recent but many of them a century or more old, that will be leaking acid and . . . toxic metals essentially forever. The vast majority of those mines have no surviving owners to bear financial responsibility, or else the known owners aren’t rich enough to reclaim the mine and treat its acid drainage in perpetuity.”).

their own cleanup costs. This subsection surveys several examples of negative value property arising from resource extraction activities, as well as the legal and policy struggles associated with such property.

1. *Surface Coal Mines*

Historically, coal mining was deep mining, taking place in hidden shafts penetrating to coal seams far underground.⁷⁰ But in the mid-1900s, surface mining became more economical, and the environmental effects of coal mining became more visible and more pronounced.⁷¹ As millions of acres of American land were stripped and blasted, observers grew concerned that mined land would not be restored, especially if the law did not affirmatively require it.⁷²

There are several environmental harms associated with unreclaimed surface coal mines.⁷³ Perhaps the leading concern is a form of water pollution known as acid mine drainage (AMD), which occurs when buried sulfides are exposed to oxygen and water, creating acidic compounds.⁷⁴ AMD is a common problem for mining of any form, but large-scale, industrial coal mining techniques introduced in the past half century—such as longwall mining, mountaintop removal, and strip mining—are especially problematic because they increase exponentially the surface area of rock exposed to air and water. AMD is only one of the harms of unreclaimed mines; many further problems are caused by the deposition of overburden,

70. See JOEL B. EISEN, EMILY HAMMOND, JIM ROSSI, DAVID B. SPENCE & HANNAH J. WISEMAN, *ENERGY, ECONOMICS AND THE ENVIRONMENT* 106 (5th ed. 2020).

71. See, e.g., NEAL SHOVER, DONALD A. CLELLAND & JOHN LYNXWILER, *ENFORCEMENT OR NEGOTIATION: CONSTRUCTING A REGULATORY BUREAUCRACY* 17–18 (1986) (noting that surface mining accounted for 45% of U.S. coal production in 1970 and 59% by 1980). On the environmental effects of coal mining, see Arnold W. Reitze, Jr., *Old King Coal and the Merry Rapists of Appalachia*, 22 CASE W. RESV. L. REV. 650, 650 (1971) (“Daily, men and machines destroy or entomb thousands of acres of soil that took thousands of years to form, leaving behind them barren land and streams poisoned by acid running off the mine site.”).

72. “Despite all reclamation efforts by man and nature, and after the lapse of considerable time, about 2 million acres still need additional reclamation work—this is 3,125 square miles, or an area equal to the combined land area of the States of Delaware and Rhode Island.” *Surface Mining Reclamation: Hearings on S. 3132, S. 3126, and S. 217 Before the S. Comm. on Interior & Insular Affs.*, 90th Cong. 37 (1968) (statement of Stuart Udall, Secretary of the Interior), cited in Reitze, *supra* note 71, at 655.

73. The basic dangers associated with exposed and unreclaimed mined land were well-known by the 1960s. See, e.g., U.S. DEP’T OF THE INTERIOR, *SURFACE MINING AND OUR ENVIRONMENT: A SPECIAL REPORT TO THE NATION* (1967); Fred P. Bosselman, *The Control of Surface Mining: An Exercise in Creative Federalism*, 9 NAT. RES. J. 137, 138–44 (1969) (describing the effects of surface mining on the environment).

74. Bosselman, *supra* note 73, at 140; see also Ata Akcil & Soner Koldas, *Acid Mine Drainage (AMD): Causes, Treatment and Case Studies*, 14 J. CLEANER PROD. 1139 (2006). Note that AMD is a naturally-occurring process that results from the mere exposure of rock to air and water.

the destruction of habitat (such as streams ruined by valley fill operations), and soil contamination.⁷⁵

By the mid-1900s, it was evident not only that surface coal mining caused such problems, but that landowners and mine operators could not be relied upon to restore their land after mining operations were complete. A prescient economic analysis in 1939 concluded that “[t]he assessed value of strip-mined land will eventually be lowered so that local revenues will be curtailed and public institutions will suffer or cease to exist. . . . A huge reclamation task is created for future citizens to finance from public funds.”⁷⁶ Concerns of this sort led coal-state legislatures to enact a first wave of reclamation legislation.⁷⁷ These statutes were undemanding by today’s standards but, burdened by post-mining requirements, many exhausted coal mines became negative-value property.⁷⁸

Concern over mined land reclamation ultimately led Congress to enact the Surface Mining Control and Reclamation Act (SMCRA) in 1977.⁷⁹ The purpose of SMCRA was to induce coal-producing states to adopt regulatory programs at least as stringent as a baseline established by the statute.⁸⁰ Under SMCRA, mine operators are required to submit a reclamation plan prior to mine opening and to abide by the terms of the plan when reclamation takes place.⁸¹ Aware that mining firms could become insolvent before completing their legal duties, Congress also imposed financial assurance requirements to guarantee that funds would be available for reclamation if operators did not fulfill their obligations.⁸²

In theory, financial assurance requirements compel firms to internalize the costs of cleanup and protect the public from bearing those costs.

75. Bosselman, *supra* note 73, at 138–44.

76. H.W. Hannah & Bert Vandervliet, *Effects of Strip Mining on Agricultural Areas in Illinois and Suggested Remedial Measures*, 15 J. LAND & PUB. UTIL. ECON. 296, 300 (1939).

77. This legislation typically required mine operators to perform minimal backfilling or reclamation upon mine closure. *See generally* Robert G. Meiners, *Strip Mining Legislation*, 3 NAT. RES. J. 442, 442 (1963) (noting that after West Virginia passed the first such legislation in 1939, five of the six other principal coal mining states—Indiana, Illinois, Pennsylvania, Ohio, and Kentucky—also did so between 1941 and 1954).

78. Early reclamation laws were often not vigorously enforced. SHOVER ET AL., *supra* note 71, at 20. Nonetheless, it became clear that “the costs and returns are not usually such that an outside investor would look at strip mine reclamation as an attractive venture.” David B. Brooks, *Strip Mine Reclamation and Economic Analysis*, 6 NAT. RES. J. 13, 28 (1966).

79. Pub. L. No. 95-87, 91 Stat. 445(1977) (codified at 30 U.S.C. § 1201).

80. 30 U.S.C. § 1253.

81. § 1253(a)(1), § 1258 (together mandating that states require reclamation and providing the substance of the reclamation plan requirement).

82. § 1259. These provisions, of course, apply prospectively to future mining applicants. SMCRA also addressed existing mines by creating an Abandoned Mine Reclamation Fund. U.S. GOV’T ACCOUNTABILITY OFF., GAO-18-305, COAL MINE RECLAMATION: FEDERAL AND STATE AGENCIES FACE CHALLENGES IN MANAGING BILLIONS IN FINANCIAL ASSURANCES 7 n.17 (2018) [hereinafter GAO 2018 REPORT]. As of Sept. 30, 2017, the Fund had paid out approximately \$3.9 billion, but at least \$10.2 billion in reclamation work remains for mines abandoned before 1977. *Id.* at 8.

SMCRA requires mining applicants to obtain bonds for “faithful performance” of reclamation duties, in an amount to be “determined by the regulatory authority” and “sufficient to assure the completion of the reclamation plan if the work had to be performed by the regulatory authority in the event of forfeiture.”⁸³ In a critical examination of the bonding regime, a good first question is simply: are regulators setting bond amounts high enough to provide adequate funds to clean up abandoned mines?

It is not hard to find substantial evidence that the answer is no. The coal industry has recently experienced a dramatic wave of bankruptcies, afflicting even the largest coal producers in the country.⁸⁴ Amidst this financial turmoil, many worried whether existing financial assurances would be sufficient to reclaim mined land should the coal firms ultimately fail.⁸⁵ Members of Congress requested a study on the matter from the Government Accountability Office (GAO).⁸⁶ The GAO reported that of the 450 bond forfeitures in the previous decade, some twenty-two percent “did not cover the cost of the required reclamation,” and in another twenty-six percent it remains too early to tell if the bond amount will be sufficient.⁸⁷ The problem, of course, is obvious and endemic to bond requirements: they establish a bond amount before reclamation work is undertaken. If cleanup costs were estimated incorrectly or if unanticipated costs arise, it may be too late to increase the bond amount or to obtain payment for the additional costs.⁸⁸ It has proven difficult in the extreme for regulators to know with precision, before a shovel has broken the earth, how much money will be

83. § 1259(a).

84. The list of coal producers recently filing for bankruptcy includes all the largest producers in the United States: Peabody Energy, Arch Coal, Cloud Peak Energy, and Alpha Natural Resources. See generally Daniel Moritz-Rabson, *Eleven Coal Companies Have Filed for Bankruptcy Since Trump Took Office*, NEWSWEEK (Oct. 30, 2019, 2:36 PM), <https://www.newsweek.com/eight-coal-companies-have-filed-bankruptcy-since-trump-took-office-1468734> [<https://perma.cc/NDJ3-EJSR>]; Mead Gruver, *Third-Biggest US Coal Company Files for Bankruptcy*, ABC NEWS (May 10, 2019, 5:28 PM), <https://abcnews.go.com/US/wireStory/biggest-us-coal-company-files-bankruptcy-62968055> [<https://perma.cc/MLG3-MLTC>]; Arathy S. Nair, *Peabody Chapter 11 Tops String of U.S. Coal Bankruptcies*, REUTERS (Apr. 15, 2016, 3:00 PM), <https://www.reuters.com/article/us-usa-coal-bankruptcy/peabody-chapter-11-tops-string-of-u-s-coal-bankruptcies-idUSKCN0XC2KQ> [<https://perma.cc/MVD6-UTZF>].

85. See, e.g., Editorial, *Will Big Coal Pay to Clean Up Its Messes?*, N.Y. TIMES (June 10, 2016), <https://www.nytimes.com/2016/06/10/opinion/will-big-coal-pay-to-clean-up-its-messes.html> [<https://perma.cc/5EAC-WSX2>]; John W. Miller & Dan Frosch, *Coal Miners Pressed on Cleanup Costs*, WALL ST. J. (July 17, 2015, 12:38 PM), <https://www.wsj.com/articles/coal-miners-pressed-on-cleanup-costs-1437151107> [<https://perma.cc/NMW8-GQQH>].

86. GAO 2018 REPORT, *supra* note 82.

87. *Id.* at 13. The GAO’s numbers aggregate national data; the problem may be more severe in particular locales. The Lexington Field Office of the Office of Surface Mining Reclamation and Enforcement (OSMRE), for example, estimated that within the State of Kentucky, “56% of permits did not have sufficient bond to reclaim the permit to permanent program standards.” LEXINGTON FIELD OFFICE, OSMRE, 2017 ANNUAL EVALUATION REPORT 9, www.odocs.osmre.gov [<https://perma.cc/A6L5-35R6>].

88. GAO 2018 REPORT, *supra* note 82, at 24–25.

required to pay for environmental restoration when a mine closes, decades later.⁸⁹

Moreover, it has become commonplace for coal producers to avoid posting third-party bonds in the first place by way of a loophole called self-bonding.⁹⁰ SMCRA allows state regulators to “accept the bond of the [mining permit] applicant itself without separate surety when the applicant demonstrates . . . a history of financial solvency and continuous operation.”⁹¹ The applicant’s “bond” is simply a promise to carry out the reclamation plan or pay an equivalent amount.⁹² So self-bonding is not bonding at all, but simply an exemption to the bonding requirement for coal producers who are then financially healthy.⁹³ A number of the largest coal mining states have chosen to allow self-bonding, including West Virginia, Wyoming, Virginia, and Texas.⁹⁴

What happens when self-bonded coal producers encounter financial difficulties? In theory, regulators could require them to replace self-bonds with more secure instruments, but in practice, regulators may not become aware of such difficulties until it is too late.⁹⁵ Financial disclosures may be dated or may not reveal the financial peril of a parent corporation or subsidiary.⁹⁶ And SMCRA regulations allow coal producers a full ninety days to procure replacement bonds.⁹⁷ In one recent instance, a major coal

89. For example, many former mining sites require ongoing water pollution management, but the duration for which water treatment is required can range from several years to many decades. One may assume that regulators improve in their ability to estimate reclamation costs, but the lapse in time between the permitting process and mine closure—often between 30–50 years—virtually guarantees that remediation practices will change and that regulators’ understanding of the relevant harms will evolve. *See, e.g.*, William E. Toffey, Charles R. Miller & L. Douglas Saylor, *Two Decades of Mine Reclamation: Lessons Learned from One of the Nation’s Largest Biosolids Beneficial Use Programs*, ht [tp://www.dep.state.pa.us/dep/subject/advoun/minrec/Reclamtn.pdf](http://www.dep.state.pa.us/dep/subject/advoun/minrec/Reclamtn.pdf) [<https://perma.cc/PW6J-GUYF>].

90. *See generally* JAYNI FOLEY HEIN, BEN SNOW, SEAN STEFANIK & LAUREN WEBB, INST. FOR POL’Y INTEGRITY, SELF-BONDING IN AN ERA OF COAL BANKRUPTCY (2016).

91. 30 U.S.C. § 1259(c).

92. Note that a self-bond, like any other bond, is not *even* a promise to pay the full costs of reclamation. It is a commitment to indemnify the regulatory authority for the cost of carrying out the reclamation plan, such costs “not to exceed the bond amount.” 30 C.F.R. § 800.23(e)(4). But the bond amount is established by the regulator at the time the mine is permitted. *See* 30 C.F.R. § 800.14. Thus it is the regulator, and not the firm, that bears the risk of underestimating the costs of reclamation.

93. More cynically, it’s also a way of providing a competitive advantage to large, secure firms as against smaller upstarts, which may provide a clue as to how this provision gained political support.

94. GAO 2018 REPORT, *supra* note 82, at 11–12.

95. *Id.* at 20–24.

96. There is, as is well known, a pervasive informational asymmetry between the firm and the regulator; the required disclosures that a firm makes to the regulator mitigate that asymmetry, but only imperfectly. “[T]he financial relationships between parent and subsidiary companies have become increasingly complex, making it difficult to ascertain an operator’s financial health on the basis of information reported in company financial and accounting documents . . .” *Id.* at 20.

97. If a firm’s financial condition changes and the firm ceases to be eligible for self-bonding, SMCRA regulations require the firm to notify the regulator immediately. The firm then has 90 days to “post an alternate form of bond in the same amount as the self-bond.” 30 C.F.R. § 800.23(g).

producer filed for bankruptcy even before the ninety-day period had elapsed, and without obtaining replacement bonds.⁹⁸

There is also a more pervasive logic at work that reduces the incentive of even the most stringent regulator to demand replacement bonds. When a coal firm falls upon truly hard times, the regulator may fear that imposing the cost of external bonds on the firm will drive it out of business entirely, leaving the regulator with even less money for reclamation than might otherwise remain.⁹⁹ Regulators need mines to remain operative in order to generate revenue for reclamation; requiring bonds diminishes this revenue. This makes it difficult for regulators to demand financial assurances at the very moment they are most needed, and thus undermines the very purpose and effectiveness of the bonding requirement.

A formal bankruptcy filing exacerbates these patterns. In a pathbreaking recent article, Joshua Macey and Jackson Salovaara describe how coal producers have exploited the bankruptcy process in recent years to evade reclamation and other regulatory obligations.¹⁰⁰ These researchers undertook a painstaking analysis of the bankruptcy documents filed by Patriot Coal, Peabody, Arch Coal, and Alpha Natural Resources—four of the largest U.S. coal producers, each of which has filed for bankruptcy since 2015.¹⁰¹ These records demonstrate that coal firms used their financial distress as a negotiating point in discussions with state regulators, well aware that regulators ultimately depend on the firms' survival for reclamation to occur. In several instances, coal firms explicitly traded on their self-bonding status in order to trim reclamation obligations.¹⁰² Here is how Macey and Salovaara describe these transactions:

The first part of [Alpha Natural Resources'] strategy was simple. As part of the bankruptcy proceedings, Alpha cut deals with Wyoming and West Virginia regulators which allowed the company to continue mining, even though it no longer met the self-bonding requirements and could not post alternative bonds. For instance, Alpha granted

98. See Joshua Macey & Jackson Salovaara, *Bankruptcy as Bailout: Coal Company Insolvency and the Erosion of Federal Law*, 71 STAN. L. REV. 879, 897 n.82 (2019) (describing the bankruptcy filing of Alpha Natural Resources in 2015).

99. GAO 2018 REPORT, *supra* note 82, at 21–22; see also Macey & Salovaara, *supra* note 98, at 897–98.

100. Macey & Salovaara, *supra* note 98.

101. Nair, *supra* note 84.

102. See, e.g., Dylan Brown, *Alpha, W.Va. Finalize Mine Cleanup Deal*, E&E NEWS PM (Jul. 13, 2016), <https://www.eenewspm/stories/1060040237/search?keyword=Dylan+Brown> [<https://perma.cc/D7ZS-4J24>]. In at least one instance (the Wyoming deal with Alpha), the federal Office of Surface Mining and Reclamation Enforcement (OSMRE) has explicitly declared a state-negotiated deal to run afoul of bonding requirements in federal law. Dylan Brown, *Feds Slap Wyo. over Alpha's Liabilities*, GREENWIRE (July 13, 2016), <https://www.eenews.net/greenwire/stories/1060040226/search?keyword=Dylan+Brown> [<https://perma.cc/7NH5-QHQJ>].

Wyoming a \$61 million superpriority claim to cover the company's \$411 million of reclamation bonding obligations in that State. Similarly, Alpha granted West Virginia a \$24 million superpriority claim and a \$15 million letter of credit to cover the company's \$244 million of reclamation obligations in that State. Although Alpha owed a total of \$655 million in reclamation liabilities, state regulators agreed to accept a superpriority claim on only \$85 million in the event that the company stopped operating. This arrangement seemingly gave Alpha a legal right to abandon over \$500 million in cleanup costs that the company would have had to pay had it been forced to liquidate.¹⁰³

Bankruptcy declarations impede the dollar-for-dollar replacement of self-bonds envisioned by SMCRA regulations. But bankruptcy does more damage than that. The recent spate of coal bankruptcies demonstrates vividly how the Chapter 11 reorganization process¹⁰⁴ enables coal producers to restructure selectively, placing high-performing assets into one successor corporation and assets saddled with reclamation liabilities into another. Macey and Salovaara's work is instructive here again, as their account explains in detail how Chapter 11 was used by Peabody, Arch, and other major coal firms to create successor entities that were destined for bankruptcy, while other successors—those no longer responsible for defunct mines—were set up for success.¹⁰⁵

Viewed against the long history of abandoned coal mines, the current state of affairs is striking. There is a wealth of evidence that, even under the strictures of modern law, coal producers are quite successfully shirking responsibility for mine reclamation. Reclamation rules are under-inclusive in that they generally do not require the complete abatement of environmental harms; financial assurance requirements are insufficient in that they under-estimate the cost of reclamation and often allow self-bonding; and the bankruptcy process allows firms to shed reclamation liabilities by reorganizing. That these problems persist, some forty years after the passage of SMCRA, testifies to the enduring difficulty of managing the temporal spillovers that inhere in negative-value property.

103. Macey & Salovaara, *supra* note 98, at 919 (footnotes omitted).

104. 11 U.S.C. §§ 1101–1195.

105. Macey & Salovaara, *supra* note 98. Patriot Coal, for example, was in such a precarious financial situation as it emerged from bankruptcy that it was “created to fail” in the view of the United Mine Workers of America. *Id.* at 913 (quoting Ken Ward Jr., *Patriot Bankruptcy Heating Up*, CHARLESTON GAZETTE-MAIL (Aug. 25, 2012), https://www.wvgazette.com/news/special_reports/patriot-bankruptcy-case-heating-up/article_0ca4d57b-09cd-5153-8d9b-5a0126a011d4.html [<https://perma.cc/6DMK-GH3M>]). Even the CEO acknowledged that the firm at its inception had “too many liabilities and not enough assets.” *Id.*

2. Oil and Gas Wells

Oil and gas production is widespread in the United States in part because, unlike most other countries, American property law generally allows landowners to develop mineral resources lying beneath the surface of their land.¹⁰⁶ Thanks to the rule of capture, the law also shields producing landowners from liability when they drain oil and gas from neighboring parcels.¹⁰⁷ The neighbor's only remedy is to drill a well on his or her tract and withdraw more oil from the same common pool.¹⁰⁸ This resource race dynamic, atop a continent saturated with fossil fuels, led to drilling boom after drilling boom during the twentieth century.

Photos from oil-rich Texas and California taken in the early 1900s show hundreds of rigs crammed just feet apart where “gushers” had been found, as fortunate landowners capitalized by selling land bit by bit to greedy speculators.¹⁰⁹ This cheek-by-jowl pattern of intensive drilling had the unfortunate consequence of dissipating the natural pressure or “drive” that propels oil and gas to the surface.¹¹⁰ Oil country was soon littered with countless defunct wells. Still today, instead of a small number of efficient and high-producing wells as is typical in other oil regions, the United States has an enormous proportion of low-producing wells.¹¹¹ Here the mean production quantity is on the order of 11 barrels per well per day; in Saudi Arabia, it is far closer to 6,000 barrels.¹¹² Some three million wellbores have

106. Joel B. Eisen, Emily Hammond, Jim Rossi, David B. Spence, Jacqueline L. Weaver & Hannah J. Wiseman, *Energy, Economics and the Environment* 149 (4th ed., 2015) (noting that “[i]n virtually all other countries of the world [besides the United States], the state owns the mineral resources”).

107. See TERENCE DAINITH, *FINDERS KEEPERS? HOW THE LAW OF CAPTURE SHAPED THE WORLD OIL INDUSTRY* 7 (2010). See generally *id.* (a comparative analysis of capture principles from several jurisdictions).

108. “If, then, the landowner drills on his own land at such a spot as best subserves his purposes, what is the standing of the adjoining landowner whose oil or gas may be drained by this well? He certainly ought not to be allowed to stop his neighbor from developing his own farm. . . . What then can the neighbor do? Nothing: only go and do likewise. He must protect his own oil and gas. He knows it is wild and will run away if it finds an opening and it is his business to keep it at home.”

Barnard v. Monongahela Nat. Gas Co., 65 A. 801, 802 (Pa. 1907).

109. See, e.g., *Spindletop History*, LAMAR UNIV. <https://www.lamar.edu/spindletop-gladys-city/spindletop-history.html> [<https://perma.cc/YF42-H6R2>].

110. In many instances, an oil field's natural drive was depleted after just a tiny fraction of the field's oil had been produced—perhaps just 3–5%. EISEN ET AL., *supra* note 106, at 165–66 (noting that less than 5% of the Spindletop field's oil was produced under its natural drive). To produce the remaining oil and gas, landowners had to install pumps or repressurize the oil field artificially.

111. See U.S. ENERGY INFO. ADMIN., *THE DISTRIBUTION OF U.S. OIL AND NATURAL GAS WELLS BY PRODUCTION RATE* 5 (2018) (“In 2017, 81% of the nearly 1 million [active] U.S. wells produced 15 or fewer BOE [barrels of oil equivalent]/day . . .”).

112. 2 *ENERGY LAW & TRANSACTIONS* (David J. Muchow & William A. Mogel, eds. 1999) App. 10 51–52, cited in EISEN ET AL., *supra* note 106, at 174–75.

been drilled across the United States, and the majority of these wells are now dry holes, no longer in active production.¹¹³

What happens to these wells? A distressing number are simply abandoned. As the Wall Street Journal recently reported, “[d]rilling booms historically leave legions of idle wells that become state or federal wards.”¹¹⁴ Wyoming, for example, is currently sitting on perhaps 4,000 idle and abandoned wells,¹¹⁵ and the problem is likely larger in Colorado, Texas, and other oil and gas states.¹¹⁶ The COVID-19 pandemic, and its dramatic effect on global oil markets, will almost certainly lead to an increase in abandoned wells.¹¹⁷

The incentive to abandon idle wells is substantial. They yield no income and may require significant expenditure related to well closure or well site cleanup.¹¹⁸ Unattended well sites are associated with methane emissions and water pollution.¹¹⁹ Although the release of liquids and gases slows over

113. See Mary Kang et al., *Identification and Characterization of High Methane-Emitting Abandoned Oil and Gas Wells*, 113 PROC. NAT’L ACAD. SCIS. 13636, 13636 (2016). Some estimates posit as many as twelve million wells. See, e.g., Nicholas Kusnetz, *Deteriorating Oil and Gas Wells Threaten Drinking Water, Homes Across the Country*, ANCHORAGE DAILY NEWS (updated Dec. 2, 2017), <https://www.adn.com/energy/article/deteriorating-oil-and-gas-wells-threaten-drinking-water-homes-across-country/2011/04/07/> [<https://perma.cc/3T3D-WGE6>].

114. Dan Frosch & Russell Gold, *How ‘Orphan’ Wells Leave States Holding the Cleanup Bag*, WALL ST. J., Feb. 25, 2015.

115. See Stephanie Joyce, *Oil Crash Raises New Fears About Abandoned Wells*, INSIDE ENERGY (Sept. 25, 2015), <http://insideenergy.org/2015/09/25/oil-crash-raises-new-fears-about-abandoned-wells/> [<https://perma.cc/NZ48-2AGL>]; see also Irina Zhorov, *Coalbed Methane Bust Leaves Thousands of Orphaned Gas Wells in Wyoming*, HIGH COUNTRY NEWS, Jan. 1, 2014 (noting that “Wyoming has about 1,200 abandoned wells”).

116. See Bruce Finley & Joe Murphy, *Colorado Land Impact of Oil and Gas Boom: Scars Spread and Stay*, DENVER POST, Mar. 1, 2015; Dave Fehling, *Texas Lawmakers Worry How State Will Keep up with Abandoned Oil Wells*, HOUSTON PUB. MEDIA (Mar. 7, 2016, 5:16 PM), <https://www.houstonpublicmedia.org/articles/news/2016/03/07/140534/texas-lawmakers-worry-how-state-will-keep-up-with-abandoned-oil-wells/> [<https://perma.cc/C6EX-GHJ8>].

117. Richards, *supra* note 6; Nichola Groom, *Special Report: Millions of Abandoned Oil Wells Are Leaking Methane, a Climate Menace*, REUTERS (June 16, 2020, 6:14 AM) <https://www.reuters.com/article/us-usa-drilling-abandoned-specialreport/special-report-millions-of-abandoned-oil-wells-are-leaking-methane-a-climate-menace-idUSKBN23N1NL> [<https://perma.cc/HF97-DGFA>] (noting that “drilling companies are likely to abandon many more wells due to bankruptcies, as oil prices struggle to recover from historic lows after the coronavirus pandemic crushed global fuel demand, according to bankruptcy lawyers, industry analysts and state regulators”).

118. Hannah J. Wiseman, *Risk and Response in Fracturing Policy*, 84 U. COLO. L. REV. 729, 765–75, 788–92, 799–01 (2013) (describing in detail various well site risks).

119. See Mya Frazier, *Gas Companies Are Abandoning Their Wells, Leaving Them to Spew Methane Forever*, BLOOMBERG (Sept. 17, 2020, 3:05 PM), <https://www.bloomberg.com/news/features/2020-09-17/abandoned-gas-wells-are-left-to-spew-methane-for-eternity> [<https://perma.cc/E2MK-WCRK>]. See also, e.g., K.S.A. § 55-179(d) (declaring that “any well which has been abandoned, in fact, and has not been plugged . . . shall be and is hereby deemed likely to cause pollution of any usable water strata or supply . . .”).

the life of a well, it never ceases completely.¹²⁰ Releases from idle wells can cause significant harms and, to make matters worse, such releases may go undetected for many years precisely because the well is unmonitored or has been abandoned.¹²¹ For this reason, oil and gas states require drillers to plug old wells as they are taken out of production.¹²² In the early years of the oil and gas industry, depleted or “dry” wells were simply left uncovered or capped with wood or brush.¹²³ Hundreds of thousands, perhaps even millions, of abandoned wells remain in such a condition.¹²⁴ A wood or brush cap, of course, cannot reliably prevent gaseous or liquid releases. More recent drilling regulations require that cement be used to seal the top of the wellbore and to create plugs at various intervals along the wellbore.¹²⁵

Effective plugging is not inexpensive: the cost of carrying out a plugging and abandonment operation depends primarily on the length of the wellbore, and as drilling operations have extended deeper into the earth, costs have

120. Even the McClintock Well #1, located at the Drake Well Museum in Titusville, Pennsylvania, where the American oil industry was launched, continues to produce a small amount of oil to this day. See *McClintock Well #1*, DRAKE WELL MUSEUM AND PAK, <https://www.drakewell.org/what-to-see-and-do/mcclintock-well-1> [<https://perma.cc/2GXL-3MEN>].

121. See generally Jaqueline Ho, Alan Krupnick, Katrina McLaughlin, Clayton Munnings & Jhih-Shyang Shih, *Plugging the Gaps in Inactive Well Policy* (2016), <https://media.rff.org/documents/RFF-Rpt-PluggingInactiveWells.pdf> [<https://perma.cc/3C4Q-ZWCH>]; Kate Galbraith, *Abandoned Oil Wells Raise Fears of Pollution*, N.Y. TIMES, June 8, 2013; Nicholas Kusnetz, ProPublica, *Deteriorating Oil and Gas Wells Threaten Drinking Water Across the Country*, SCI. AM., Apr. 4, 2011.

122. See, e.g., OKLA. ADMIN. CODE § 165:10-11-3; TEX. ADMIN. CODE, title 16, pt. 1, ch. 3, § 3.14.

123. An early Pennsylvania law, for example, required well operators to “plug their oil wells, at proper depth, with wood and sediment, in a manner sufficient to exclude all fresh water from oil-bearing rock, and to prevent the flow of oil and gas into fresh water.” WILLIAM WHEELER THORNTON, 2 THE LAW RELATING TO OIL AND GAS 1461 (3d ed. 1918) (listing a 1913 Pennsylvania statute on plugging of oil and gas wells); see also Technology Subgroup of the Operations & Environment Task Group, *Plugging and Abandonment of Oil and Gas Wells* (NPC N. Am. Res. Dev. Study, Working Paper No. 2-25, 2011) [hereinafter National Petroleum Council], https://www.npc.org/Prudent_Development-Topic_Papers/2-25_Well_Plugging_and_Abandonment_Paper.pdf [<https://perma.cc/VX5X-KAAZ>]. For an eye-opening account of the damage that can result from uncapped wells, see Jim Malewitz, *In West Texas, Abandoned Well Sinks Land, Sucks Tax Dollars*, TEXAS TRIB. (Jan. 22, 2017, 12:00 AM), <https://www.texastribune.org/2017/01/22/west-texas-abandoned-well-sinks-land-sucks-tax-dol/> [<https://perma.cc/287N-VB3Q>].

124. It is difficult to estimate the number of abandoned wells with precision. In New York, for example, experts suggest that as many as half of the state’s abandoned wells are “forgotten,” their locations unknown. Ronald E. Bishop, *Historical Analysis of Oil and Gas Well Plugging in New York: Is the Regulatory System Working?*, 23 NEW SOLS. 103, 104–105 (2013).

125. Technology Subgroup of the Operations & Environment Task Group, *supra* note 123, at 7; HO ET AL., *supra* note 121, at 35–39 (describing heterogeneity of well plugging requirements).

soared.¹²⁶ Whereas older wells could be plugged for perhaps several thousand dollars, plugging a deep modern well can easily cost \$100,000.¹²⁷

As with surface coal mines, the imposition of costly end-of-life requirements for oil and gas wells threatened to push the value of many wells into the red. Wells that previously might have been regarded as low-value or zero-value came to represent a clear liability to their owners. And as with surface coal mines, the emergence of this liability led to patterns and practices within the oil and gas industry that cut against the fulfillment of well-closure requirements.

The most important pattern by far is a tendency towards delay. Faced with the prospect of expensive plugging and abandonment procedures, oil and gas firms tend to delay well closure as long as possible. Even without plugging costs, producers have no incentive to hasten well closure and every incentive to wait: underperforming wells that are uneconomical under certain price conditions may, if oil prices rise, become profitable in the future. For this reason, it has long been industry practice, in many instances,

126. "Plugging and abandonment" (or simply "P&A") is industry jargon for this category of expenditure; the term "abandonment," in this context, refers to the business decision to terminate well production, rather than a legal process of abandoning ownership.

127. See Stephanie Joyce & Jordan Wirfs-Brock, *The Rising Cost of Cleaning Up After Oil and Gas*, INSIDE ENERGY (Oct. 1, 2015), <http://insideenergy.org/2015/10/01/the-rising-cost-of-cleaning-up-after-oil-and-gas/> [<https://perma.cc/WB64-8X8Z>] (noting the relationship between well depth and plugging cost). The most expensive well plugging operation mentioned in this article cost a whopping \$527,829. Well plugging and abandonment cost estimates vary greatly based on well characteristics and reclamation practices and requirements. Some reports assume a per-well cost as low as \$15,000; other estimates stretch into the millions of dollars. Compare OFF. OF THE INSPECTOR GEN., U.S. DEP'T OF THE INTERIOR, REP. NO. 2016-EAU-061, BUREAU OF LAND MANAGEMENT'S IDLE WELL PROGRAM 4 (2018) (assuming a cost of \$15,000 per well in one field office), with Lucija Muehlenbachs, *80,000 Inactive Oil Wells: A Blessing or a Curse?*, UNIV. CALGARY SCH. PUB. POL'Y BRIEFING PAPER, Feb. 2017, at 2 (citing estimates ranging from \$50,000 to several million dollars per well).

Plugging and abandonment costs have been rising, even for shallow wells, for several reasons. First, industry and regulatory standards have been tightened in response to emerging information about, in particular, methane leakage from oil and gas wells, which contributes to climate change. Second, unconventional production near existing oil fields often involves unintentional stimulation or repressurization of those fields, which can cause previously idled or abandoned wells to leak. See Shane Hoover, *Special Report: Uncovering Abandoned Oil and Natural Gas Wells*, CANTONREP.COM (July 16, 2015, 9:58 AM) <https://www.cantonrep.com/article/20150716/SPECIAL-REPORTS/150719981> [<https://perma.cc/P9Q6-2YTF>] ("When abandoned wells are near the rock layer being fractured, the increased underground pressure can cause the old wells to leak oil and gas, similar to the way squeezing a juice box squirts liquid from the straw."); see also Richard J. Davies et al., *Oil and Gas Wells and Their Integrity: Implications for Shale and Unconventional Resource Exploitation*, 56 MARINE & PETROLEUM GEOLOGY 239 (2014); Mary Kang et al., *Direct Measurements of Methane Emissions from Abandoned Oil and Gas Wells in Pennsylvania*, 111 PROC. NAT'L ACAD. SCI. 18173 (2014); Amy Townsend-Small, Thomas W. Ferrara, David R. Lyon, Anastasia E. Fries & Brian K. Lamb, *Emissions of Coalbed and Natural Gas Methane from Abandoned Oil and Gas Wells in the United States*, 43 GEOPHYSICAL RSCH. LETTERS 2283 (2016); Jennifer Oldham, *In the Birthplace of U.S. Oil, Methane Gas Is Leaking Everywhere*, BLOOMBERG (June 20, 2016, 8:01 AM), <https://www.bloomberg.com/news/articles/2016-06-20/in-the-birthplace-of-u-s-oil-methane-gas-is-leaking-everywhere> [<https://perma.cc/AWT7-LGMR>].

to maintain a portfolio of marginal, idle wells.¹²⁸ Even when such wells no longer fit into a producer's strategy—perhaps because they are unlikely to become profitable—the typical move is to sell them to another firm with a different risk profile, rather than to undertake expensive plugging and abandonment procedures. In the words of one oil and gas executive:

I think you will find that it is rare for the larger companies to plug and abandon their older wells. Rather, at some point, a smaller company with lower overheads and less expensive operating costs will offer to buy the old wells at a price that gives the original company a better return than continued operations. The original company uses the cash to finance new investments. The buying company operates with lower costs because they spend less on maintenance and safety items and they have fewer well-qualified people to pay. The chain may end there or continue through smaller and ever lower cost operators who do no preventive maintenance at all, do the bare minimum of repairs to keep the well going and eventually walk away, maybe after plugging the hole as cheaply as possible and maybe not plugging at all.

In conventional fields these selling/buying cycles might start when the field is 20-30 years old and run for another 20-30 years. By the time these wells are abandoned, the casings have been subjected to corrosive fluids for many years. When it costs too much to repair versus what might be produced, the well is abandoned. Whether it is plugged before it is abandoned depends on the final operator. In tight shale this could all take place over a much shorter time period and the abandoned wells could increase quickly.¹²⁹

This dynamic is exacerbated, of course, by the rising cost of plugging and abandonment, which increases the incentive to delay. The result is that unproductive, unplugged wells are legion in oil and gas territory and that producers hew tightly to the fiction that such wells should not be closed because they may one day become productive again. Perhaps they will—but it is likely that most will simply remain idle until their owners go belly-up, at which point the plugging and abandonment costs may well wind up at the feet of taxpayers.¹³⁰

128. See, e.g., Muehlenbachs, *supra* note 127, at 5-6 (describing operators' incentive to delay plugging and abandonment in order to maintain the possibility of future production).

129. Bishop, *supra* note 124, at 107 (quoting from personal communication received by the author in January 2012 from Louis W. Allstadt, retired Executive Vice President of Mobil Oil Corporation).

130. See Muehlenbachs, *supra* note 127, at 2 (noting that a "significant increase in the number of reactivated oil and gas wells" is unlikely absent implausible conditions, implying that wells are "left suspended not because of the option to reactivate, but rather to avoid costly environmental obligations . . . introducing a high risk of potential future liability for both the industry and taxpayers").

To counteract this pattern, oil and gas states (as well as the U.S. federal government, in certain instances) have enacted financial assurance requirements, just as they did for coal mines.¹³¹ But also as with coal mines, financial assurance requirements are plagued with difficulties. Simply keeping track of existing wells and their status is an enormous challenge; much more could be said about this, but suffice it to say that well data is often imprecise at best.¹³² And when, exactly, should a government agency insist upon closure?¹³³ Tracking well productivity is difficult, as is assessing the profitability of marginally-performing wells. Temporarily idled wells may one day be placed back into production, so even when a firm has gone bankrupt, it may not be clear that its portfolio of wells should be forever sealed.¹³⁴ Perhaps the wells will be purchased and further developed by a successor entity.

Moreover, bonding requirements take a one-size-fits-all approach in that they typically establish a uniform bond amount, applicable to all wells, despite the fact that the cost of well closure is highly variable.¹³⁵ The per-well amount is often far too low to cover the actual cost of proper closure.¹³⁶ Most jurisdictions also allow a blanket cap on bonding: once an operator has bonded a certain number of wells, no further bonding is required.¹³⁷ As

131. See, e.g., Lucas W. Davis, *Bonding Requirements for U.S. Natural Gas Producers*, 9 Rev. ENV'T ECON. & POL'Y 128 (2015); U.S. GOV'T ACCOUNTABILITY OFF., GAO-10-245, OIL AND GAS BONDS: BONDING REQUIREMENTS AND BLM EXPENDITURES TO RECLAIM ORPHANED WELLS (2010).

132. See, e.g., U.S. Dep't of Interior, Off. of Inspector Gen., *supra* note 127 (noting deficiencies in BLM's tracking program); U.S. GOV'T ACCOUNTABILITY OFF., GAO-18-250, OIL AND GAS WELLS: BUREAU OF LAND MANAGEMENT NEEDS TO IMPROVE ITS DATA AND OVERSIGHT OF ITS POTENTIAL LIABILITIES (2018) (describing shortcomings in BLM's oversight of bond adequacy) [hereinafter U.S. GAO].

133. Brian Maffly, *BLM Allows Old Unplugged Wells to Fester in Utah, Former Employee's Report Says*, SALT LAKE TRIB. (Mar. 30, 2015, 6:10 PM), <https://archive.sltrib.com/article.php?id=2347171&itype=CMSID> [<https://perma.cc/9PMC-4GR7>] (retired BLM well inspector identifies 557 unplugged wells, primarily in the Uinta Basin, that haven't produced in at least ten years).

134. See, e.g., Muehlenbachs, *supra* note 127 (discussing the possibility that unproductive wells may become profitable in the future).

135. See HO ET AL., *supra* note 121, at 11, 44–45.

136. See U.S. GOV'T ACCOUNTABILITY OFF., GAO-11-292, OIL AND GAS BONDS: BLM NEEDS A COMPREHENSIVE STRATEGY TO BETTER MANAGE POTENTIAL OIL AND GAS WELL LIABILITY 30–32 (2011); Ho et al., *supra* note 121, at 44–45; cf. Davis, *supra* note 131, at 140 (noting that a “blanket” bond often leads “to cases in which the available blanket bond was inadequate to pay for necessary cleanups on multiple sites”). A recent news account paints a grim picture along these lines: “Another company, Pure Petroleum, went bankrupt in 2011, after years of unpaid bills and violations for spills and poorly maintained well sites, leaving just a \$25,000 BLM bond and a \$93,045 state bond to cover 106 wells. In a letter to the state, co-owner Greg Karl wrote, ‘We have given every single dime Pure has made to our obligations and have lost our homes in doing so.’ To date, Wyoming has spent \$552,698 from its conservation tax fund cleaning up just five of Pure’s wells. The company also owes nearly \$1 million in state and federal taxes and fines. Meanwhile, Luca Technologies declared bankruptcy this year and is almost \$2 million short in bonds for just its 900 state and private wells, leaving the fate of those and its 400 federal wells uncertain.” Zhorov, *supra* note 115.

137. See Davis, *supra* note 131, at 140. See also, e.g., OKLA. STATS. § 52-318.1(C) (limiting bond exposure to \$100,000).

with self-bonding, this limitation is apparently intended to account for the financial integrity of larger producers. Instead, it yields inadequate bonding coverage.¹³⁸ And in any event, financial assurance requirements provide no remedy when previously completed plugging operations prove inadequate. Bonds are released upon the completion of a plugging and abandonment procedure, but not infrequently, previously plugged wells present new risks.¹³⁹ This may be because plugging was carried out improperly,¹⁴⁰ or because prior abandonment procedures did not anticipate new risks.

All these problems could easily be fixed by tightening bond requirements. But because bonds tie up operating capital, oil and gas firms resist increased bonding, and they have a record of political success.¹⁴¹ Many jurisdictions' bonding rules have not been updated in decades and reflect outmoded well plugging techniques.¹⁴² To compensate for the inadequacy of financial assurance rules, many oil and gas states also maintain abandoned well funds, usually bankrolled by taxes on oil and gas production, in order to pay for the closure of abandoned wells.¹⁴³ These programs vary in their size and efficacy, but most analysts expect that fund resources are insufficient for the population of wells requiring closure.¹⁴⁴

138. See Davis, *supra* note 131, at 140.

139. For example, abandoned conventional oil wells near an area of shale development can, if inadequately sealed, lead to a bevy of unintended consequences as the formation is stimulated. See, e.g., Bret Wells & Tracy Hester, *Abandoned but Not Forgotten: Improperly Plugged and Orphaned Wells May Pose Serious Concerns for Shale Development*, 8 MICH. J. ENV'T & ADMIN. L. 115, 121–22 (2018).

140. *Id.* For a harrowing urban account, see also Edward J. Boyer & Janet Wilson, *The Methane Down Below*, L.A. TIMES, July 30, 1999.

141. See, e.g., Mike Lee, *Sweeping Drilling Reforms Advance in Colo.*, E&E NEWS (Mar. 6, 2019, 9:02 AM) <https://www.eenews.net/stories/1060123259/> [<https://perma.cc/C7PD-DFGL>] (noting opposition to a legislative package including bonding reform, which opponents say “could cripple the state’s oil and gas industry”); Anne C. Mulkern, *State Hikes Bond Level Mandate for Oil and Gas Wells*, E&E NEWS (Sept. 11, 2013), <https://www.eenews.net/energywire/stories/1059987052> [<https://perma.cc/QW39-C7YF>] (describing industry opposition to major increases in bond levels, resulting in legislation that only increased levels “a little bit more than the rate of inflation”).

142. See, e.g., U.S. GAO, *supra* note 132, at 13 (noting that the Bureau of Land Management’s “minimum bond amounts were set in the 1950s and 1960s and have not been updated”); Sarah Terry-Cobo, *In a Bond Bind: Low Requirements Leave State Stuck With Bill for Abandoned Oil Wells*, THE JOURNAL RECORD (Nov. 21, 2012) (noting that Oklahoma’s bonding requirements have not been updated since 1986).

143. See, e.g., *State Managed Plugging*, RRC (last visited Feb. 2, 2021) <http://www.rrc.texas.gov/oil-and-gas/environmental-cleanup-programs/state-managed-plugging/> (describing Texas’s plugging program); *DEP Well Plugging Program*, PA. DEP’T OF ENV’T PROT., <https://www.dep.pa.gov/Business/Energy/OilandGasPrograms/OilandGasMgmt/LegacyWells/Pages/Well-Plugging-Program.aspx> [<https://perma.cc/GCD8-SES5>] (describing Pennsylvania’s program). Oklahoma’s program is unusual in that it relies not on taxation, but on a voluntary contribution of one-tenth of one percent of revenues. See OKLA. STAT. tit. 52 § 288.1–.12. The Oklahoma Energy Resources Board claims industry participation of ninety-five percent. See *Voluntarily Funded by the People of Oklahoma Oil & Natural Gas*, OKLAHOMA OIL & NATURAL GAS, <https://oerb.com/about/funding/> [<https://perma.cc/9RPD-BWKY>].

144. Joshua Zaffos, *‘Orphaned’ Oil and Gas Wells Are on the Rise*, HIGH COUNTRY NEWS (Jan. 16, 2018); Sophie Quinton, *Why ‘Orphan’ Oil and Gas Wells Are a Growing Problem for States*, PEW:

To summarize, then, the oil and gas industry presents a negative-value property dilemma that mirrors the case of surface coal mining in many respects. Bond coverage is required but leaves substantial gaps. Both per-well and blanket bonding amounts are inadequate to guarantee proper well closure. States have supplemented bond programs with abandoned well funds, but these funds are unlikely to cover even existing liabilities. An untold number of wells limp along, unlikely ever again to produce in paying quantities, yet not targeted for plugging and closure, leaving the public with a liability of unknown magnitude.¹⁴⁵

3. *Hardrock and Other Mines*

Most high school students learn about the California Gold Rush, but far fewer learn how thoroughly the American West was (and continues to be) scoured for valuable minerals.¹⁴⁶ Lead, copper, silver, uranium—these and many other minerals have been extracted in massive quantities throughout the region.¹⁴⁷ When the West was sparsely populated, mining activities tended to be of the cut-and-run variety. Minerals were extracted from relatively desolate landscapes, and mining sites were simply abandoned

STATELINE (July 9, 2018), <https://www.pewtrusts.org/en/research-and-analysis/blogs/stateline/2018/07/09/why-orphan-oil-and-gas-wells-are-a-growing-problem-for-states> [https://perma.cc/W6NN-XLY9]; HO ET AL., *supra* note 121, at 48.

145. All of this is to say nothing of the problem of abandoned *offshore* wells, which are harder to monitor and raise far greater and more expensive risks in an environment that is orders of magnitude more difficult for operations. Proper closure of exhausted wells is extraordinarily expensive, exceedingly dangerous, and tactically challenging. See Gus Lubin, *27,000 Abandoned Oil and Gas Wells in Gulf of Mexico Are Ignored by Government, Industry*, BUS. INSIDER (July 7, 2010, 10:03 AM), <https://www.businessinsider.com/27000-abandoned-oil-and-gas-wells-in-gulf-of-mexico-are-ignored-by-government-in-dustry-2010-7> [https://perma.cc/EF53-SR8T]; Nathaniel Gronewold, *Big Oil Grapples with Cost of Plugging Wells, Removing Equipment*, E&E NEWS (Mar. 14, 2017), <https://www.eenews.net/energywire/2017/03/14/stories/1060051392> [https://perma.cc/FG8H-YFU9] (describing how Big Oil resisted new rules that would have required larger financial assurance for rig decommissioning); Nathaniel Gronewold, *Derelict Rigs to Remain as Decommissioning Costs Skyrocket*, E&E NEWS (Mar. 23, 2017), <https://www.eenews.net/energywire/2017/03/23/stories/1060051922> [https://perma.cc/MCE3-J8 MX]; Nathaniel Gronewold, *U.S. Taxpayers Could Pay \$10B for Oil Rig Cleanup*, E&E NEWS (Apr. 9, 2019), <https://www.eenews.net/energywire/stories/1060149999> [https://perma.cc/H7ER-FAGB]; Margaret Kriz Hobson, *Study: Thousands of Wells Headed for Abandonment*, E&E NEWS (Feb. 22, 2019) https://www.eenews.net/energywire/stories/1060121963?show_login=1&t=https%3A%2F%2Fwww.eenews.net%2Fenergywire%2Fstories%2F1060121963 [https://perma.cc/26UH-P56Z]; Becky Bohrer, *BLM Releases Plan to Address Abandoned Arctic Oil Wells*, ANCHORAGE DAILY NEWS (July 2, 2016), <https://www.adn.com/alaska-news/article/blm-releases-plan-address-abandoned-arctic-oil-wells/2013/05/08/> [https://perma.cc/W52T-GNEX].

146. See generally OTIS E. YOUNG, JR., *WESTERN MINING: AN INFORMAL ACCOUNT OF PRECIOUS-METALS PROSPECTING, PLACERING, LODGE MINING, AND MILLING ON THE AMERICAN FRONTIER FROM SPANISH TIMES TO 1893* (1970); WILLIAM S. GREEVER, *THE BONANZA WEST: THE STORY OF THE WESTERN MINING RUSHES, 1848-1900* (1963).

147. See NAT'L MINING ASS'N, *THE ECONOMIC CONTRIBUTIONS OF U.S. MINING* (2012) 4 (2014) (providing estimates of mining's contributions to state GDP: in Wyoming, the estimate is 20.0%; in Nevada, 8.7%; in Montana, 6.1%).

when their purpose had been served.¹⁴⁸ The result is that Western lands are pockmarked with the scars of long-forgotten mining operations. Already by 1977, the EPA estimated that two million acres in America were “orphaned” mine lands.¹⁴⁹

Orphaned mines vary enormously in size, ranging from vast open pits (like the Berkeley Pit) to barely visible openings leading to underground mine shafts. Orphaned mines vary also in the risks they represent. Abandoned mines create acid mine drainage, taint both surface and subsurface water supplies, threaten wildlife, endanger users of the outdoors, and at the most extreme can lead to extraordinary contamination of large areas or waterways.¹⁵⁰ Some of the nation’s most expensive industrial waste cleanup sites are former mining sites.¹⁵¹ Mines associated with certain minerals carry special hazards: uranium mines, for example, have a particularly lethal legacy.¹⁵²

This section began with a brief description of the Berkeley Pit in Butte, Montana. The costs of ongoing management at that defunct copper mine are

148. See U.S. DEP’T OF THE INTERIOR, FS-891, ABANDONED MINE LANDS: A DECADE OF PROGRESS RECLAIMING HARDROCK MINES I (2007) (noting the itinerancy of early mining communities). Wallace Stegner’s award-winning novel *ANGLE OF REPOSE* (1971) poignantly captures the itinerant lifestyle associated with the mining industry a century ago. The protagonist moves from California to Mexico to Colorado to Montana, in the employ of various mining operations and ultimately the U.S. Geological Survey.

149. U.S. EPA, *Reclaiming ‘Orphan’ Lands*, EPA J., June 1977, at 10. Orphaned mines are those for which no operator can now be identified, and the present owner—if found—is unable or unwilling to remediate the site. Federal agencies have had difficulty numbering abandoned mines on federal lands. See generally U.S. GEN. ACCT. OFF., GAO/RCED-96-30, FEDERAL LAND MANAGEMENT: INFORMATION ON EFFORTS TO INVENTORY ABANDONED HARD ROCK MINES (1996); DEBORAH J. SHIELDS, DOUGLAS D. BROWN & THOMAS C. BROWN, U.S. DEP’T OF AGRICULTURE, U.S. FOREST SERVICE, RM-GTR-260, DISTRIBUTION OF ABANDONED AND INACTIVE MINES ON NATIONAL FOREST SYSTEM LANDS (1995). Many mine openings on private land are small inholdings (patented mining claims) within larger tracts of public land. Paul Stokstad, *Structuring a Reclamation Program for Abandoned Noncoal Mines*, 25 *ECOLOGY* L.Q. 121, 126–27 (1998). Regarding the difficulties with the inventory process, see *id.* at 141–42. For an account of the situation in Canada, see Joseph F. Castrilli, *Wanted: A Legal Regime to Clean Up Orphaned / Abandoned Mines in Canada*, 6 *MCGILL INT’L J. SUST. DEV. L. & POL’Y* 109 (2010).

150. The Bureau of Land Management maintains a detailed website about the problem at BUREAU OF LAND MGMT., ABANDONEDMINES.GOV, <https://www.abandonedmines.gov> [<https://perma.cc/WYV3-TNF6>]. See also Scott Fields, *The Earth’s Open Wounds: Abandoned and Orphaned Mines*, 111 *ENV’T HEALTH PERSP.* A154 (2003); U.S. DEP’T OF THE INTERIOR, BUREAU OF LAND MGMT., BLM/RS/GI-99/002+3595, *Abandoned Mines are Potential Killers* (1999); U.S. DEP’T OF THE INTERIOR, *supra* note 148. As only one example of the dangers posed by abandoned mines, the breach of an impoundment from an abandoned mine in southwestern Colorado made national headlines in August 2015 when it turned the Animas River bright yellow. See, e.g., Richard Parker, *A River Runs Yellow*, *ATLANTIC* (Aug. 21, 2015) <https://www.theatlantic.com/national/archive/2015/08/a-river-runs-yellow/401966/> [<https://perma.cc/EY9M-XYZY>].

151. See, e.g., NAT’L RSCH COUNCIL OF THE NAT’L ACADS., *SUPERFUND AND MINING MEGASITES* 18 (2005).

152. See David Iannella, *Arizona’s “Zombie” Uranium Mines: Lax Regulations Threaten Los Angeles Tap Water*, 41 *B.C. Env’t Affs. L. Rev.* (Electronic Supplement) 54 (2014); JUDY PASTERNAK, *YELLOW DIRT: AN AMERICAN STORY OF A POISONED LAND AND A PEOPLE BETRAYED* (2010).

largely borne by successors of the Anaconda mining company, which operated the Pit for many years.¹⁵³ But there are countless other negative-value mines nearby whose reclamation costs will be carried entirely by the public, as Jared Diamond describes:

In Montana there are about 20,000 abandoned mines, some of them recent but many of them a century or more old, that will be leaking acid and . . . toxic metals essentially forever. The vast majority of those mines have no surviving owners to bear financial responsibility, or else the known owners aren't rich enough to reclaim the mine and treat its acid drainage in perpetuity.¹⁵⁴

Except in those instances in which a successor corporation can be identified for purposes of liability, the costs of cleanup and reclamation for abandoned mines are borne by taxpayers.¹⁵⁵

The mining industry claims that the problem of mine abandonment is “a finite and historical problem and not one that will grow in the future,” because under current regulations, “today’s mines are designed, built and operated for closure.”¹⁵⁶ It is true that mining regulation today requires reclamation backed by financial assurances in many instances.¹⁵⁷ But this regulatory scheme is subject to similar pathologies as those described above in connection with coal mines and oil and gas wells. In some cases, the substance of the reclamation requirements falls short of preventing the

153. The public still bears many costs, however, as the Pit’s oversight and enforcement expenses are far from trivial.

154. Diamond, *supra* note 69.

155. See, e.g., CTR. FOR WESTERN PRIORITIES, *THE MINING BURDEN* (2015). Assigning private liability is especially difficult for mines located on public land, and there are many: for example, there are perhaps 38,500 abandoned mine sites that are on (or affect) U.S. Forest service land, and those sites together carry roughly a \$4 billion cleanup price tag. Mary Carr, *A Multiheaded Beast: Abandoned Mine Lands and the Challenge of Water Protection*, WILDLAND WATERS, Winter 2005 (FS-812), at 2, 5.

156. *Abandoned Mined Lands: Innovative Solutions for Restoring the Environment, Improving Safety and Creating Jobs: Oversight Hearing Before the H. Subcomm. on Energy and Min. Res., H. Comm. of Nat. Res.*, 112th Cong. 50 (2011) (statement of Laura Skaer, Executive Director, Northwest Mining Association). “The abandoned mines that dot the western landscape, and the toxic tailings that accompany some of them, are a byproduct of the mineral demands of an industrial society at a time when reclamation was not required or expected.” David Gerard, *The Mining Law of 1872: Digging a Little Deeper*, PERC (Dec. 1, 1997), <https://www.perc.org/1997/12/01/the-mining-law-of-1872-digging-a-little-deeper/> [<https://perma.cc/PW64-Y4SX>].

157. See generally JAMES R. KUIPERS, *HARDROCK RECLAMATION BONDING PRACTICES IN THE WESTERN UNITED STATES* (2000). Hardrock mining is primarily regulated at the state level. See, e.g., NEV. REV. STAT. §§ 519A.230–260 (setting forth rules concerning mine reclamation plans). What little federal reclamation regulation exists has been promulgated under 43 U.S.C. § 1732(b), a general provision of the Federal Land Policy and Management Act (FLPMA) which directs the Interior Secretary to “take any action necessary to prevent unnecessary or undue degradation of the lands.” See 43 C.F.R. § 3809 (2020). Some have argued persuasively that CERCLA creates a mandatory duty for EPA to seek financial assurances from hardrock mine operators. See Braden Murphy, Note, *Financial Assurance for Hardrock Mining: EPA and CERCLA*, 94 NOTRE DAME L. REV. 1855, 1857 (2019) (arguing that section 108(b) of CERCLA articulates such a duty).

emergence of negative-value property. As to pit mines, for example, reclamation rules generally do not require that such mines are backfilled and restored to their prior condition.¹⁵⁸ In part, this is because residual ore that is presently not economically recoverable may one day become so, and backfilling would foreclose future recovery.¹⁵⁹ But mostly it is because truly massive pits would be financially impractical to backfill.¹⁶⁰ Instead, defunct pit mines become lakes when dewatering pumps are shut off. As the Berkeley Pit demonstrates, these lakes can become toxic.

Quite apart from the substance of reclamation requirements, the financial assurances required of mining entities are in many cases insufficient to cover the costs of reclamation. Nearly every study that has explored the matter has reached this conclusion. The GAO, for example, has issued several reports concluding that the federal Bureau of Land Management's financial assurances requirements are inadequate.¹⁶¹ State requirements, too, are deficient, and in some instances, state officials are none too eager to establish the extent of the shortfall.¹⁶² In West Virginia, for example, environmental organizations attempted in vain for years to learn how much state money was being spent on sites at which bonds had been forfeited, information they sought in order to demand that mining firms pay cleanup costs themselves.¹⁶³

In short, hardrock mines present the potential for negative value property, and existing financial assurance rules may well be insufficient to internalize the costs of post-closure cleanup.

158. See, e.g., EARL M. HILL, *THE NEVADA LAW OF MINING* 127 (2015) (citing Nev. Admin. Code § 519A.250(1), (2) for the proposition that “an operator creating open pits or rock faces may obtain an exception to the requirement for reclamation upon proof to NDEP’s satisfaction that reclamation is not feasible”).

159. Interview by Steven Melzer with Bruce Holgren, Chief, Bureau of Mining Regulation and Reclamation, Nev. Div. of Env’t Prot. (July 14, 2014).

160. *Id.*

161. U.S. GOV’T ACCOUNTABILITY OFF., GAO-12-189R, *HARDROCK MINING: BLM NEEDS TO REVISE ITS SYSTEMS FOR ASSESSING THE ADEQUACY OF FINANCIAL ASSURANCES* (2011); U.S. GOV’T ACCOUNTABILITY OFF., GAO-05-377, *HARDROCK MINING: BLM NEEDS TO BETTER MANAGE FINANCIAL ASSURANCES TO GUARANTEE COVERAGE OF RECLAMATION COSTS* (2005).

162. See Murphy, *supra* note 157, at 1864–67 (describing state requirements and some of their deficiencies).

163. See Manuel Quiñones, *Enviro Groups Reach Settlement with W. Va. Regulators*, E&E NEWS PM (Aug. 2, 2011), <https://www.eenewspm.com/stories/1059952396/search?keyword=%22groups+reach+settlement%22> [<https://perma.cc/N5BA-9HUF>] (describing an environmental plaintiff’s effort to obtain “full treatment costs” at abandoned mines: “We have been asking for that calculation for over twenty years.”). The environmental plaintiffs prevailed in litigation asserting that the state needed Clean Water Act permits in order to clean up forfeited mines, a position they took in part because they sought the data required to demand appropriate financial assurances from mining firms. See, e.g., *W. Va. Highlands Conservancy v. Huffman*, 625 F.3d 159 (4th Cir. 2010).

B. Obsolete and Derelict Structures

Another important subcategory of negative-value property is property on which is located a derelict structure, for which the cost of disassembly or cleanup exceeds any residual land value. Many derelict structures can be rededicated to alternate uses with relative ease, but others require expensive handling. In these instances, land may be zero-value if the law simply allows it to be left in its current state. But where dismantling or remediation is required by law, such property becomes negative in value unless the land can be sold for an amount greater than the cost of cleanup.

1. Nuclear Power Plants

At the time of this writing, there are ninety-eight commercial nuclear reactors in operation in the United States, located at fifty-nine sites.¹⁶⁴ Nuclear power plants are extraordinarily complex structures that require expensive decontamination processes upon closure in order to prevent the release of radioactive material.¹⁶⁵ The law requires plant operators to set aside funds for decommissioning, but projections indicate these funds may be insufficient.¹⁶⁶ In all likelihood, sizeable public expenditures will be required to remediate defunct plant sites.

The financial assurance scheme for nuclear power plants is relatively straightforward. Generally, plant operators are required by Nuclear Regulatory Commission (NRC) regulations to direct a portion of plant revenues into a decommissioning fund.¹⁶⁷ The amount is established by a federal formula and is based on NRC estimates about the costs of proper decommissioning.¹⁶⁸ The formula and NRC estimates have been heavily criticized. First, there is mounting evidence that the NRC underestimates the costs of plant closure. The Callan Institute reports annually on the adequacy of nuclear trust funds; in its most recent report, the Institute concluded that these funds at the time covered only 71% of the expected costs of decommissioning.¹⁶⁹ A recent audit conducted by the NRC's

164. MARK HOLT, CONG. RSCH. SERV., R42853, NUCLEAR ENERGY: OVERVIEW OF CONGRESSIONAL ISSUES 2 (updated Nov. 16, 2018).

165. See generally 10 C.F.R. § 50.82 (2020).

166. See generally JULIA A. MORIARTY, CALLAN INST., 2019 NUCLEAR DECOMMISSIONING FUNDING STUDY: NDT FUND BALANCES, ANNUAL CONTRIBUTIONS, AND DECOMMISSIONING COST ESTIMATES AS OF DEC. 31, 2018 (2019) (reporting that decommissioning trust funds' current assets cover 71% of expected costs).

167. 10 C.F.R. § 50.75(e) (2020). This code section allows licensees several methods by which they may demonstrate financial assurance for decommissioning activities: pre-payment, a surety instrument, or an external sinking fund coupled with some surety instrument.

168. 10 C.F.R. § 50.75(c) (2020).

169. See MORIARTY, CALLAN INSTITUTE, *supra* note 166, at 3.

Inspector General revealed that the Commission's funding formula is based on studies conducted in the 1970s.¹⁷⁰ The GAO had raised similar issues a half decade earlier, finding that calculations of decommissioning expenditures included as little as 57% of the costs estimated by plant operators themselves.¹⁷¹

Second, a funding model dependent on setting aside a share of revenues takes for granted the extended commercial viability of the plants themselves.¹⁷² But nuclear power plants have struggled recently due to stiff competition from wind, solar, and natural gas generators.¹⁷³ Although some states are working hard to bail out their nuclear plants, a number of plants have closed ahead of schedule and more are slated for early retirement.¹⁷⁴ Early closure, in turn, could imperil the adequacy of the trust funds required for closure.¹⁷⁵

Finally, it is worth noting that the entire nuclear decommissioning process is shrouded in uncertainty. Only a few U.S. plants have yet been decommissioned; much about the process remains unknown.¹⁷⁶ But the greatest source of uncertainty has to do with the treatment of spent nuclear fuel. Despite decades of effort, federal officials have failed to resolve an intractable dispute about where to site a national nuclear waste repository.¹⁷⁷ For as long as this national problem endures—and there is no end even remotely in sight—nuclear power plants themselves will continue to serve as the interim resting place for the spent fuel rods previously used to power

170. U.S. NUCLEAR REGUL. COMM'N, DEF. NUCLEAR FACILITIES SAFETY BD., OFF. OF THE INSPECTOR GEN., OIG-16-A-16, AUDIT OF NRC'S DECOMMISSIONING FUNDS PROGRAM 9-14 (2016).

171. U.S. GOV'T ACCOUNTABILITY OFF., GAO-12-258, NUCLEAR REGULATION: NRC'S OVERSIGHT OF NUCLEAR POWER REACTORS' DECOMMISSIONING FUNDS COULD BE FURTHER STRENGTHENED 13 (2012).

172. The licensed lifespan of commercial reactors is a period of forty years, with a possible twenty year extension. 10 C.F.R. §§ 50.51, 54.31 (2020).

173. See, e.g., Jim Polson, *More than Half of America's Nuclear Reactors Are Losing Money*, BLOOMBERG (June 14, 2017, 11:01 PM), <https://www.bloomberg.com/news/articles/2017-06-14/half-of-america-s-nuclear-power-plants-seen-as-money-losers> [<https://perma.cc/NM8A-VSTM>].

174. See, e.g., Chris Mooney, *Three Struggling Nuclear Plants Need an 'Emergency' Government Rescue, Company Pleads*, WASH. POST (Mar. 29, 2018, 3:21 PM), <https://www.washingtonpost.com/news/energy-environment/wp/2018/03/29/three-struggling-nuclear-plants-need-emergency-rescue-by-ric-k-perry-company-pleads/> [<https://perma.cc/9VN9-E5V3>].

175. See, e.g., Peter Maloney, *Nuclear Plant Closures to Test Sufficiency of Decommissioning Funds*, UTILITYDIVE (Oct. 10, 2017) <https://www.utilitydive.com/news/nuclear-plant-closures-to-test-sufficiency-of-decommissioning-funds/506763/> [<https://perma.cc/6SAX-DQQ7>].

176. As of July 2015, nineteen nuclear reactors had officially entered the NRC's decommissioning process (as compared to the ninety-eight commercial reactors in operation today). U.S. NUCLEAR REGUL. COMM'N, *supra* note 170, at 2-3; HOLT, CONG. RSCH. SERV., *supra* note 164.

177. See generally Bruce R. Huber, *Checks, Balances, and Nuclear Waste*, 48 ARIZ. ST. L.J. 1169 (2016).

those plants.¹⁷⁸ The costs associated with extended spent fuel management are typically not included in the NRC's decommissioning cost estimates.¹⁷⁹ Instead, these costs are initially born by plant operators, who then seek federal reimbursement due to the government's breach of its obligations to dispose of waste.¹⁸⁰ This too is a form of temporal externality, a cost shifted from plant owners to the general public.

If there is a ray of hope, it is this: as firms develop expertise with decommissioning processes, a new model is emerging. In order to limit their downside risk, some operators of shuttered plants have transferred their plant licenses—along with the accumulated decommissioning funds—to separate entities with experience in plant decommissioning.¹⁸¹ The existence of such a market suggests that, in some cases, firms believe that they can complete closure for less money than the fund contains, retaining any surplus as profit. If they are correct, this is all to the good; if they are incorrect, however, the public may be left worse off, because decommissioning firms may have fewer outside assets which could be tapped into should the need arise.

2. Other Power Plants

Nuclear power plants present a unique set of worries due to the risk of radioactive release. But other electricity generating facilities also raise now-familiar concerns about negative-value property. Power plants face unavoidable dismantling and decommissioning expenditures. Coal-fired power plants, for example, generate “coal ash” as a byproduct of combustion. Coal ash contains dangerous heavy metals and other toxins.¹⁸² Plant operators that impound coal ash on site are required to address these

178. See, e.g., Fred Pearce, Opinion, *Awash in Radioactive Waste*, N.Y. TIMES (May 24, 2018), <https://www.nytimes.com/2018/05/24/opinion/nuclear-power-radioactive-waste.html> [<https://perma.cc/AX6X-SC5E>].

179. The costs of spent fuel management are not included in NRC decommissioning cost estimates because spent fuel removal is not required to terminate a plant's operating license. See 10 C.F.R. § 50.75(c) (2020); U.S. NUCLEAR REGUL. COMM'N, *supra* note 170, at 7.

180. Huber, *supra* note 177, at 1204–11.

181. See, e.g., NUCLEAR ENERGY INSIDER, *DECOMMISSIONING NUCLEAR POWER PLANTS IN THE U.S.: LICENSE TRANSFER: CHALLENGES AND OPPORTUNITIES* (2016); LATHAM & WATKINS CLIENT ALERT WHITE PAPER NO. 2236, *NUCLEAR DECOMMISSIONING AND LEGAL RISK* (NOV. 14, 2017); WILMERHALE, *NUCLEAR POWER IN THE AGE OF DECOMMISSIONING* (MAR. 14, 2019).

182. See generally U.S. GOV'T ACCOUNTABILITY OFF., *GAO-10-85R, COAL COMBUSTION RESIDUE: STATUS OF EPA'S EFFORTS TO REGULATE DISPOSAL* (2010). See also ENV'T INTEGRITY PROJECT, *COAL'S POISONOUS LEGACY: GROUNDWATER CONTAMINATED BY COAL ASH ACROSS THE U.S.* (2019).

impoundments upon plant retirement.¹⁸³ Even after decommissioning, former coal sites may carry significant liabilities. Owners and operators are currently required to monitor groundwater quality for thirty years following plant closure.¹⁸⁴ These monitoring programs impose substantial costs, and if contamination is found, groundwater remediation efforts could impose yet further expenses on site owners. Because these requirements are relatively new, reliable cost estimates do not yet exist.¹⁸⁵

How will such costs be borne? Regulated utilities generally build decommissioning costs into their rate base so that costs are recovered from electricity consumers.¹⁸⁶ But where generating facilities are not subject to cost-of-service regulation and instead sell electricity into competitive wholesale markets, coverage for decommissioning expenditures rests on a shakier footing. Generators like these are usually beyond the reach of state utilities commissions.¹⁸⁷ Publicly traded energy firms are required to list “asset retirement obligations” as a liability in their regular securities filings, but such obligations could easily be understated,¹⁸⁸ and in any event, private firms have no similar obligation and are not legally required to accumulate decommissioning funds during the years of a plant’s operation. And bankruptcy offers a potential escape: firms undergoing Chapter 11 reorganizations can sometimes negotiate for release from or limitation of environmental liabilities.¹⁸⁹

183. See generally Hazardous and Solid Waste Management System; Disposal of Coal Combustion Residuals from Electric Utilities, 80 Fed. Reg. 21,302 (Apr. 17, 2015) (to be codified at 40 C.F.R. pts. 257, 261); Hazardous and Solid Waste Management System: Disposal of Coal Combustion Residuals from Electric Utilities; Amendments to the National Minimum Criteria (Phase One, Part One), 83 Fed. Reg. 36,435 (July 30, 2018) (to be codified at 40 C.F.R. pt. 257). For news accounts of dangerous incidents involving coal ash releases, see Shaila Dewan, *At Plant in Coal Ash Spill, Toxic Deposits by the Ton*, N.Y. TIMES (Dec. 29, 2008), <https://www.nytimes.com/2008/12/30/us/30sludge.html> [<https://perma.cc/6MHL-WRBQ>]; Kendra Pierre-Louis, Nadja Popovich & Hiroko Tabuchi, *Florence’s Floodwaters Breach Coal Ash Pond and Imperil Other Toxic Sites*, N.Y. TIMES (Sept. 24, 2018), <https://www.nytimes.com/interactive/2018/09/13/climate/hurricane-florence-environmental-hazards.html> [<https://perma.cc/K3SW-2QSH>].

184. See RAIMI, *supra* note 14, at 24 (citing 40 C.F.R. pt. 257).

185. *Id.*; see also ENV’T INTEGRITY PROJECT, *supra* note 182.

186. RAIMI, *supra* note 14, at 38. Raimi notes, however, that in some cases, large unanticipated costs arise, which are borne disproportionately by current ratepayers, causing yet another form of temporal spillover.

187. See generally LINCOLN L. DAVIES & JOSEPH P. TOMAIN, *ENERGY LAW IN THE UNITED STATES OF AMERICA* 57–66 (2015).

188. See RAIMI, *supra* note 14, at 39–40.

189. See, e.g., Jeffrey Tomich, *Feds Blast FirstEnergy for ‘Abuse of the Bankruptcy System,’* E&E NEWS (Apr. 3, 2019) <https://www.eenews.net/energywire/stories/1060140823/search?keyword=Feds+Blast+FirstEnergy+for+Abuse+of+the+Bankruptcy+System> [<https://perma.cc/U9SC-W5TJ>] (describing federal and state interventions in a Chapter 11 proceeding in order to prevent inadequate coverage of coal and nuclear power plant decommissioning costs).

Coal-fired power plants are numerous and will represent an important category of negative-value property for years to come.¹⁹⁰ But there are other electricity generating facilities whose liabilities are less widely known. Hydroelectric dams, for example, appear so permanent that one can be forgiven for forgetting that they, too, have a finite lifespan and are prone to failure.¹⁹¹ The Federal Power Act, the most significant federal law bearing upon hydroelectric facilities, says almost nothing about the allocation of expenses upon a dam's retirement.¹⁹² It was newsworthy, then, when the Federal Energy Regulatory Commission (FERC) in 1995 claimed the authority to order the decommissioning and removal of obsolete dams at the expense of dam owners.¹⁹³ But FERC has not made extensive use of this authority against uncooperative licensees, nor has it tested the policy in court.¹⁹⁴ Instead, dam removal costs are typically allocated during a settlement process, as operators avoid direct challenges to FERC authority.¹⁹⁵ Unless and until that authority is firmly established, dams too represent a category of potential negative-value property, and the costs of dam removal loom as a temporal externality, a cost shifted from the dam-building generation to the dam-removing generation.

Not all power generating facilities, then, are accompanied by prepaid funds that sit ready for disbursement upon the facility's retirement. A good many such facilities are or will become negative-value property, and the

190. Some 433 plants have gone offline since 2005, and of those still operating, nearly 300 are at least fifty years old. RAIMI, *supra* note 14, at 19.

191. See, e.g., Kristine Phillips, *The Stunning Destruction at Oroville Dam and the Work Ahead*, WASH. POST (Feb. 14, 2017, 5:53 PM), <https://www.washingtonpost.com/news/post-nation/wp/2017/02/14/its-like-the-rock-was-melting-the-stunning-destruction-at-oroville-dam-and-the-work-ahead/> [<https://perma.cc/S9W7-NHMV>] (describing the near failure of the massive Oroville Dam in northern California); NIC LANE, CONG. RSCH. SERV., RL 33108, AGING INFRASTRUCTURE: DAM SAFETY (2006).

192. See Beth C. Bryant, *FERC's Dam Decommissioning Authority Under the Federal Power Act*, 74 WASH. L. REV. 95, 106 n.106 (1999) (noting that "[d]uring the water power legislation debates, dam removal was rarely mentioned, and even then summarily dismissed without further discussion").

193. Project Decommissioning at Relicensing; Policy Statement, 60 Fed. Reg. 339 (Jan. 4, 1995) (codified at 18 C.F.R. § 2.24 (2020)). See generally Bryant, *supra* note 192 (arguing in support of FERC authority); Michael A. Swiger, Ann P Southwick & Stephanie L. Mairs, *Paying for the Change: Can the FERC Force Dam Decommissioning at Relicensing?*, 17 ENERGY L.J. 163 (1996) (arguing the opposite); Katherine Costenbader, Comment, *Damning Dams: Bearing the Cost of Restoring America's Rivers*, 6 GEO. MASON L. REV. 635 (1998) (analyzing, inter alia, the nature of the operator's property interest in a dam license); Carlos M. Marquez, II, *Federal Power Act Limitations on FERC Dam Decommissioning Authority: Shielding Preexisting Licensees and Revisiting Trust Funds to Protect the Public Interest*, 27 COLO. NAT. RES., ENERGY & ENV'T L. REV. 157, 170 (2016) (referring to the decision as "The FERC Bombshell").

194. In several proceedings following its announcement, FERC asserted its decommissioning authority, but subsequent removals have proceeded by way of settlement negotiations. See Marquez, II, *supra* note 193, at 171–75.

195. See *id.* at 172; U.S. SOC'Y ON DAMS, GUIDELINES FOR DAM DECOMMISSIONING PROJECTS 19–20 (2015). See generally Philip M. Bender, *Restoring the Elwha, White Salmon, and Rogue Rivers: A Comparison of Dam Removal Proposals in the Pacific Northwest*, 17 J. LAND, RES & ENV'T L. 189 (1997).

costs of their decommissioning, if undertaken, will fall upon the general public.

3. Gas Stations and Underground Storage Tanks

The sorts of sites just discussed—nuclear power plants, coal-fired power plants, hydroelectric dams, and the like—tend to involve massive, conspicuous installations. These facilities cannot easily be hidden, nor could their owners readily abandon these properties and escape notice. By contrast, there are other forms of negative-value property (or potential negative-value property) that are much less conspicuous but more numerous, and thus quite important as a matter of public policy. Service stations, and the underground storage tanks often used to hold their gasoline and diesel products, furnish just such an example.

Gas stations trade in products that contain dangerous contaminants.¹⁹⁶ Unfortunately, the tanks used to store gasoline products have a long history of leakage, resulting in site contamination and sometimes groundwater infiltration as well.¹⁹⁷ During the 1980s, Congress passed legislation to address the growing number of leaking underground storage tanks.¹⁹⁸ Pursuant to this legislation, the EPA established strict standards for new tank installations and required existing tanks to be upgraded, removed, or replaced by 1998.¹⁹⁹ In addition, Congress created a fund to help states pay for cleanup where a responsible party could not complete the task.²⁰⁰ The cost of site cleanup is high relative to the scale of the businesses involved, and many tank owners lack the financial wherewithal to clean up their sites adequately.²⁰¹ The resulting public expenditures, of course, represent a temporal spillover.²⁰²

196. See generally MARY TIEMANN, CONG. RSCH. SERV., RS21201, LEAKING UNDERGROUND STORAGE TANKS (USTS): PREVENTION AND CLEANUP 4 (2010); Ronald W. Falta, *The Potential for Ground Water Contamination by the Gasoline Lead Scavengers Ethylene Dibromide and 1,2-Dichloroethane*, GROUND WATER MONITORING & REMEDIATION, Aug. 2004, at 76.

197. TIEMANN, CONG. RSCH. SERV., *supra* note 196, at 1.

198. Legislation in 1984 added a chapter to Solid Waste Disposal Act, codified at 42 U.S.C. §§ 6991-6991i, to regulate underground storage tanks. Pub. L. No. 98-616, 98 Stat. 3277-87. In 1986, Congress also passed the Superfund Amendments and Reauthorization Act, Pub. L. No. 99-499, § 521, 100 Stat. 1613, 1774 which created the LUST (Leaking Underground Storage Tank) fund to help states pay when tank owners or operators cannot be found or made to pay for cleanup.

199. TIEMANN, *supra* note 196, at 1.

200. The fund was created by a 0.1 cent per gallon tax on retail sales of gasoline. *Id.* at 2.

201. See CITY OF L.A. BROWNFIELD PROGRAM, GUIDE TO RESOLVING ENVIRONMENTAL AND LEGAL ISSUES AT ABANDONED AND UNDERUTILIZED GAS STATION SITES 4 (rev. 2013) (noting that tank removal costs range from \$5,000-\$10,000, but jump to the \$50,000-\$500,000 range when leaks have occurred).

202. The magnitude of this spillover is not exactly clear, but a 2007 GAO report estimated remaining cleanup costs of around \$12 billion nationwide. U.S. GOV'T ACCOUNTABILITY OFF., GAO-

Today, most new underground tanks must be double-walled and equipped with sophisticated leak monitoring systems that diminish the likelihood of costly and toxic releases.²⁰³ Extensive financial assurance requirements afford more thorough coverage for future problems than we have seen in the previous cases discussed in this Article.²⁰⁴ But cleaning up existing sites remains a significant policy challenge.²⁰⁵ With large industrial sites, the owner of record is well-known; if cleanup costs are passed to the public, it is because the owner has gone bankrupt or is otherwise unable or unwilling to pay for it. With smaller sites like gas stations, the situation is slightly different. Identifying the owner of record may itself be a costly and time-consuming task, and cities are not always able to accomplish it.²⁰⁶ In this setting, individual owners are sometimes able to abandon property in the conventional sense—that is, to walk away, relocate, and simply avoid the reach of legal authorities.²⁰⁷

C. Other Contaminated Sites

Resource extraction sites and sites home to obsolete structures represent vast amounts of negative-value land, but land's value can become negative also by way of contamination or other attributes that trigger legal obligations or liability. Soil and land contamination are serious and widespread problems; examples abound. When David Beckham sought to build a soccer stadium in Miami, the discovery of soil contaminants threatened \$30–50 million in unanticipated cleanup costs.²⁰⁸ Michigan and other states are contending with an ongoing crisis involving PFAS, a long-lived set of chemicals thought to endanger human health via both land and water contamination.²⁰⁹ Even outdoor shooting ranges—not exactly the first

07-152, LEAKING UNDERGROUND STORAGE TANKS: EPA SHOULD TAKE STEPS TO BETTER ENSURE THE EFFECTIVE USE OF PUBLIC FUNDING FOR CLEANUPS 4 (2007).

203. See, e.g., 40 C.F.R. § 280.20 (2019).

204. See, e.g., 40 C.F.R. §§ 280.90--116. Current regulations require large operators to have per-occurrence coverage of \$1 million, 40 C.F.R. § 280.93(a)(1), and aggregate coverage of \$2 million, 40 C.F.R. § 280.93(b)(2).

205. Despite the availability of public funds for cleanup, a backlog of some 100,000 sites remains. See TIEMANN, *supra* note 196, at summary.

206. See CITY OF L.A. BROWNFIELD PROGRAM, *supra* note 201, at 8–13.

207. *Id.* at 4 (“In neighborhoods with high property values, the cost to remediate a site can come out of the purchase price or rental income. . . . In some cases, owners who cannot afford to remediate simply abandon the site.”).

208. See Chris Marr, *Soil Contamination Could Bend David Beckham's Miami Soccer Plan*, BLOOMBERG L. (July 18, 2018, 4:24 PM) <https://news.bloomberglaw.com/environment-and-energy/soil-contamination-could-bend-david-beckhams-miami-soccer-plan-1> [<https://perma.cc/3H9X-369Y>].

209. See Leonard N. Fleming, *PFAS in Water Have Mich. Families Fearing Future, Pushing for Standards*, DETROIT NEWS (Mar. 21, 2019, 12:40 PM) <https://www.detroitnews.com/story/news/politics/2019/03/21/pfas-families-school-federal-state-standard/3015338002/> [<https://perma.cc/5DEV-XFNN>]. PFAS refers to the category of per- and polyfluoroalkyl substances.

thing to come to mind in this context—are associated with significant contamination.²¹⁰

The Love Canal crisis of the late 1970s focused national attention on the problem of land contamination and contributed to the enactment of CERCLA, the Superfund law.²¹¹ CERCLA creates an extensive web of liability whereby parties associated with the prior disposal of toxic waste may be compelled to share in the costs of remediation.²¹² The statute also levied a temporary tax on chemical and petroleum companies to create an enormous fund—the “Superfund”—to pay for cleanups conducted by the EPA, although cleanups (and lawsuits seeking contributions) can also be initiated by private parties.²¹³ CERCLA’s sweeping liability provisions have made parties understandably reluctant to acquire property that may be contaminated. Thus, “brownfield” properties, a common scourge especially in Rust Belt cities, often sit vacant and underutilized for years.²¹⁴

By subjecting those associated with contaminated property to retroactive liability—even for messes created by others—CERCLA “created” a good deal of negative-value property. Today, concerns about land contamination are ever-present in urban development. Merely estimating the cost of cleanup often requires expensive soil testing, so even parcels with minimal contamination are sometimes treated as negative-value and avoided by developers.²¹⁵ Thorough environmental assessment is standard.²¹⁶ Although some parcels will appreciate over time, public expenditures will likely remain a sizeable part of the story for the foreseeable future.

CERCLA’s liability provisions serve not only to pay for the cleanup of existing sites, but also to deter improper waste disposal in the future.²¹⁷ By

210. See, e.g., A.O. Fayiga & U.K. Saha, *Soil Pollution at Outdoor Shooting Ranges: Health Effects, Bioavailability and Best Management Practices*, 216 ENV’T POLLUTION 135 (2016).

211. CERCLA refers to the Comprehensive Environmental Response, Compensation, and Liability Act of 1980, Pub. L. No. 96-510, 94 Stat. 2767, now codified at 42 U.S.C. §§ 9601–9675. The Love Canal crisis involved a welter of public health problems in a small New York town, built atop an old landfill where chemical wastes had been deposited. See generally ADELINE GORDON LEVINE, *LOVE CANAL: SCIENCE, POLITICS, AND PEOPLE* (1982).

212. Liability under CERCLA is strict, joint, several, and retroactive, and applies to current and prior owners and operators, arrangers of disposal, or transporters of waste. See JAMES SALZMAN & BARTON H. THOMPSON, JR., *ENVIRONMENTAL LAW AND POLICY* 253–55 (4th ed. 2014).

213. *Id.* at 252–53.

214. *Id.* at 261–62.

215. See, e.g., David Slutzky & A.J. Frey, *Brownfields Uncertainty: A Proposal to Reform Superfund*, 12 CITYSCAPE, no. 3, 2010, 85. Noting that “[u]ncertainty is the enemy of economic activity,” the authors propose an absolute waiver of liability for “truly innocent private parties that undertake to redevelop brownfield sites.” *Id.* at 87.

216. The American Society for Testing and Materials (ASTM) establishes standards for Environmental Site Assessment (ESA). See ASTM E1527-13, E1901.

217. See, e.g., Evan Bogart Westerfield, Comment, *When Less is More: A Significant Risk Threshold for CERCLA Liability*, 60 U. CHI. L. REV. 697, 711 n.87 (1993) (noting that deterrence is one of CERCLA’s “fundamental concerns”).

extending liability to include even arrangers and transporters of waste, CERCLA gives numerous actors a vested interest in making certain that hazardous materials are contained and properly treated or disposed.²¹⁸ *Ex post* liability, however, accomplishes its work by inducing firms to internalize the present value of expected expenditures in the future; that present value is discounted to the degree that firms expect to avoid cleanup costs.²¹⁹ As we've seen already in other contexts, bankruptcy can allow firms to discharge environmental liabilities, and insurance coverage, even if required, may not adequately cover the costs of environmental remediation.²²⁰ Recent work by Sarah Light notes the extent to which, as a general matter, the law's treatment of environmental obligations upon bankruptcy acts as a disincentive "for firms to comply in full with environmental obligations."²²¹ Light points out that the government's own analysis, conducted by the GAO, concludes that taxpayer obligations for toxic waste liabilities discharged in bankruptcy could easily reach hundreds of billions of dollars.²²²

D. Negative-Value Personal Property

The problems posed by negative-value personal property are surprisingly similar to those raised by negative-value real property. As long as goods retain some positive value, owners are incentivized to preserve that value. Once an article has become negative in value, its owner is incentivized to dispose of it at the lowest cost—the lowest cost to the owner, that is.²²³ But

218. Other laws also bear on land contamination, such as those that regulate landfills, pesticides, other toxic products, and so forth. *See, e.g.*, Resource Conservation and Recovery Act (RCRA), 42 U.S.C. §§ 6901–6992k; Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA), 7 U.S.C. §§ 136–136y; Toxic Substances Control Act (TSCA), 15 U.S.C. § 2601–2697.

219. *Developments in the Law: Toxic Waste Litigation*, 99 HARV. L. REV. 1458, 1573 (noting that firms will finance future liabilities through insurance, bankruptcy, or both, depending on which system allows it to "pay less than its full liabilities").

220. *Id.* at 1586; *see also* Sarah E. Light, *The Law of the Corporation as Environmental Law*, 71 STAN. L. REV. 137, 191 (2019) (contending that "bankruptcy law operates as a disincentive, not only to full compliance with public environmental law obligations, but also to environmentally positive behavior that goes beyond compliance with the law"); J. Ricky Arriola, Note, *The Life & Times of a CERCLA Claim in Bankruptcy: An Examination of Hazardous Waste Liability in Bankruptcy Proceedings*, 67 ST. JOHN'S L. REV. 55 (1993).

221. Light, *supra* note 220, at 200.

222. *Id.* at 192–93 (discussing U.S. GOV'T ACCOUNTABILITY OFF., GAO-05-658, ENVIRONMENTAL LIABILITIES: EPA SHOULD DO MORE TO ENSURE THAT LIABLE PARTIES MEET THEIR CLEANUP OBLIGATIONS (2005)). Moreover, the EPA sometimes "fails to behave like a rational economic actor in pursuing its CERCLA claims." Scott E. Blair, Note, *Toxic Assets: The EPA's Settlement of CERCLA Claims in Bankruptcy*, 86 N.Y.U. L. REV. 1941, 1941 (2011).

223. Recycling and compost programs struggle precisely because many people are unwilling to pay even trivial costs, in terms of time or effort, to separate materials or to seek out appropriate receptacles.

the method of waste disposal that costs the owner the least may foist costs onto the public.

All waste, after all, must be somewhere. Although owners of personal property have the legal right to abandon it (unlike real property), Eduardo Peñalver has noted that one's right to abandon personal property is qualified by the need to find a place to abandon it: all land in the United States must be "at least formally owned by someone."²²⁴ Licit abandonment requires the consent of the receiving landowner, and parties rarely consent to receive trash or waste without some payment for doing so. That is precisely why *illicit* abandonment is so common. Illicit abandonment includes not only litter—an enormous policy hassle all its own, and one which imposes significant costs on society²²⁵—but also the less visible problem of illegal dumping. Large, unattended rural tracts make easy targets for the dumping of unwanted goods. At public parks and other public lands, for example, such dumping occurs with regrettable frequency. And there is no easy way to force offenders to bear the attendant costs. Deterrence policies focus not on recovering damages but on creating and enforcing criminal sanctions, supplemented perhaps by public information campaigns and other mechanisms of norm adjustment.²²⁶

Public policy manages to channel a substantial amount of unwanted personal property into landfills or commercial waste processing facilities.²²⁷ But these facilities take us right back to the now-familiar territory of negative-value real property. True, such a facility may be a positive-value asset to a profitable waste disposal firm. But waste facilities create incentives for owners that resemble those associated with mines or other resource extraction sites. Just as a mine generates revenue only while producing, a waste processor receives payment for accepting waste. From that point forward, both types of entity have an incentive to shirk cleanup responsibilities. The waste disposal industry is highly regulated; landfills and other disposal firms are required to comply with financial assurance

224. Peñalver, *supra* note 16, at 203. Peñalver continues: "[t]he fact that all land is owned means that the owner of an item of personal property who wishes legally to abandon it must intentionally deposit the item on some piece of *owned* land . . ." *Id.*

225. Litter management is often addressed at the local level, and in many instances by volunteer contributions, but its aggregate costs are substantial. *See generally* KEEP AMERICA BEAUTIFUL, 2009 NATIONAL VISIBLE LITTER SURVEY AND LITTER COST STUDY ES-1 (2009) (noting litter costs in the United States of roughly \$11.5 billion annually). In recent years, a great deal of attention has also been devoted to the problem of marine litter, a massive problem which will require an international solution. *See generally* MARINE ANTHROPOGENIC LITTER (Melanie Bergmann, Lars Gutow & Michael Klages, eds., 2015).

226. *But see* Ann E. Carlson, *Recycling Norms*, 89 CAL. L. REV. 1231, 1233–34 (2001) (describing recycling as a "large-number, small-payoff" problem for which social norm management is an unlikely solution).

227. *See generally* RAMESHA CHANDRAPPA & DIGANTA BHUSAN DAS, *SOLID WASTE MANAGEMENT: PRINCIPLES AND PRACTICE* (2012).

requirements, along with stringent substantive requirements.²²⁸ These entities have a vested interest—at least in theory—in pricing their services to reflect internalized costs. But what we cannot yet know is whether the law has adequately compelled these entities to internalize the actual, total costs of land maintenance by designing rules and setting financial assurance requirements appropriately.²²⁹ If not, landfills and waste processing plants may represent another target for future public expenditures.

III. ANALYSIS

Having completed this tour among various categories of negative-value property, we turn now towards analysis. The descriptions above, of negative-value property and the various policies enacted to contain related externalities, permit some general observations.

A. There's Much More to Come

An important threshold observation simply has to do with the magnitude of the problem posed by negative-value property. It is far larger than most assessments would suggest. This is because, in nearly every policy category mentioned above, we remain in the opening stages of an unfolding situation. Of all the nuclear power plants that have ever operated in the United States, only a small number have entered decommissioning.²³⁰ Of all the oil and gas wells drilled in the United States, a relatively trivial fraction has been plugged.²³¹ Of all the offshore drilling rigs on the continental shelf, only a few have been removed or disassembled.²³² In these and other cases, the bulk of the work of cleanup or land reclamation lies ahead. The financial assurance and other policies that have been deployed to protect the public fisc might be regarded as experimental, and the experiment has only just begun.

228. Solid waste disposal is regulated under RCRA, 42 U.S.C. §§ 6901–6992k.

229. The EPA has expressed concern, for example, that solid waste disposal regulations could, if not designed properly, create “perverse incentives . . . to over-accumulate hazardous secondary materials without recycling them.” See *Am. Petroleum Inst. v. EPA*, 862 F.3d 50, 68 (D.C. Cir. 2017) (internal punctuation omitted) (discussing an EPA regulation defining “solid waste” under RCRA).

230. “Worldwide we have almost no experience of dismantling power plants and burying radioactive waste. . . . In France not a single nuclear power plant has been completely decommissioned. . . . Worldwide less [sic] than twenty commercial reactors have been completely dismantled.” LÉVÊQUE, *supra* note 51, at 23.

231. See *supra* Part II.A.2; see also Jim Malewitz, *Abandoned Texas Oil Wells Seen as “Ticking Time Bombs” of Contamination*, THE TEXAS TRIBUNE (Dec. 21, 2016, 12:00 PM), <https://www.texastribune.org/2016/12/21/texas-abandoned-oil-wells-seen-ticking-time-bombs/> [<https://perma.cc/SQ8N-9KGH>] (quoting a local official as noting that “[t]here is about to be a tsunami of abandoned wells”).

232. See *supra* note 145.

In a sense, the United States is facing a second wave of negative-value property. The first wave, perhaps best epitomized by the burst of resource exploitation that accompanied westward expansion across the North American continent, was characterized by the *actual* abandonment of damaged property. During this wave, the law could do little to bind owners to land or otherwise compel the remediation of exploited land. In many instances, the very process of establishing ownership, if invoked at all, could be terminated unilaterally.²³³ Thus miners simply packed up and moved elsewhere when their operations were no longer profitable.²³⁴ Timber harvesters razed forests, decamped, and moved farther west.²³⁵ In effect, land abandonment was not only possible; it was often the norm.²³⁶ Although the externalities caused by this first wave of abandonment were small by today's lights, the taxpaying public has absorbed almost entirely the costs of land restoration for this negative-value property because land users had disappeared off the scene long before the cumulative consequences of abandonment were understood.²³⁷ Land law at the time had not yet addressed rehabilitation, and even if it had, enforcement capacity was minimal.²³⁸

233. The public land laws that authorized the disposal of federal lands generally involved several stages. The initial stages secured a claimant's status vis-à-vis other settlers, but the process could be abandoned before a patent issued. For example, the Homestead Act required five years of occupancy before vesting title in a settler; six months of nonoccupancy effected a forfeiture of the claim. Homestead Act of 1862, § 5, ch. 75, 12 Stat. 392, 393. Similarly, the General Mining Act of 1872 did not require prospectors to patent title before extracting minerals; to the contrary, an unpatented mining claim secured all rights necessary for commercial mining operations, and had the added benefit of avoiding state property taxes. General Mining Act of 1872, ch. 152, 17 Stat. 91 (1872). These claims could be and often were abandoned without patent issuance. For general information regarding these laws' operation and their widespread abuse, see REPORT OF THE PUBLIC LAND COMMISSION, H. EX. DOC. NO. 46-46 (2d Sess. 1880) (Serial No. 1923); see also PAUL W. GATES, HISTORY OF PUBLIC LAND LAW DEVELOPMENT (1968).

234. These migrations are perhaps best captured by the literature describing the phenomenon of the "ghost town." See generally MURIEL SIBELL WOLLE, THE BONANZA TRAIL: GHOST TOWNS AND THE MINING CAMPS OF THE WEST (1953); WOLLE, STAMPEDE TO TIMBERLINE: ABOUT COLORADO GHOST TOWNS (2d ed. 1974). "Historically the mining town developed when the ore was discovered and when the ore ran out, the town was abandoned. Many ghost towns attest to this course of events." Robert E. Beck, *Reclamation During and After Mining*, 24 J. LAND RESOURCES & ENVTL. L. 333, 333 (2004).

235. See generally JOHN ISE, THE UNITED STATES FOREST POLICY (1920). Ise's classic work focuses predominantly on the abuse of the federal land laws around the turn of the last century, but it also addresses the waste of timber and land associated with large-scale timber harvest before the industry became serious about reforestation. See, e.g., *id.* at 359-77.

236. For example, one California land register estimated that approximately two-thirds of filings in his office were not consummated. REPORT OF THE PUBLIC LAND COMMISSION, *supra* note 233, at 23. See also Struhsaker, *supra* note 57 (describing a pattern of land abandonment in Michigan).

237. Legislation to address abandoned hardrock mines, for example, did not appear until the late 1900s. See generally Stokstad, *supra* note 149.

238. See generally GATES, *supra* note 233 (note especially the vast difference in administrative capacity between, e.g., Chapters 15-17, covering the mid to late nineteenth century, and Chapter 20-21, covering the early to mid twentieth century).

The second wave, by contrast, is characterized by the *functional* abandonment of negative-value property, and the property at issue is vastly greater in the magnitude of its temporal externalities. Massive dams; nuclear power plants; mines a mile wide and a mile deep; oil and gas fields whose wellbores extend thousands of feet underground—titanic projects of this sort, impossible only a century ago, are now reaching the ends of their lifespans and require attention. In each of these contexts, we have seen that there is ample cause for concern about temporal externalities. Even if owners are unable to terminate ownership unilaterally, bonding and bankruptcy processes often enable the functional abandonment of degraded property. There is profound uncertainty about what additional cleanup costs may yet arise in these contexts, and current law functionally allows owners to divert such costs to the general public.

B. Property and Time

Owners of negative-value property commonly seek to defer expenditures associated with remediation. In part, this is because of the possibility what is now considered waste might one day have economic value. Coalbed methane, once considered a dangerous and unwanted byproduct of coal mining, was later recognized as a valuable fuel source in its own right.²³⁹ Tailings, the material left behind after the desired substances have been extracted from a mine, have themselves been “mined” for other substances as market conditions allow.²⁴⁰ And markets for recycled goods have brought economic value to certain streams of what would otherwise be household waste. An owner of negative-value property, therefore, may in some instances elect to delay cleanup or remediation as a form of speculation, gambling that future gains will reduce or eliminate the loss associated with immediate cleanup. Perhaps the same land attributes that are now considered a liability might one day be considered an asset. Or perhaps the land’s other characteristics—its location, for example—might enhance the tract’s positive values until they one day exceed the costs of contamination, restoring the land’s market appeal. In other words, in this view, the opportunity costs associated with immediate cleanup are unacceptably high.

A landowner may also choose to delay land remediation because she believes that the cost of cleanup is likely to decrease over time. One reason simply has to do with the time value of money: a rational actor would prefer

239. *Amoco Prod. Co. v. S. Ute Indian Tribe*, 526 U.S. 865, 874–78 (1999) (noting the changing value of coalbed methane in the context of the proper interpretation of federal reservations of “coal” in land grant statutes).

240. See Alan Farnahm, *Old Mine Tailings: New Mother Lode for Rare Elements*, ABCNEWS (July 24, 2013, 7:29 AM), <https://abcnews.go.com/Business/rare-earth-elements-mine-tailings/story?id=19739320> [<https://perma.cc/8RPG-BJR2>].

to spend a dollar in the future than a dollar now. Discussions about nuclear decommissioning regularly invoke this idea to downplay the present estimates of decommissioning costs.²⁴¹ But the cost of cleanup may also decline due to technological development and innovation. There may in the future be cleanup techniques or machinery that are able to accomplish the job more cheaply, more effectively, or both. Of course, cleanup costs could also rise: additional harms could be discovered or the extent of existing harm better understood, or the standards for cleanup could become more stringent. Nonetheless, a landowner could easily conclude that this risk is worth taking.

These reasons for delay are legitimate. But owners may also elect to delay cleanup or remediation simply because they wish to shirk their cleanup responsibilities. And in such instances, owners can draw upon the rationales just rehearsed to argue that immediate remediation is imprudent, making it difficult for regulators to distinguish between sound business practices and mere manipulation. For example, an oil well that is no longer producing in profitable quantities must, at some point, be plugged and decommissioned in accordance with state requirements.²⁴² The plugging process can cost hundreds of thousands of dollars.²⁴³ Well owners, happy to defer this expense, may simply neglect to notify the relevant authority of the well's inactivity.²⁴⁴ Alternatively, operators may keep a well in operation even though its production is miniscule.²⁴⁵ In either case, a delay in well closure increases the likelihood that the well operator will become insolvent before plugging, at which point the well will likely become the ward of the state.

From a policy standpoint, this aspect of delay—and shifting land values more generally—complicates the law of cleanup or land remediation. While owners might prefer to postpone cleanup, policy makers may fear that land harms will spread, that contamination may extend to neighboring parcels, that groundwater might become tainted, and so forth. They may also fear that unresolved land harms will cause land values to decline in the vicinity of the site. And they may recognize that the passage of time increases the likelihood of insolvency. These factors place lawmakers and regulators in a difficult position: if they allow landowners to delay remediation, they may

241. See LÉVÊQUE, *supra* note 51, at 23–34.

242. See *supra* notes 123–127 and accompanying text.

243. See *supra* note 127.

244. Trey Scott, *Railroad Commission Adopts Rule Changes Affecting Inactive Wells*, 16 TEX. LAND & MIN. OWNERS ASS'N OFF. NEWSL., no. 4, 2016, at 4 (discussing the practice of keeping declining wells in active status).

245. This also occurs when mineral lessees wish to keep a lease alive: a single producing well can perpetuate a lease of even a very large tract. See James W. Coleman, *The Third Age of Oil and Gas Law*, 95 IND. L.J. 389, 403–04 (2020).

expose the public to greater danger and expense. But if they choose stringency and require prompt cleanup, they may foreclose genuine opportunities for land improvement, impose unnecessary costs on business, and incur political opposition.

C. Hiding in Plain Sight: Property Value and Scale

Another important aspect of the problem of negative-value property arises from the fact that real property values depend, by definition, on the boundaries of the units at issue. The market value of any piece of property is wholly contingent upon the definition or delineation of the property right. Change the parameters of the right, change the value of the property. An urban parcel contaminated by highly toxic chemicals, negative-value by itself, could be joined to adjacent parcels to form a positive-value unit. Conversely, large properties with positive market value might contain negative-value portions. An oil well in need of plugging may be negative-value if severed from surrounding land, but if its tract also contains many productive wells, the negative value attributable to the defunct well may scarcely be of note.

Whether real property appears to the marketplace as positive-value or negative-value, then, often turns on the scale of its negative-value characteristics relative to the entirety of the property. This simple observation implies that there is a good deal more unwanted or liability-laden property than meets the eye: it is hiding in plain sight, attached to or subsumed within positive-value property. If existing lot lines and boundaries could be redrawn—say, if owners could freely sever and abandon undesirable portions of their property—a great deal of negative-value property, presently contained within larger tracts with a clear positive value, would be exposed. Of course, owners cannot unilaterally redraw boundaries, and portions of land cannot easily be abandoned. We might infer, in fact, that one way to contend with negative-value property is to keep it bundled or batched with positive-value property such that the owner of the bundle acquires an interest in remediating the negative-value condition. More about this possibility in Section IV.D.

The key point here is that the relationship between scale and value is thoroughgoing and essential. In part, this is old news. Property scholars have long recognized that the scale at which property units are legally delineated matters a great deal.²⁴⁶ It matters because externalities arise when there is a mismatch between parcel size and the effects of a particular land use—as

246. See, e.g., Michael A. Heller, *The Boundaries of Private Property*, 108 YALE L.J. 1163 (1999); Ellickson, *supra* note 2, at 1327–32.

when, for example, noxious odors emanate from one parcel into neighboring ones.²⁴⁷ Another mismatch arises when resource systems extend across numerous parcels, such that efforts to manage the system confront a serious collective action problem.²⁴⁸ Land demarcation regimes impose a blunt homogeneity atop these concerns: even though any given scheme of surface ownership may make sense under the circumstances of its origin, serious frustrations and inefficiencies can arise when established boundaries no longer suit the land management issues of the moment.²⁴⁹

One way that American law has responded to this set of problems is by allowing the fragmentation of land ownership. The fundamental land unit remains the tract, demarcated on the land's surface, and held in fee simple. But the law permits owners to fragment their interests in various ways across space, time, and even substance.²⁵⁰ An owner could, for example, lease the oil beneath his land to X for ten years, sell the rights to natural gas in fee simple to Y, and convey the surface rights of the same land to Z for life, with the result that the original owner, X, Y, and Z would each presently own a legally-enforceable interest in the same property.²⁵¹ Some scholars extol this divisibility as an efficiency-enhancing virtue of the flexible system of American property law.²⁵² Thus oil and gas firms, for example, can pool the oil and gas rights of multiple owners in order to allow the efficient extraction of the hydrocarbons owned by the members of the pool, while these owners continue to make individualized use of the surface above.²⁵³

But the negative-value property problem adds a twist to this optimistic account because fragmented rights can be more easily abandoned than full-fledged land ownership. Consider the situation of abandoned oil and gas wells. In most instances, landowners do not themselves drill or operate wells, but instead sell or lease their oil or gas rights to firms. Although most

247. Ellickson, *supra* note 2, at 1323–1335.

248. See, e.g., Karen Bradshaw Schulz & Dean Lueck, *Contracting for Control of Landscape-Level Resources*, 100 IOWA L. REV. 2507 (2015). The nature of the collective action problem depends upon the characteristics of the resource, the resource users, and so forth. See generally Elinor Ostrom, *Analyzing Collective Action*, 41 AGRIC. ECON. 155 (2010).

249. See Schulz & Lueck, *supra* note 248, at 2520–22 (describing Congress's shift from prioritizing privatization of western lands to conservation).

250. See Daniel B. Kelly, *Dividing Possessory Rights*, in LAW AND ECONOMICS OF POSSESSION 175 (Yun-Chien Chang ed., 2015).

251. The original owner's interest, of course, would be a future interest—a reversion—but as every first-year law student learns, future interests are presently existing even if not currently possessory.

252. Kelly, *supra* note 250. Professor Kelly argues that “under most circumstances, private owners will not have an incentive to divide their property excessively,” *id.* at 176, but acknowledges that “unlike private owners, public officials do not necessarily internalize the economic costs and benefits of dividing possessory rights,” *id.* at 189.

253. See generally JOHN S. LOWE, OWEN L. ANDERSON, ERNEST E. SMITH, DAVID E. PIERCE, CHRISTOPHER S. KULANDER & MONIKA U. EHRMAN, *CASES AND MATERIALS ON OIL AND GAS LAW* 226–304 (7th ed. 2018).

states track mineral ownership, absentee mineral ownership is common, and mineral rights may change hands without the surface owner's knowledge.²⁵⁴ If a producer encounters financial difficulties, even a vigilant surface owner may not know about it, even though that owner is likely to be the party most affected by an abandoned well. If an aggrieved landowner wishes to plug an abandoned well rather than wait for a state agency to do it, the state's reimbursement may be incomplete.²⁵⁵ To be clear, the law does not countenance the abandonment of oil and gas interests. But enforcement is difficult, and whereas the abandonment of land would at least allow for the seizure of the abandoned parcel, the abandonment of mineral rights ordinarily leaves no offsetting, recoverable positive-value asset.²⁵⁶

Another version of this dynamic is visible on the federal public lands, where fragmented land interests are everywhere.²⁵⁷ Public lands law invites private parties to secure rights in lands—rights to timber, to minerals, and so forth—while retaining residual ownership in the United States.²⁵⁸ Once those rights are exhausted or terminated, federal agencies are often left to bear some or all of the cost of cleanup, either because the law does not require full reclamation, or because of failures in law enforcement.²⁵⁹

Residual losses of this sort are not inevitable: the law could specify precisely the duties of public lands claimants, enforce those duties diligently, and impose penalties for noncompliance. Certain private firms, such as landlords and car rental firms, trade in divided property rights as a matter of course; their viability suggests that it is possible to contain the resulting temporal spillovers.²⁶⁰ But public land managers are not running a

254. For a description of the challenges of tracking mineral ownership, see, for example, Sara K. Sorenson, *A Need for Clarification: North Dakota's Abandoned Mineral Statute*, 86 N.D. L. REV. 521 (2010). See also Robert W. Roll, *Wards of the State: Abandoned Oil and Gas Wells in Texas*, DALLAS BAR ASS'N HEADNOTES, Aug. 2017, at 19 (noting that “[p]ugging is never the royalty owner’s obligation. Of course, this is little consolation if an abandoned well is left behind with no one around to plug it.”)

255. See, e.g., Roll, *supra* note 254. (noting that the Texas Railroad Commission will reimburse a maximum of fifty percent of the costs of plugging, if carried out by the surface owner).

256. The state oversight agency may place a lien on well site equipment, *id.*, but this may be of little to no value.

257. See generally Jan G. Laitos & Richard A. Westfall, *Government Interference with Private Interests in Public Resources*, 11 HARV. ENV'T L. REV. 1, 9–19 (1987).

258. The proliferation of private interests on public lands created, in the words of the Supreme Court, “virtual chaos with respect to the public lands. In 1975, it was estimated that more than 6 million unpatented mining claims existed on public lands other than the national forests” *United States v. Locke*, 471 U.S. 84, 86–87 (1985).

259. See U.S. GAO, *supra* note 132 (describing the costs to government associated with reclaiming abandoned well sites). Note too that the federal government may be liable under CERCLA merely as an owner of land contaminated by hazardous substances. See *Chevron Mining Inc. v. United States*, 863 F.3d 1261 (10th Cir. 2017).

260. Drivers tend to treat rental cars with less care than vehicles they own, for example, yet well-managed rental car companies remain profitable. See Wayne R. Dunham, *Moral Hazard and the Market*

business. The price that a mining company pays to mine on public lands, for example, is as much the product of politics as the logic of the bottom line.²⁶¹ Unlike the landlord or the rental car company, lawmakers have little incentive—and certainly no existential business need—to establish resource leasing and development policies that achieve a profit. At no stage of public lands law have lawmakers accurately priced the harms caused by resource development.²⁶² There is no doubt that the public lands have fueled American economic growth, both literally and metaphorically.²⁶³ Public lands law has generously encouraged resource development, richly rewarded those who engage in it, and effectively immunized them from subsequent liabilities.²⁶⁴ But the remaindermen—the public and its representative officials—have paid a steep price.²⁶⁵

D. The Way Forward

So where does this leave us? With the foregoing observations in mind, what might we say about how better to address temporal spillovers and negative-value property?

As to policy, our findings thus far suggest that negative-value property is a sizeable problem in numerous economic sectors. Existing policy tools, if calibrated and implemented properly, could substantially reduce the incidence and magnitude of the resulting temporal spillovers. There is no technical reason why financial assurance policies cannot effectively address the bulk of land remediation. The failures of such policies thus far have

for *Used Automobiles*, 23 REV. INDUS. ORG. 65 (2003) (finding that fleet vehicles depreciate more rapidly than owner-driven vehicles, in part due to moral hazard). Similarly, a delinquent tenant in a rented apartment, for example, can cause damage in excess of a security deposit, leaving the landlord to pay the overage or attempt to recover against the tenant.

261. For more about the pricing of natural resource assets, see Bruce R. Huber, *The Fair Market Value of Public Resources*, 103 CAL. L. REV. 1515 (2015).

262. *Id.*

263. See generally U.S. ENERGY INFO. ADMIN., SALES OF FOSSIL FUELS PRODUCED FROM FEDERAL AND INDIAN LANDS, FY 2003 THROUGH FY 2014 (2015). This publication provides historical production data regarding fuels sold from federal land use. During the reported period, the share of U.S. fossil fuel production derived from federal land was between twenty-three and thirty-six percent. *Id.* at 2.

264. See generally ROBERT L. GLICKSMAN & GEORGE CAMERON COGGINS, MODERN PUBLIC LAND LAW IN A NUTSHELL (3d ed. 2006).

265. See, e.g., U.S. GOV'T ACCOUNTABILITY OFF., GAO-19-28, DEP'T OF ENERGY: PROGRAM-WIDE STRATEGY AND BETTER REPORTING NEEDED TO ADDRESS GROWING ENVIRONMENTAL CLEANUP LIABILITY (2019) (total cleanup liability of Department of Energy alone reaches nearly \$400 billion); see also J. Alfredo Gómez, U.S. GOV'T ACCOUNTABILITY OFF., GAO-15-830T, HAZARDOUS WASTE CLEANUP: NUMBERS OF CONTAMINATED FEDERAL SITES, ESTIMATED COSTS, AND EPA'S OVERSIGHT ROLE (2015) (describing testimony before the House of Representatives' Committee on Energy and Commerce's Subcommittee on Environment and the Economy and estimating a total cleanup liability of nearly \$359 billion on sites managed by the Departments of Agriculture, Interior, Defense, and Energy).

stemmed less from policy structure than from policy implementation.²⁶⁶ If the cost of cleanup is properly assessed, if bond or assurance coverage is sufficient to cover such costs, and if regulators supervise the process adequately, then financial assurance policies can reliably provide for the cleanup of most degraded sites and spare the public the costs of temporal spillovers.²⁶⁷

At the same time, these are big “ifs.” The same incentives that might lead owners to abandon property can also mobilize these owners in the political realm. The possibility of abandonment, and the likelihood of the resulting temporal spillovers, have long been known to lawmakers in jurisdictions where coal, oil, gas, and other extractive industries operate, but political pressures often prevent these lawmakers from creating effective policies and empowering agencies to implement them. It goes without saying that many regulated firms will resist both the imposition and the enforcement of stringent reclamation policies. What might be less obvious, however, are the political dynamics among those parties that might most plausibly oppose the regulated community. Some of the very parties that stand to suffer the most direct losses due to negative-value property—owners of adjacent land or surface title above mineral claims—are unlikely to support strict remediation rules at the front end of a resource boom. Quite the contrary: such owners will, in all likelihood, be eager to cash in on lucrative resource deposits and to benefit from economic activity. As such, they tend to oppose regulatory safeguards and instead stand shoulder-to-shoulder with producers and developers as the rules of remediation are being written even

266. And in some industries, financial assurance requirements simply have gone untried. CERCLA authorizes the EPA to impose financial assurance requirements on industry segments to cover the costs of releases of hazardous substances, but the agency has never exercised this authority. *See* CERCLA § 108(b), 42 U.S.C. § 9608(b); *see also* *In re Idaho Conservation League*, 811 F.3d 502, 506 (D.C. Cir. 2016) (noting that “[t]hirty years later, EPA has yet to issue any regulations” pursuant to section 108(b)). The EPA did, under the Obama administration, initiate a rulemaking process for the hardrock mining sector. *See* Identification of Priority Classes of Facilities for Development of CERCLA Section 108(b) Financial Responsibility Requirements, 74 Fed. Reg. 37,213 (July 28, 2009). However, the Trump EPA decided not to issue the final rule. Financial Responsibility Requirements Under CERCLA Section 108(b) for Classes of Facilities in the Hardrock Mining Industry, 83 Fed. Reg. 7556, 7568 (Feb. 21, 2018). More recently, the Trump EPA also decided not to require financial assurances under CERCLA from several other industries. E.A. Crunden, *EPA Won't Require Cleanup Insurance for 3 Major Industries*, GREENWIRE (Nov. 30, 2020), <https://www.eenews.net/greenwire/stories/1063719469/feed> [<https://perma.cc/CJ5Y-MDVU>].

267. When financial assurance policies are implemented inadequately, substantial pressure is placed on other areas of law, and particularly on the law of bankruptcy, as regulators seek to enforce reclamation rules against ailing or insolvent firms. Many excellent analyses have examined how bankruptcy law might be improved to better address unremediated sites. *See, e.g.,* Macey & Salovaara, *supra* note 98; Light, *supra* note 220; Brent Bolea, *Bankruptcy Abandonment Power and Environmental Liability*, 106 COM. L.J. 83 (2001); *Developments in the Law of Toxic Waste Litigation*, *supra* note 219, at 1587–1601.

though, once the boom has ended, those same landowners may well find themselves adversely affected by nearby negative-value property.

Our earlier observations about time and delay (Section IV.B) suggest further that owners may be unwilling to acknowledge the need for cleanup until it is too late, and that regulators will have a difficult time distinguishing between legitimate and illegitimate reasons for delay.²⁶⁸ These political forces are unsurprising and we should expect them to persist until countervailing political pressures come to the fore—something that would presumably require, among other things, a much greater awareness of the problem on the part of the taxpaying public, and a corresponding willingness on the part of voters to hold lawmakers accountable for weak and ineffective financial assurance policies.

So a first step towards better policy on negative-value property would be to simply deliver on the promise of existing financial assurance strategies in the face of certain political opposition. But given the foregoing observations regarding scale (Section IV.C), there is another strategy that has perhaps received inadequate attention in the literature. This is the idea of bundling. Ownership ordinarily bundles together desirable qualities with aversive ones.²⁶⁹ Negative-value problem becomes a social problem when a parcel's aversive aspects—and specifically remediation costs—exceed its expected post-remediation value, leading to abandonment. But a parcel's value is entirely a function of its particular demarcation: as we have said, a great deal of negative-value property is “hiding” within positive-value property. This suggests that another approach to negative-value parcels might be to bundle them with positive-value parcels—in essence, to curb an owner's incentive to abandon a newly-defined bundle of property.

Some real estate transactions already employ a form of this approach. Brownfield specialists note that distressed properties are sometimes sold as a batch, and may be marketable notwithstanding the inclusion of negative-value properties, if the positive-value properties offset the costs of remediation.²⁷⁰ Firms willingly remediate negative-value brownfield properties that would be unprofitable alone if doing so is the price of acquiring more desirable tracts elsewhere.²⁷¹ Bundling of this sort is artificial in that it involves not a physical connection with adjacent land, but a legal connection with parcels elsewhere. Nonetheless, regulators might

268. Moreover, because the externalities of greatest concern are temporal rather than spatial, the constituency most likely to bear the costs of abandoned negative-value property is a future one. Politicians themselves serve time-limited terms of office, such that the time-horizon of their decision-making is importantly limited, to the extent that their behavior is driven by electoral considerations.

269. See Fennell, *supra* note 8, at 1316.

270. Interview with real estate attorney (Nov. 9, 2018) (on file with the author).

271. If such deals emerge out of bankruptcy proceedings, there is still a temporal spillover: the acquiring firm (rather than the general public) is paying for cleanup costs shirked by the previous owner.

employ this approach more widely, conditioning future opportunities on the remediation of old sites.

Bundling of a different form could also be employed on public lands. As noted earlier, public land law presently relies a great deal on fragmented interests—mining claims, timber contracts, and so forth, on lands which otherwise remain titled in the federal government. Although environmental organizations typically oppose the divestiture of public lands, in limited circumstances an outright sale of land may provide greater incentives for extractive industries to conserve land for the long-term than would the current scheme of limited use rights. By preserving land as a complete “bundle,” land management agencies would eliminate the disjoint of incentives that otherwise enables resource development interests to disregard the long-term health of the land.

By this point, some readers may be disappointed by the “ways forward” explicated here. In this disappointment lies an important lesson about property. The problem of negative-value property is simply part and parcel of our property system, and all the more so in an age in which lasting damage to land can be imposed in the blink of an eye. Sparing other owners the costs of such damage requires a social system that can anticipate it and extract compensation (or some reliable guaranty thereof) *ex ante*. Systems of that sort are difficult to organize and maintain, and American property law gets us only partway there.

CONCLUSION

The core social functions of property are bound up in the protection of ownership.²⁷² Property law links the welfare of the owner with his or her stewardship of the owned thing: ownership of something, vouchsafed by the state, often provides an incentive to conserve and protect it.²⁷³ This simple logic is the foundation for fundamental approaches to resource access, allocation, management, and governance.²⁷⁴ Understandably, then, many

272. See Demsetz, *supra* note 4, at 356 (“[P]rivate ownership of land will internalize many of the external costs associated with communal ownership, for now an owner, by virtue of his power to exclude others, can generally count on realizing the rewards associated with husbanding the game and increasing the fertility of his land.”). Obviously the same logic extends to value-generating activities beyond husbandry and agriculture.

273. See, e.g., Fennell, *supra* note 26 at 1468 (“The fee simple thus does an excellent job of encouraging optimal investments in outcomes that are spatially constrained (within the parcel) but temporally extended.”). Needless to say, there are also ample noneconomic reasons for the stewardship of property.

274. Further, “some economic historians have identified the emergence of freehold land tenure in Western Europe after the Dark Ages as a major source of the great release of energy that ensued there.” Ellickson, *supra* note 2, at 1317 (citing DOUGLASS C. NORTH & ROBERT PAUL THOMAS, *THE RISE OF THE WESTERN WORLD* 18 (1973)).

regard property rights as a road to conservation, a road built on a bed of individual decisions rather than a heavy-handed state.

But negative-value property upsets this picture. In predictable instances, the incentive to conserve is replaced by the incentive to exploit and to abandon. When land contains valuable resources such as oil, coal, timber, or minerals, any incentive to protect such land for the future may be dwarfed by the incentive to market the resource. Similarly, as industrial facilities age and deteriorate, owners may find it more economical to mothball or abandon them than to dismantle or decontaminate them. In each of these instances, owners' incentives cut against the protection of property, and avoiding temporal spillovers and public expenditure will require affirmative governmental effort.

It is neither possible nor desirable to do away with all externalities, for the cost would far exceed the benefits. To simply identify a persistent and generally unnoticed area of externalized costs, as this article has done, is to highlight the costs borne by the public due to the delinquency of property owners in particular circumstances. But whatever the feasibility of reducing the public cost of negative-value property, the existence and abundance of such property exposes the tradeoffs embedded in certain pillars of American property law. The flexibility of property fragmentation, the long tradition of public land ownership, and the relaxed approach to land use that typify the American system all take on a different cast in light of the imposing burden of negative-value property. Negative-value property is not some aberration, an idiosyncratic problem that will disappear of its own: it is endemic to our system of landownership, and its prevalence demonstrates that a more thoroughgoing approach to conservation must look beyond the law of property.

