REFLECTIONS ON THE "PORE SPACE ESTATE"

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ABSTRACT

As state legislatures and courts increasingly address the severability of subterranean porosity or storage space, known as "pore space," from ownership of the overlying land, the time is ripe for an account of what it means for property law to recognize a severed estate in pore space. This Article examines the economic and technological forces driving the severance of pore space and reflects on the consequences, good and bad, of a severed "pore space estate." As an aid to lawmakers and courts tasked with deciding whether to inaugurate such an interest into their jurisdiction's property law, the Article searches for lessons in the law's experience with severed property interests in other natural resources like oil and gas, wind, and water.

Three takeaways emerge from the discussion. First, the costs and complications of recognizing a perpetual, freehold estate in pore space counterbalance and may even outweigh the benefits in doing so. Second, many of the costs and complications of a freehold estate would be ameliorated by limiting the duration of pore space interests to the period of their use. And third, prohibiting severance of pore space estates while permitting creation of easements in pore space would do little, if anything, to ameliorate the costs and complications of allowing severance of pore space.

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INTRODUCTION

Over the past few years, a novel interest in land has started to emerge in American property law: the severed estate in geologic porosity, or "pore space." With an eye toward carbon dioxide capture and storage (CCS), multiple state legislatures have enacted statutes to enable the severance of a property estate in pore space from land.[1] For their part, courts are beginning to hear questions raised by private transactions that purport to sever ownership of pore space or sequestration rights from land. Some early opinions are favorable to the recognition of a pore space estate.[2] A new *Restatement (Fourth) of Property* takes the position that "[o]ne who has the right to possess underground space subjacent to land may sever the subsurface rights and transfer those rights as separate interest in property to another for any legally permissible use."[3] All in all, the trajectory of American law seems to be bending toward recognition of a pore space estate.

There are headwinds, however, from state legislatures, legal scholars, and classical common law doctrine. One state, North Dakota, statutorily prohibits the severance of ownership of pore space from land.[4] In earlier years, the prospect of a severed wind estate met the same legislative fate in several states.[5] Though as yet silent on the merits of a severed pore space estate, legal scholars have expressed skepticism about allowing severance of a separate estate in wind.[6] These legislative and scholarly efforts may counsel caution on the part of courts and lawmakers in fully embracing separate ownership of pore space. The common law itself,

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[1] WYO. STAT. § 34-1-152(b); 60 OKLA. STAT. 6(B)(2). *Contra* N.D. CENT. CODE § 47-31-05.

[2] Darkhorse Water, LP v. Birch Operations, Inc., 681 S.W.3d 900, 902 (Tex. App. 2023), *pet granted* Birch Operations, Inc. v. Darkhorse Water, LP, 2024 Tex. LEXIS 1136 (Dec. 20, 2024); *see also* Bushey v. Seven Lakes Reservoir Co., 545 P.2d 158, 161–62 (Colo. Ct. App. 1975) (involving adverse possession of underground storage space).

[3] RESTATEMENT (FOURTH) PROPERTY Vol. 1 § 1.19 (TD 4 2023).

[4] N.D. CENT. CODE § 47-31-05.

[5] The following states prohibit or limit severance of wind ownership from land: COLO REV. STAT. § 38-30.7-103; NEB. REV. STAT. ANN. § 66-912.02; N.D. CENT. CODE ANN. § 17-04-03; S.D. CODIFIED LAWS §§ 43-13-19 & -16; MONT. CODE. ANN. § 70-17-404; KAN. STAT. ANN. § 58-2272; 60 OKLA. STAT. ANN. § 820.1; WYO. STAT. ANN. § 34-27-103.

[6] *See, e.g.*, K.K. DuVivier, *Sins of the Father*, 1 TEX. A&M J. REAL PROP. L. 391, 417–18 (2013); Alan J. Alexander, *The Texas Wind Estate: Wind As a Natural Resource and a Severable Property Interest*, 44 U. MICH. J.L. REFORM 429, 455–56 (2011).

moreover, contains a presumption against new and novel interests in land.[7]

This Article explores the consequences of legal recognition of a separate estate in pore space or the right to inject and store fluid in pore space. Part I furnishes a brief background of the uses of pore space and the forces that appear to be leading to recognition of a pore space estate. Part I also examines the only case thus far to consider whether pore space may be severed in a separate estate, *Darkhorse Water, LP v. Birch Operations, Inc.*[8] Part II defines what it means in legal terms to recognize a severed estate in pore space, or any other resource. Part III considers the consequences of a severed pore space estate for the development of pore space, complication of land titles, controversies over surface use, and coordination with development of other natural resources. Part IV concludes with some thoughts for courts and legislatures considering the matter.[9]

I. USES AND COMPETITION FOR PORE SPACE

Like other severed interests that emerged before it, the putative pore space estate is ultimately the result of technological and economic forces. Oil provides a classic example of this. Demand for cheaper illuminating oil and advances in refining technology touched off the world's first oil boom near Oil Creek, Pennsylvania in the 1850s.[10] This in turn caused private parties to devise new and novel forms of property in oil (and natural gas), including the severed oil and gas estate and the interest called the oil and gas lease.[11] Courts shortly came to accept the severance of rights to oil and gas from land as a matter of common law.[12]

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[7] This takes the form of the principle (called *numerus clausus*) that the recognized estates are a closed list and the doctrine that prohibits the creation of novel burdens on land. *See generally* Thomas W. Merrill & Henry E. Smith, *Optimal Standardization in the Law of Property: The* Numerus Clausus *Principle*, 110 YALE L.J. 1 (2000); Alfred F. Conard, *Easement Novelties*, 30 CAL. L. REV. 125 (1942).

[8] 681 S.W.3d 900, 902 (Tex. App. 2023), *pet granted* Birch Operations, Inc. v. Darkhorse Water, LP, 2024 Tex. LEXIS 1136 (Dec. 20, 2024).

[9] What is offered here is a springboard into future work, in which I will present a more comprehensive analysis of the process by which the law decides when to embrace a novel estate in property and the doctrinal and policy considerations that structure that determination. *See* Joseph A. Schremmer, *Custom and Separate Ownership of Natural Resources* (manuscript on file with author).

[10] DANIEL YERGIN, THE PRIZE: THE EPIC QUEST FOR OIL, MONEY & POWER 19–34 (Simon & Shuster 1992).

[11] *See* Brown v. Vandergrift, 80 Pa. 142 (Pa. 1875).

[12] For evidence, consider the relatively cursory treatment that mineral severance receives in the earliest oil and gas law treatises and casebooks. GEORGE BRYAN, THE LAW OF PETROLEUM AND NATURAL GAS § 1 (1893); W.W. THORNTON, OIL AND GAS § 18 (1904); V.B. ARCHER, LAW AND PRACTICE IN OIL AND GAS CASES

A. Technological and Economic Forces

Although not nearly as dramatic or romantic as the discovery at Oil Creek, economic and technological phenomena have conspired in the first quarter of the twenty-first century to cause society to view pore space as a valuable property right in land. A significant reason for contemporary interest in pore space is the invention of carbon dioxide capture and storage (CCS). CCS technology makes it possible to sequester carbon dioxide from anthropogenic emissions, and even pull carbon dioxide from the atmosphere directly in "direct air capture."[13] Through deep injection wells, this carbon dioxide can then be placed in the naturally occurring pore space of deep subterranean structures like saline aquifers, depleted oil and gas reservoirs, and coal seams.[14] Through the miracle of technology, pore space is now useful as a storage unit for the primary greenhouse gas.

There is also an economic component to the pore space revolution. With the goal of incentivizing private parties to reduce carbon dioxide emissions and encourage deployment of carbon sequestration technologies, Congress enacted an income tax credit in Section 45Q of the Internal Revenue Code for the sequestration of anthropogenic carbon dioxide through CCS or utilization of the carbon, including through enhanced oil or gas recovery.[15] That was 2008. Ten years later, after the United States had committed to emissions reductions as an original signatory of the Paris Climate Agreement, Congress expanded 45Q and enhanced the available credit.[16] Four years after that, in the Inflation Reduction Act of 2022, Congress once again enriched the 45Q tax credit and made it easier to claim by taxpayers lacking substantial tax liabilities.[17]

These tax incentives proved effective at spurring CCS and enhanced recovery projects using carbon dioxide. Applications for permits to inject carbon dioxide have risen consistently since the

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§§ 27, 49 (1911); VICTOR H. KULP, CASES ON OIL AND GAS 1 (AM. CASEBOOK SERIES 1924).

[13] *See* Joseph A. Schremmer, *The Concurrent Use of Land for Carbon Sequestration and Mineral Development*, 75 BAYLOR L. REV. 630, 633–35 (2023).

[14] *See* Joseph A. Schremmer, *Getting Past Possession: Subsurface Property Disputes as Nuisances*, 95 WASH. L. REV. 315, 320–22 (2020).

[15] Energy Improvement and Extension Act of 2008. *See generally* Elizabeth L. McGinley, et al., *Critical Issues for Carbon Capture Projects: Tax, Environmental, Land Rights, and Commercial Issues*, 68 NATURAL RESOURCES & ENERGY L. INST. 7-1, § 7.02 (2022).

[16] 26 U.S.C. § 45Q; Bipartisan Budget Act of 2018, Pub L. No. 115-123, 132 Stat. 64.

[17] Inflation Reduction Act of 2022, Pub. L. No. 117-169, 136 Stat. 1818.

introduction of 45Q[18] Since 2008, states have enacted a variety of legislation to deal with the increase (partly real and partly anticipated) in carbon sequestration projects within their borders. These statutes address regulatory jurisdiction over CCS operations, well permitting rules, unitization, and legacy liability.[19] Over this same period, landowners and CCS developers have begun negotiating for the necessary rights in land to conduct CCS operations. These transactions have taken many forms, including leases and easements in pore space for CCS purposes, as well as conveyances of title to pore space itself.[20]

With ample tax credits to incentivize the geologic sequestration of carbon dioxide through CCS, competition for use of pore space for *all* purposes has intensified.[21] Well before the advent of carbon capture technology, pore space was used by multiple industries. The oil and gas industry injects wastewater into pore space as the primary means of wastewater disposal, and it injects carbon dioxide, water, and many other substances into pore space for secondary and enhanced recovery.[22] Subterranean pores are also used in the storage of produced and refined hydrocarbons and have been for many decades.[23] Other industries use pore space, too, mostly for disposal of various kinds of hazardous and nonhazardous waste, historically including radioactive wastes.[24]

Until recently, the value of pore space for these activities was rarely seen as significant. In earlier times, when landowners granted rights to dispose of saltwater in their land, for example, the compensation for the grant was nearly always intended to pay for

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[18] *See Current Class VI Projects Under Review at EPA*, EPA (April 25, 2025), https://www.epa.gov/uic/current-class-vi-projects-under-review-epa; *Class VI Program Permit Tracker*, HUNTON (last visited May 2, 2025), https://www.hunton.com/class-vi-program-permit-tracker.

[19] *See* CCUS State Legislative Tracker, CDR LAW (April 13, 2025), https://cdrlaw.org/ccus-tracker/; State Legislation, GREAT PLAINS INSTITUTE (Feb. 22, 2023), https://carboncaptureready.betterenergy.org/state-legislation/.

[20] *See* Keith B. Hall, *Drafting and Negotiating Instruments to Acquire Pore Space Rights for CCS*, 69 NATURAL RESOURCES & ENERGY L. INST. 5 (2023); Schremmer, *supra* note 13, at 649–53.

[21] Hannah J. Wiseman, Anne Menefee, Seth Blumsack, and Michael Helbin, *Zoning the Subsurface*, 72 UCLA L. REV. __, 1–5 (forthcoming 2025), *available at* https://papers.ssrn.com/sol3/papers.cfm?abstract_id=4790207; Joseph A. Schremmer, *Pore Space Property*, 2021 UTAH L. REV. 1, 59–61 (2021).

[22] Schremmer, *supra* note 14, at 343–55. Several other industries also dispose of various wastes into pore space.

[23] *See id.* at 355–58.

[24] *See* Underground Injection Control Well Classes, EPA (Mar. 11, 2025), https://www.epa.gov/uic/underground-injection-control-well-classes (discussing Class I wells for injecting hazardous and nonhazardous wastes and Class IV wells that at one time were used to dispose of hazardous and radioactive waste).

use of the surface, rather than occupancy of the subsurface.[25] This has changed in light of CCS and 45Q, as landowners and developers increasingly view pore space rights as economically valuable and as potential objects of sale apart from the property. In this way, even seemingly ordinary transactions in pore space, like the grant of disposal rights, are now conducted and interpreted in the shadow of CCS.

B. Darkhorse Water, LP v. Birch Operations, Inc.

Darkhorse Water, LP v. Birch Operations, Inc. is illustrative.[26] The dispute involved the priority of two contracts granted by the same landowner to different companies, Darkhorse and Birch Operations, to dispose of saltwater in the landowner's parcel. Darkhorse sued Birch Operations claiming the superior right to dispose of wastewater under an agreement entitled a "SaltWater Reclamation, Treatment, Water Purchase and SaltWater Disposal Agreement."[27] The district court dismissed Darkhorse's quiet title claim on standing grounds, finding that Darkhorse lacked title or ownership in the land necessary to bring a quiet title suit.[28] Thus, the question presented to the Court of Appeals was whether the SaltWater Reclamation, Treatment, Water Purchase and SaltWater Disposal Agreement was merely a contract or lease for water disposal or instead constituted the severance of an ownership interest in the pore space of the land.[29]

Saltwater disposal leases are ubiquitous in oil and gas development. They are generally drafted and interpreted as surface-occupancy leases, easements, or contractual licenses to enter the surface to dispose of wastewater—not as conveyances of a portion of the realty or the right to recover a natural resource.[30] Nevertheless, the *Darkhorse* agreement included some provisions that may reflect the contemporary view that subsurface occupancy rights are valuable in themselves, separate and apart from surface occupancy rights. For example, the agreement provided for a royalty on "the disposal of waste water into the reservoir storage space."[31] Considering this and other terms in the document, the *Darkhorse*

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[25] *See* Burlington Res. Oil & Gas Co., LP v. Lang & Sons Inc., 259 P.3d 766, 771 (Mont. 2011) (noting expert witness testimony that "no demonstrable market exists for pore space").
[26] 681 S.W.3d 900, 902 (Tex. App. 2023), *pet granted* Birch Operations, Inc. v. Darkhorse Water, LP, 2024 Tex. LEXIS 1136 (Dec. 20, 2024).
[27] *Id.* at 902.
[28] *Id.*
[29] *Id.* at 902–04.
[30] *See* Royalco Oil & Gas Corp. v. Stockhome Trading Corp., 361 S.W.3d 725, 731 (Tex. App. 2012) (characterizing a disposal agreement as an ordinary lease rather than the conveyance of a right to recover any natural resource).
[31] *Darkhorse Water*, 681 S.W.3d at 907.

court concluded that the parties intended to convey a fee simple determinable in reservoir pore space to Darkhorse for the duration of disposal operations.[32]

In the court's view, the subject matter of the *Darkhorse* agreement was not the use of the surface of land to support disposal operations but the reservoir storage space itself, which it described as "an attribute of the surface estate that is capable of being consumed and depleted by the disposal of saltwater just like oil, gas, sand, gravel, coal, and lignite may be extracted from the property."[33] The provisions of the agreement were so similar to those of an oil and gas lease that the court characterized the agreement by analogy, calling it a fee simple determinable in the pore space, just as Texas law characterizes an oil and gas lease as a fee simple determinable in oil and gas.[34] Pending review by the Texas Supreme Court, the Texas Court of Appeals thus recognized the severability of an estate in pore space, akin to oil and gas.

There is much notable about the *Darkhorse* case. For one thing, it is perhaps a bit ironic that the first pore space severance case did not involve carbon sequestration, though it seems fair to say that but for sequestration, the value of pore space for water disposal would have been less dear and the case might never have arisen. For another thing, *Darkhorse* is notable for how little it considers the consequences for property law of implicitly empowering the landowner to sever an estate in pore space. The decision to recognize a new severable estate in property law bears significant legal and policy implications for land titles, surface use, and coordination of pore space development with other resource development, as the following Parts aim to explain.

II. DEFINING SEVERED ESTATES

Just what does a "severed estate" in pore space entail? Other than its significance for standing to bring a quiet title, what difference does it make to characterize the *Darkhorse* agreement as a conveyance of an estate in pore space rather than as a surface-occupancy lease or a mere contract? There is surprisingly little in the legal literature encapsulating what it means to sever an independent legal estate in a natural resource from land. The following sections attempt to synthesize a legal definition of estate severance to help analyze the consequences of recognizing a severed estate in pore space.

A. The Concept of "Severance"

[32] *Id.* at 908.
[33] *Id.*
[34] *Id.*

Conceptually, a new estate of property is severable when the law empowers an owner to separate a new, original title to some aspect of an existing object of property. Title to land is severable because a portion of the land may be subdivided into separate ownership, as where *A* owns fee in Section 1 and conveys a new, original title in fee to the Northeast Quarter to *B*. Likewise, an estate in a natural resource is severable if the landowner is empowered to separate a new title to the resource from title to the land. Thus, "severing" an estate in natural resources means permitting the resource to be owned and used separately from the land itself.

Calling a severed interest in a natural resource an estate distinguishes it as an independent object of ownership, an interest in property rather than a contractual interest. Property rights are *in rem* in nature, which means they are enforceable against "the world at large."[35] Contractual rights, in contrast, are *in personam* rights, which are enforceable only against defined persons (counterparties to the contract) but not society generally.[36] While a landowner has the power to contract with another for the use or enjoyment of natural resources on the land, those rights of use and enjoyment will not bind third persons or give the recipient "a right of suing in his own name for an interruption of the right by a third party."[37] Thus, when the law recognizes the power of a landowner to create in another a severed estate in a natural resource, the status of the rights that may be created leaps from *in personam* to *in rem*. The law thereby institutes a new object of property.[38]

The move from *in personam* to *in rem* treatment brings with it a more robust package of rights, privileges, and immunities, since they are good against the world rather than a defined set. But this largess comes with conditions. Unlike *in personam* contractual rights, the validity of which are loosely limited by conditions like unconscionability and illegality, the law strictly circumscribes the kinds of ownership rights it recognizes as valid. As one court explained, "it is not competent for an owner of land to render it

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[35] 1 TIFFANY, REAL PROPERTY § 243 (3d ed.) (defining "in rem" rights as "available against the world at large," and "in personam" rights "available against a definite person or persons, is one on which conflicting views have been expressed by writers of authority").

[36] *Id.*

[37] Stockport Waterworks Co. v. Potter, (1864) 3 H. & C. 300, 326–27; 159 E.R. 545, 556 (Pollock, C.B.); Keppel v. Bailey, (1834) 2 My. & K. 517; 39 E.R. 1042 (Ch.).

[38] *See* J.E. Penner, *Property*, *in* THE OXFORD HANDBOOK OF THE NEW PRIVATE LAW 282 (Gold, et al., eds. 2021) (explaining that property rights arose as "the law determined in its wisdom to allow certain *originally purely contractual* obligations of the owner to 'run with the land,' that is, to bind successors in title to the obligor and, in cases such as easements, to pass to successors in title of the obligee.").

subject to a new species of burthen [sic] at his fancy or caprice."[39] Rather, the law places "validity conditions" on the power of landowners to create new estates of property, similar to the conditions placed on valid contracting, but much more restrictive.[40] Theoretically, by insisting on compliance with these validity conditions, courts police the conceptual boundary between the legal forms of contract and property and regulate the creation of new forms of property.[41]

B. Defining "Estates" in Land

1. Characteristics of Estates

At its most general, "estate" merely refers to "[t]he amount, degree, nature, and quality of a person's interest in land or other property."[42] Yet, not every interest in real property constitutes an "estate in land." That is a status afforded only to certain interests in land. Some interests, like easements, are generally not considered estates even though they may be property interests in land in the *in rem* sense.[43]

To be an estate in land, a property interest must have certain characteristics. Some of these characteristics distinguish the interest from contractual interests while others distinguish estates from non-estates like easements and licenses. In general, estates include the right to freedom from interference from both the grantor and third parties;[44] they are generally alienable, assignable, and inheritable (unless limited by their own terms to a life estate);[45] they are not personal to the holder;[46] they are irrevocable;[47] they are legal rather than equitable;[48] they may be of freehold tenure (i.e., potentially perpetual in duration)[49] and are not terminable solely for nonuse.[50] The final distinguishing trait of an "estate" of ownership is

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[39] Nuttall v. Bracewell, (1866) L.R. 2 Exch. 1, 9–10 (Exch.) (Martin, B.).

[40] *See* Paul B. Miller, *The New Formalism in Private Law*, 2 AM. J. OF JURISPRUDENCE 207–08 (2021).

[41] *See id.*

[42] BLACK'S LAW DICTIONARY *estate* (11th ed. 2019).

[43] 3 TIFFANY, *supra* note 35, § 757. Licenses may not be entirely *in rem*. *See id.* § 829; Doe dem. Hanley v. Wood, 105 Eng. Rep. 529, 534, 2 B. & Ald. 736 [1819] (distinguishing licenses from estates in land).

[44] 3 TIFFANY, *supra* note 35, § 840.

[45] 91 A.2d 514.

[46] 3 TIFFANY, *supra* note 35, § 757.

[47] *Id.*

[48] *Id.*

[49] "Tenure" refers to the potential duration of an estate. Freehold estates are of perpetual duration. BLACK'S, *supra* note 42, *freehold*. Leasehold estates, i.e., leases for terms of years, periodic tenancy, tenancy at will, or tenancy at sufferance, are not of perpetual duration. *Id. leasehold*.

[50] Jilek v. Chi., Wilmington & Franklin Coal Co., 47 N.E.2d 96, 102 (Ill. 1943); Bodcaw Lumber Co. v. Goode, 254 S.W. 345, 349 (Ark. 1923).

especially important: estates are entitled "to participate in the profits of the soil."[51] Recognized estates in land include fees simple, life estates, and certain profits à prendre (in modern usage, "profits"), on which more will be said later.[52]

2. Leases

Interests that are limited to a term of years and are thus limited to a leasehold rather than freehold tenure, "are not held and owned as the whole or a part of a freehold ownership"—they are not estates of ownership.[53] Leaseholders take possession of the leased land, essentially "stepping into the shoes" of the fee-owning lessor, which entitles them to use and enjoyment of many aspects of the land. Leaseholders may be entitled to temporary enjoyment of any number of resources on the land, for example the rights to harvest growing crops, collect the sun's rays, and capture wind. This makes leases a useful vehicle for granting rights to solar and wind developers. Wind and solar leases, however, generally do not purport to grant an ownership interest in wind or solar rights and thus do not purport to create a profit or fee that could constitute an estate in land.[54] These leases often incorporate various easements, which also would not constitute an "estate" for the reasons explained shortly.

Under a typical lease, the right to take non-renewing natural resources, like minerals and some kinds of timber, remains with the fee estate and does not pass to the leaseholder, and it is waste for the leaseholder to take them.[55] For this reason, true leases have played little role in the development of most natural resources. However, the most common instrument used to confer development rights in oil and gas goes by the name the "oil and gas lease." Yet, in most jurisdictions, the oil and gas lease is characterized as creating a profit of determinable duration; in others, it is classified as creating a fee simple determinable. In either case, it is not a true lease but the conveyance of a hereditament (essentially an estate) in land.[56]

3. Profits

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[51] 3 TIFFANY, *supra* note 35, §§ 757, 839.
[52] RESTATEMENT (THIRD) OF PROPERTY: SERVITUDES § 1:2 cmt.f.
[53] State v. South Penn Oil Co., 24 S.E. 688, Syl. ¶ 5 (W. Va. 1896).
[54] Distinct from wind leases, landowners in West Texas have been documented to sever wind incidents from land by deed. Ernest E. Smith & Becky H. Diffen, *Winds of Change: The Creation of Wind Law*, 5 TEX. J. OIL GAS & ENERGY L. 165, 176 (2010). This, of course, does implicate the power of a landowner to sever such an interest.
[55] 2 TIFFANY, *supra* note 35, §§ 631, 633, 634.
[56] *See* 2 KUNTZ, LAW OF OIL AND GAS § 18.2.

Profits are an important category of estate in the context of natural resources. They endow the holder with "a right to acquire, by severance or removal from another's land, some thing or things previously constituting a part of the land."[57] The grant of a profit also implies a freehold duration and full assignability and inheritability, although these characteristics may be limited by the terms of the grant.[58] When granted, a profit implies the right to access and do such things on the land as are reasonably necessary to exercise the right.[59] Common instances of profits include rights to timber, gravel, and minerals like oil and gas.[60]

In contrast to estates in fee and leaseholds, which are corporeal or possessory property, profits are considered incorporeal hereditaments, meaning they are nonpossessory in nature. Their nonpossessory nature disqualifies profits from treatment as estates in land under some definitions, which require the interest to be possessory or be able to become possessory to constitute an estate.[61] For certain kinds of profits, including especially profits in oil and gas, however, courts have conferred the status of an "estate" in land despite their being nonpossessory.[62] This is because profits are freehold interests based on their tenure and because they entitle their holder to take and profit from part of the land.[63] In sum, a profit is "a distinct, independent object of ownership," i.e., a severed estate in land.[64]

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[57] Jackson Cnty. v. Compton, 609 P.2d 1293, 1294 (Ore. 1980).
[58] *Id.*
[59] *Id.*
[60] 3 TIFFANY, *supra* note 35, § 839.
[61] RESTATEMENT OF PROPERTY § 9 (defining "estate" as "an interest in land which . . . is or may become possessory . . . .").
[62] Bruce M. Kramer, *Property and Oil and Gas Don't Mix: The Mangling of Common Law Property Concepts*, 33 WASHBURN L.J. 540, 541–42 (1994) (citing Gerhard v. Stephens, 442 P.2d 692 (Cal. 1968); Callahan v. Martin, 43 P.2d 788 (Cal. 1935); Stewart v. Amerada Hess Cop., 604 P.2d 854 (Okla. 1979)); *see also See* 1 PATRICK H. MARTIN & BRUCE M. KRAMER, WILLIAMS & MEYERS, OIL AND GAS LAW § 301 n.2 [hereinafter WILLIAMS & MEYERS] (citing cases referring to nonpossessory profits in oil and gas as "estates" in minerals). No such characterization has been given an easement, in contrast, because unlike a profit, an easement does not entitle the holder to "profit" from the land but merely use it.
[63] *See* Watford Oil & Gas Co. v. Shipman, 84 N.E. 53, 54 (Ill. 1908) ("The right to go upon the land and occupy it for the purpose of prospecting, if unlimited duration, is a freehold interest." (internal citations omitted)); Callahan v. Martin, 3 Cal. 110, 120, 43 P.2d 788, 792 (Cal. 1935) ("Where this limited interest is to endure in perpetuity or for life, it is a freehold interest, and real property or real estate, as well as an estate in real property."); Rich v. Doneghey, 177 P. 86, 89 (Okla. 1918) ("Considered with respect to duration, if the grant be to one and his heirs and assigns forever, it is of an interest in fee."); Gerhard v. Stephens fn. 7, 69 Cal. Rptr. 612.
[63] BLACK'S, *supra* note 42, 736.
[64] Moore v. Schultz, 91 A.2d 514, 516 (N.J. Ct. App. 1952).

The distinction between corporeal and incorporeal interests is deeply rooted in the common law. Incorporeal property interests are "not the object of sensation, can neither be seen nor handled, are creatures of the mind, and exist only in contemplation."[65] Unlike corporeal property, the owner of incorporeal property is thought to be entitled to certain legal *rights* in things rather than the things *themselves*.[66] Accordingly, in classifying a severed right to take a resource from land as an incorporeal profit or a corporeal fee, courts have focused on the nature of the underlying resource. Courts confer corporeal treatment on resources that seem capable of exclusive control, such as solid, immobile minerals (the theory being that the property is tangible), whereas they have treated as incorporeal profits rights in fluid and fugacious resources, like wild animals or water. The greatest interest a landowner may enjoy in moveable, incorporeal resources is the right to take them away from the land.

Certain resources, like oil and gas, pose especially difficult classification problems because of their peculiar physical nature.[67] The result in oil and gas law is the divide between "ownership" jurisdictions that view oil and gas in place as corporeal and "non-ownership" or "exclusive right to take" jurisdictions that view oil and gas as inherently incorporeal.[68] Despite the profundity of the difference between the opposing views, in modern practice the distinction little.[69]

4. Easements and Licenses

Easements, and less so licenses, resemble profits in certain respects. Easements are a form of *in rem* property, enforceable against third parties, are capable of perpetual duration, and in modern law are generally assignable.[70] Yet, while they resemble profits in certain respects, easements and licenses are not given the dignity of an estate in land. Another way to phrase the distinction would be to say that easements are property but they do not

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[65] 2 WILLIAM BLACKSTONE, COMMENTARIES ON THE LAWS OF ENGLAND ch. 2, 17–18 (Oxford, Clarendon Press 1765).

[66] *Id.* ch. 3, 20–21. Common law recognized many varieties of incorporeal hereditaments, among which was the commons, which was a right to take particular resources (like fish, turf, or wood) from the land of another. The commons is the ancestor of the *profit a prendre*, and there was even a common "of digging for coals, minerals, stones, and the like." *Id.* at 32.

[67] *See generally* 1 WILLIAMS & MEYERS, *supra* note 62, § 203.

[68] *Id.* § 203.1–.4.

[69] *Id.* §§ 204.9, 211.

[70] 3 TIFFANY, *supra* note 35, § 761 ("Indeed, there is a growing recognition of the assignability of all easements in gross except those demonstrably intended to benefit only the individual who is its first recipient. Thus, easements in gross designed and used for commercial exploitation are assignable where the language of the instrument creating them indicates an intention to make them assignable.").

constitute ownership.[71] Easements entitle their holders to the use of another's land but, unlike profits, they do not entitle their holder to participate in the profits of the land. They neither entitle their holder to call part of the land one's own, nor to recover a resource from the land.[72]

Licenses lack several estate characteristics. They are "revocable, usually temporary, and personal to the licensee," and in contrast, to a right *in rem*, licenses pass only a privilege to take certain actions on another's property.[73] Far from having the character of an estate in land, licenses are rather closer to contractual rights, having been said to "passeth no interest" in property whatsoever.[74]

C. Characterizing a "Pore Space Estate"

In sum, a severed estate in pore space would constitute an ownership interest in pore space separate from the land itself, which may be perpetual, irrevocable, alienable, and enforceable against third parties as well as the grantor from whose interest the pore space estate was created. A pore space estate would be more than a contractual interest or a license in the land.

It is a difficult question, however, whether a perpetual, alienable, *in rem* interest in pore space should be characterized an estate or merely an easement—the right to use the pore space for storing or transmitting fluids. If pore space is thought of as a part of the earth that is consumable by filling it with fluids, then the property right to inject into the pore space of another's land ought to be classifiable as a separate *estate*. But if pore space is conceptualized as empty space, merely a location under the land where things can be placed or kept under the land, then classification of the right to locate things in that space under another's land might be more appropriately classified as an *easement*.[75] In this, pore space differs from a resource like oil or gas, which are physically severable parts of the land.

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[71] *See* Eric R. Claeys, *Property, Concepts, & Functions*, 60 B.C. L. REV. 1, 19 (2019) ("Thus, a fee simple absolute constitutes both property and rights of ownership. If a fee owner grants an easement to someone else, however, that second party would hold property but not ownership rights in the easement."). Moreover, the power to grant novel easements, like the power to grant or convey novel legal estates, is subject to legal validity conditions that limit the forms they may take. *See generally* Conard, *supra* note 7.

[72] 3 TIFFANY, *supra* note 35, §§ 840, 757. *But see* RESTATEMENT (THIRD) OF PROPERTY: SERVITUDES § 1:2 cmt.f (defining a profit as an easement).

[73] 3 TIFFANY, *supra* note 35, §§ 757, 829.

[74] *Id.* § 829.

[75] *See* BLACK'S, *supra* note 42, at 568 (noting that one recognized easement is "a right to place or keep something on the servient estate").

The *Darkhorse* court believed that pore space is a consumable part of land, which is capable of ownership as a fully possessory fee simple interest.[76] This reasoning seems to exclude the possibility that occupying pore space constitutes mere *use* of it, which would be done via an easement. It is plausible that other courts could view a conveyance of pore space as merely the right to use pore space, rather than to consume it, since once injected into pore space, fluid may be extracted and removed or displaced by further injection.

Assuming the right to inject into the pore space under another's land ought to be classed as an estate, the quandary that follows is whether to characterize the pore space estate as a corporeal fee or an incorporeal profit. No single correct answer to either of these questions is to be found. On the one hand, pore space is a stationary part of the rock structure of the land itself, which may be possessory in nature as land itself and solid minerals are possessory. At least one court has taken the position that a landowner's interest in pore space is possessory and thus that any government-authorized entry into a person's pore space is a *per se* trespass and a taking of the owner's private property.[77]

On the other hand, pore space is interconnected within most rocks, which means that fluids injected under one tract may migrate into another and there is no possibility of effective exclusive possession of pore space except by occupying it first.[78] In this, pore space acts more like a moveable or fugitive resource that is inherently nonpossessory.[79] Neither of these positions is indisputably correct and jurisdictions are likely to split on the question as they did in characterizing the oil and gas estate.

No matter whether a severed interest in pore space is characterized as an easement, a profit, or a fee, or as possessory or nonpossessory, it would generally have a few key characteristics: *in rem* enforceability, free alienability, and perpetual duration. As the following Part of this Article explores further, these traits provide a stable property-rights foundation for development of pore space for large-scale, capital-intensive projects like CCS. At the same time, however, these traits may have negative consequences for land titles, surface use, conflicts with development of other resources, and even for development of the pore space itself.

III. THE CONSEQUENCES OF SEVERING PORE SPACE

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[76] Darkhorse Water, LP v. Birch Operations, Inc., 681 S.W.3d 900, 908 (Tex. App. 2023), *pet granted* Birch Operations, Inc. v. Darkhorse Water, LP, 2024 Tex. LEXIS 1136 (Dec. 20, 2024).

[77] Nw. Landowners Ass'n v. North Dakota, 978 N.W.2d 679, 691 (N.D. 2022).

[78] Schremmer, *supra* note 21, at 7–11.

[79] Schremmer, *supra* note 14, at 340–42.

At first glance, it might seem that allowing severance of pore space is not only doctrinally consistent with our treatment of other subsurface resources but that it also makes unequivocally good policy. As this Part endeavors to show, however, while there are policy advantages to a separate estate in pore space, there are also real costs. These costs will largely be familiar to the mineral lawyer, who deals routinely with similar issues arising from severance of a separate estate in oil, gas, and other mineral substances. These include the fragmentation of title to the resource, the complexities of examining title to the resource and land, the difficulties of coordinating the activities of one estate with others (including the surface estate), and the physical consequences of resource development on the land and the resources themselves.

A. Facilitating Development

The ability to transfer ownership of a natural resource, like pore space, separately from the attached land may be thought to increase beneficial use of the resource, through the mechanism of the free market. Once the right to recover natural resources is made transferable, those rights become articles of trade and commerce and control of those rights start to move, through market transactions, to the people who value them most highly. Those are the people who are likeliest to put the resource to its highest and best use. Severance thereby facilitates investment in the development of natural resources.

Take oil and gas resources as an example. Although empirical study of this question is lacking, it may be that estate severance has played a part in the massive growth in mineral development since the mid-nineteenth century. Perhaps the stability of a separate estate in minerals helps support a market for mineral rights and enhance development.[80] It would certainly seem that a perpetual or defeasible property interest would be a more certain basis for investment and have a greater value on a mineral developer's balance sheet than a mere leasehold or servitude.

In water law, the severance of water rights for use away from the appurtenant tract has been crucial in the development of many municipalities, most notably in the American west.[81] It has also made large-scale agriculture possible in places that otherwise had little or no access to appurtenant surface water or underlying groundwater. The drafters of the *Restatement (Second) of Torts*

[80] Patrick H. Martin, *Unbundling the Executive Right: A Guide to Interpretation of the Power to Lease and Develop Oil and Gas Interests*, 37 NAT. RESOURCES J. 311, 316 (1997).

[81] *See generally* Burke W. Griggs, *Go West, Young Town, for Water*, 24 U. DEN. L. REV. 209 (2021) (discussing the history of water disputes in Colorado).

advocate for the free severance and transferability of riparian rights on just these grounds. The comments explain,

> [T]here are many reasons that make freedom from restraints on transfer desirable. Since the water in a particular source of supply is a finite resource, rights to it are limited by the quantity available. As the reasonable uses of riparians increase, the source may become exhausted or otherwise totally put to use. Yet new and better uses for the water will be found as progress and population pressure create new demands. The law of water rights should allow a new enterprise to buy a supply of the resource by acquiring the rights of a present user, and should effectuate and facilitate changes of water use that bring improvement and progress.[82]

B. Hindrances to Development

Perhaps counterintuitively, allowing severance of a freehold estate in a resource, like pore space, may in fact hinder the resource's development because of the perpetual duration of freehold interests. Because there is no requirement to work or develop resources owned in perpetuity, freehold ownership might discourage—or at least fail to encourage—beneficial use. Moreover, the perpetual nature of severed estates also makes them a target for speculators, who may have no interest in actually developing a resource but wish to hold the right to develop in anticipation of profit if circumstances change in the future.

1. Discouragement of Development

On occasion, courts have recognized that the perpetual nature of separate mineral ownership may discourage, rather than encourage, development of resources. On this basis, Louisiana courts declined to recognize a perpetual mineral estate. In the seminal case, *Frost-Johnson Lumber Co. v. Salling's Heirs*, the state's high court held that an attempted severance of oil and gas in place could give only a servitude, which under the civil law doctrine of liberative prescription is immutably limited to a duration of ten years unless continually developed.[83] Justice O'Neill explained that if the law were to recognize a separate estate of freehold duration in minerals, "it would . . . tend to paralyze the oil and gas industry of this state; for it would recognize a species of perpetual incumbrance

[82] RESTATEMENT (SECOND) OF TORTS § 856 cmt.b.
[83] Frost-Johnson Lumber Co. v. Salling's Heirs, 91 So. 207, 242–45 (La. 1922).

upon real estate which has never yet found an abiding place in our civil law system."[84]

Similarly, the Queen's Bench in the 1847 case of *Rogers v. Brenton* declined to enforce a severed freehold estate in tin under a Cornish mining custom, on the ground that the customary right's perpetual duration would be unreasonable.[85] The perpetual duration of the customary right "positively prevented" the extraction of tin, which frustrated both the public's interest in the production of tin and the landowner's interest in receiving a royalty portion of the tin, called a "tin toll."[86] Rather than encourage production of valuable minerals from the earth, the freehold interest "may be made the means of keeping them locked up within it."[87] Accordingly, the law would enforce the customary tin right only for so long as the claimant actively worked the tin mines (called "bounds").[88]

For similar reasons, courts generally favor the creation of *defeasible* interests in minerals, which by their own terms terminate with the cessation of production and thereby incentivize their holders to actively work the minerals to perpetuate the interest.[89] The oil and gas lease stands as a testimony to the effectiveness of defeasible interests in spurring mineral development.[90] From early in the development of oil and gas jurisprudence, courts interpreted oil and gas leases to avoid their having perpetual duration and incentivize development. In 1875, the Pennsylvania Supreme Court summarized the historical interpretation of oil and gas leases this way:

> Hence it was found necessary to guard the rights of the landowner as well as public interest, by numerous covenants, some of the most stringent kind, to prevent their lands from being burdened by unexecuted and profitless leases, incompatible with the right of alienation, and the use of the land. Without these guards, lands would be thatched over with oil-leases by sub-letting, and a farm riddled with holes and bristled with derricks, or operations would

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[84] Frost-Johnson Lumber Co. v. Salling's Heirs, 91 So. 207, 239 (La. 1921) (O'Neill, J., dissenting).

[85] Under traditional, Blackstonian doctrine, customary rights in land are enforceable only if reasonable. *See* Rogers v. Brenton, 116 Eng. Rep. 10, 20–23, 10 Q.B. 26 [1847]; 1 BLACKSTONE, *supra* note 65, 76–78.

[86] *Rogers*, 116 Eng. Rep. at 23.

[87] *Id.*

[88] *Id.*

[89] 2 WILLIAMS & MEYERS, *supra* note 62, § 335.

[90] The vast majority of domestic oil and gas development occurs under such an instrument, which provides for a definite "primary" term (which is usually short) followed by a defeasible "secondary" term that continues so long as production or operations continue.

> be delayed so long as the speculator would find it hopeful or convenient to himself alone.[91]

Another way courts favor use of defeasible interests in mineral conveyancing is by exempting them from the operation of the rule against perpetuities, even when the terms of an instrument create a future interest that would technically violate the rule.[92] Courts have accepted that whereas perpetual interests tend to depress alienability of minerals, defeasible interests promote alienability.[93] Thus, applying the rule to void a future interest following a defeasible mineral interest would "frustrate the policies behind the rule" by turning a defeasible interest into a perpetual one.[94] Williams and Meyers famously explained this phenomenon thusly:

> [D]efeasible term interests serve a useful social purpose, whether reserved or granted. The term interest, as compared with a perpetual interest, tends to remove title complications when the land is no longer productive of oil or gas. This simplification of title promotes alienability of land, which is one purpose served by the Rule against Perpetuities. We believe, therefore, that the courts should simply exempt interests following granted or reserved defeasible term interests from the Rule, on the straight-forward basis that they serve social and commercial convenience and do not offend the policy of the Rule Against Perpetuities.[95]

The logic in this proposition tracks the reasoning of both *Frost-Johnson* and *Rogers*, which favored a defeasible (use-it-or-lose-it) duration for mineral interests over a perpetual one because of its salutary effect on alienability and development of the resource.

There is no reason to think that a perpetual estate in pore space would behave differently than the perpetual mineral estate in terms of discouraging (or at least not encouraging) development. Hence, limiting pore space interests to a defeasible period may be better suited to the goal of encouraging development of pore space for CCS or any other activity. In sum, the limitations imposed by *Frost-Johnson* and *Rogers* on the mineral servitude and the tin

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[91] Brown v. Vandergrift, 80 Pa. 142, 147–48 (Pa. 1875).
[92] *E.g.*, Jason Oil Co., LLC v. Littler, 446 P.3d 1058, 1068 (Kan. 2019); Earle v. International Paper Co., 429 So. 2d 989, 995 (Ala. 1983).
[93] *Jason Oil Co., LLC*, 446 P.3d at 1068.
[94] *Earle*, 429 So. 2d at 995.
[95] 2 WILLIAMS & MEYERS, *supra* note 62, § 335 (quoted in *Jason Oil Co., LLC*, 446 P.3d at 1067).

estate, respectively, would hold the same benefits for a pore space estate and for the same reasons.

2. Encouragement of Speculation

A separate but related concern is that a perpetual severed estate in a resource can encourage speculation because there is no requirement to work or develop the resource to maintain ownership. The court *Rogers* court expressed concern that recognition of a perpetual interest in tin would invite speculation:

> Many bounds may become the property of the same owners, who may think their interests best served by limiting the supply and diminishing competition, while the owner will decline to expend his capital in building or agricultural improvements, because at any moment the bounder may renew his operations and, entirely and without compensation, defeat the purposes of his expenditure.[96]

Speculation was likewise a concern for the nineteenth century courts that developed water law's prior appropriation doctrine. Under prior appropriation doctrine, water "[i]nstead of being a mere incident to the soil," as under common law riparian rights doctrine, "rises, when appropriated, to the dignity of a distinct usufructuary estate, or right of property."[97] The prior appropriation doctrine limits the appropriator's estate in water to only the amounts that are put to beneficial use—and only for the period during which that use continues.[98] By this, courts sought to limit waste, monopolization, and speculation in water rights.[99]

Many states embraced an anti-speculation policy regarding wind power rights, as well. In passing legislation to prohibit the severance of wind rights from land, several state legislatures wanted to ensure that the economic benefits of wind development redound

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[96] *Id.*

[97] Coffin v. Left Hand Ditch Co., 6. Colo. 443, 446 (1882); *see also* David B. Schorr, *Appropriation as Agrarianism: Distributive Justice in the Creation of Property Rights*, 32 ECOLOGY L.Q. 3, 23–24 (2005) (describing the key feature of prior appropriation doctrine as the severability of water rights from land).

[98] Drake v. Earhart, 23 P. 541, 542 (Idaho 1890); Ortman v. Dixon, 13 Cal. 33, 38–39 (1859).

[99] Tara K. Righetti & Joseph A. Schremmer, *Waste and the Governance of Private and Public Property*, 93 U. COLO. L. REV. 609, 631–32, 648–49 (2022); Weaver v. Eureka Lake Co., 15 Cal. 271, 273–74 (1860); Basey v. Gallegher, 87 U.S. 670, 679 (1874).

to landowners rather than third parties and speculators, who may own no interest in the land itself or even any land within the state.[100]

Similar concerns would apply to pore space, which if severed would permit third parties with no interest in the land itself to enjoy the economic benefits of injection and storage activities in the pore space. Although not a critical resource like water, the severance of a perpetual estate in pore space, which needn't be continually developed, could lead to the sorts of monopolization and speculation that prior appropriation doctrine seeks to avoid.

C. Fragmentation of Title

The severance of natural resources into separate estates may also hamper their development by causing "too much ownership" of the resources, which may "gridlock" investment in it.[101] One of the ways that estate severance can result in gridlock is through fragmentation of title to the resource itself. Ownership of certain natural resources, like oil and gas, tends to fragment over time, leading to problems in identifying and locating all the co-owners of an estate and coordinating development among them.[102]

The title-fragmentation problem is well illustrated in the history of oil and gas development. Unless otherwise provided in the instrument creating the interest, severed mineral estates do not terminate for mere lack of use. Rather, because it is an independent estate in land, it can be terminated or lost (otherwise than by its own terms) only through adverse possession, which applies to corporeal fees, or abandonment for profits.[103] Under either doctrine, something more than nonuse is necessary to divest the mineral owner and cause the mineral interest to rejoin the estate in the surface of the land.

Over time, title to severed mineral estates become fragmented, as ownership diffuses across successive generations and the cotenants sell or dispose of their shares to others.[104] The fragmentation depresses the property's marketability as it makes it

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[100] *See, e.g.*, Senate Committee on Local Government & Housing, Hearing on Colo. HB 12-1105, at 4:01 (April 3, 2012); House Floor Debate on Okla. SB 1787 at 9:43 to 10:00 (April 15, 2010).

[101] *See* MICHAEL HELLER, THE GRIDLOCK ECONOMY: HOW TOO MUCH OWNERSHIP WRECKS MARKETS, STOPS INNOVATION, AND COSTS LIVES (2010).

[102] Although not unheard of, this problem is less common in the ownership of land as such, probably because land is possessable and usable for myriad purposes, many of which, like setting up a residence, are easier with relatively few owners. Ownership of natural resources, in contrast, is often valuable for narrow economic purposes and is conveniently distributed among co-owners.

[103] 1 WILLIAMS & MEYERS, *supra* note 62, §§ 210.1, 210.7.

[104] Ernest E. Smith, *Methods for Facilitating the Development of Oil and Gas Lands Burdened with Outstanding Mineral Interests*, 43 TEX. L. REV. 129, 129–31 (1964).

difficult to identify and obtain the consent of all the owners to development and renders it risky to proceed without such consent. Oil and gas development is often stymied as a consequence.[105] Because adverse possession and abandonment are unsatisfactory remedies for most of these situations,[106] "The title problems interfered with ownership to such an extent that legislatures in several states were forced to adopt statutes to deal with these problems."[107]

That remedial legislation includes mineral lapse acts, dormant mineral acts, and marketable record title acts.[108] State legislatures have also enacted a number of other statutory remedies to fragmentation, including compulsory pooling, mineral partition, and special statutes to deal with contingent future interests.[109] Yet, these remedies are imperfect and often raise problems of their own. Ohio's Dormant Minerals Act and Marketable Title Act, to take but two examples, generate dozens of appellate cases each year disputing the proper application of these statutes.[110]

Pore space estates would be likely to fragment over time much like mineral estates do. Pore space has a relatively narrow range of uses. It can be used to store, dispose of, and transmit substances for various purposes.[111] Each of these uses is essentially economic in nature and the same across all pore space, making pore space more like a commodity than the surface of land. Pore space is thus a good candidate, as are minerals, for being divided and carved up into several ownership, and it is likely to become fragmented over time. The consequences of fragmentation for development of pore space would be similar in kind, if not also in degree, to those experienced in the mineral context. The bottom line is that severance of a freehold estate in pore space might well necessitate the kinds of remedial measures to address fragmentation and outstanding interests that states have employed for oil and gas ownership.

D. Complication of Land Titles

Anytime the law recognizes the severability of a new interest in land, land titles are instantly and everywhere made more complex. That is of course true for every tract of land that is itself subject to the new interest. When, for example, the owner of Blackacre

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[105] *Id.*; Ronald W. Polston, *Legislation Existing and Proposed Concerning Marketability of Mineral Titles*, 7 LAND & WATER L. REV. 73, 73 (1972).
[106] Ronald W. Polston, *Mineral Ownership Theory: Doctrine in Disarray*, 70 N.D. LAW REV. 541, 560–61 (1994).
[107] *Id.*
[108] *See generally* Smith, *supra* note 104 (discussing each type of legislation).
[109] *Id.* at 131, 136 & 144.
[110] *See* 1 KUNTZ, *supra* note 56, § 10.6 (Cum. Supp. 2024).
[111] *See* Joseph A. Schremmer, *Subsurface Trespass: Private Remedies and Public Regulation*, 101 NEB. L. REV. 1005, 1069–71 (2023).

conveys a freehold interest in the pore space to another, title to Blackacre itself is complicated by the fact that it is no longer unified with title to the pore space. Title to Blackacre (sans pore space) will also be harder to market as a result of the pore space severance, and not only because it does not include title to the pore space, but also because Blackacre will likely be subject to an implied easement for access in favor of the pore space estate.[112] Examining title to Blackacre will be more costly due to the presence of a severed pore space estate in the chain of title.

It is also true that *all* land titles in a jurisdiction that recognizes a new interest in land will instantly become more complicated, even those that are not themselves subject to the new interest. Every purchaser of an interest in land in that jurisdiction will need to consider the possible presence of the newly recognized interest in the chain of title to the parcel that is for sale. Since title to any tract of land in the jurisdiction could be subject to the newly recognized interest, purchasers must incur the costs of investigating title to every tract of land for the interest or take the risk of purchasing subject to the interest. This additional cost, which has been called a "measuring cost" or an "information cost," affects every land transaction in the jurisdiction.[113]

Part of the measuring cost problem is that conveyances and reservations of severable estates often require interpretation to determine the scope of the interest created. This is another familiar issue to mineral lawyers. Conveyances and reservations of "minerals" or "other minerals" often are not explicit about what substances or rights are covered by the grant or reservation. Similarly, conveyances and reservations of "pore space," "sequestration rights," "injection rights," "storage rights," this or that "formation," "subsurface strata," or any other of the limitless ways one could formulate a grant or reservation of pore space rights, will require costly and uncertain interpretation, and sometimes adjudication, to understand. Do such phrases include only title to the microscopic void spaces that naturally occur in porous rocks, or do they also include larger voids like caves and artificial voids left behind from hard-rock mining? Do these descriptions include title to the rock structures in which pore space is found or just the space itself? Compounding the problem further, title investigators will need to determine whether a grant or reservation of pore space rights is intended to create an estate of ownership in pore space or merely an easement to use pore space.[114]

The measuring costs created when a jurisdiction recognizes a new estate in land cannot be overcome by recording statutes. Title

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[112] Schremmer, *supra* note 13, at 688.
[113] Merrill & Smith, *supra* note 7, at 24–26.
[114] *See supra* Part II.C.

recording systems undoubtedly reduce the costs of conducing a title examination, but they cannot eliminate the need to conduct a title investigation for the newly recognized interest.[115] Nor can recording systems make it any cheaper or easier to interpret conveyances and reservations to determine their scope and whether they create an easement or an estate. The only way to manage these measuring costs is by limiting the creation of estates in the first place.

E. Coordination Problems

The creation of a new estate for pore space necessitates interactions between the new estate and other property interests in the same tract of land.[116] At a minimum, this means that the pore space estate must share rights in the land with the owner of the surface estate. Severed estates in natural resources have always enjoyed an implied easement in the surface estate giving the dominant severed estate the right to use the surface as reasonably necessary to exercise its rights in the natural resources.[117] Thus, the servient surface estate must generally accommodate the reasonably necessary activities of the dominant estate.

In oil and gas development, competitions and disputes over the use of the surface are frequently litigated and are the subject of a substantial scholarly literature.[118] Disputes between surface owners and developers of severed minerals are intensified by the fact that surface owners not only receive none of the economic benefits of development, which inure to the severed estate owner, they also may not have been the one to benefit from selling off the mineral interest in the first place.[119] Rather, surface owners often inherit or purchase land that is already subject to a severed mineral interest. And because the severed mineral estate is capable of perpetual duration, there may be no prospect of reuniting mineral ownership with the surface. This set of conditions tends to make disputes between surface owners and mineral developers tense and costly to resolve.[120]

Many states have legislation regulating relations between mineral and surface owners in the form of surface damage or surface

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[115] *Id.* at 41–42.
[116] *See* DuVivier, *supra* note 6, at 417–18.
[117] Schremmer, *supra* note 13, at 688.
[118] *See* Bruce M. Kramer, *The Legal Framework for Analyzing Multiple Surface Use Issues*, 44 ROCKY MTN. MIN. L. FDN. J. 273, n.1 (2007) (cataloguing the legal scholarship concerning surface-use disputes).
[119] For a famously intense dispute, see generally Grimes v. Goodman Drilling Co., 216 S.W. 202 (Tex. App. 1919).
[120] *See* Joseph A. Schremmer, *Crystal Gazing: Foretelling the Next Decade in Oil and Gas Law*, 66 ROCKY MTN. MIN. L. INST. 5-1, 5-33 (2020); *see also* Duvivier, *supra* note 6, at 396–99; Smith & Diffen, *supra* note 54, at 179–182.

owner protection statutes.[121] Some of these statutes simply require that mineral developers compensate surface owners for damage to the land, while others require developers to negotiate surface-use agreements with surface owners to coordinate their activities and compensate for use of the surface.[122] Even still, the compensation surface owners receive under these arrangements, as David Pierce observed, "can pale in comparison to the value of the production from the land"; disputes persist for this reason.[123]

Concerns over use of the surface motivated state legislatures to prohibit severance of wind rights. The legislative history of Kansas's anti-wind severance statute, for instance, reveals that the goal was to avoid the "detrimental effect that permanent severance of wind and solar rights could have on agricultural use of the land."[124] Similar sentiments were aired in the floor debate in the Oklahoma Legislature over its anti-severance statute.[125]

The problem of coordination would be more acute in land where other resources are also held in severed ownership.[126] The severance of multiple natural resources within a single tract can quickly lead to conflicting easements, which hamstring all owners' ability to develop the land or the natural resources. For this reason, coordinating conflicting surface uses among natural resources developers is a major concern in areas where oil and gas development occurs alongside wind and solar energy development.[127] In fact, the problem of surface-use fragmentation has caused some scholars to advocate against the severance of an estate in wind.[128] At a minimum, the coordination problems increase the costs of developing, and contracting for the development of, natural resources.

Accordingly, coordinating a separate pore space estate with both surface and severed estates in minerals would be highly complex. I have written extensively about the particular issues in

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[121] *See generally* Ronald W. Polston, *Surface Rights of Mineral Owners—What Happens When Judges Make Law and Nobody Listens*, 63 N.D. L. REV. 41, 51–62 (1987) (discussing legislative treatment of the issue).
[122] *Id.*
[123] David E. Pierce, *Sustaining the Unsustainable: Oil and Gas Development in the 21st Century*, 23 KAN. J.L. & PUB. POL'Y 362, 369 (2014).
[124] Supp. Note on Kan. SB 227 as Amended by House Committee on Energy and Utilities (2011).
[125] House Floor Debate on Okla. SB 1787 at 9:43 to 10:00 (April 15, 2010).
[126] *See* DuVivier, *supra* note 6, at 417–18.
[127] Schremmer, *supra* note 120, at 5-26.
[128] DuVivier, *supra* note 6, at 418 ("[S]ome commentators, including the Author here, have argued in the past for a ban on wind severance to simplify the situation and to protect all parties' interests." (citing K.K. DuVivier, *Animal, Vegetable, Mineral—Wind-The Severed Wind Power Rights Conundrum*, 49 WASHBURN L.J. 69, 98 (2009); Alexander, *supra* note 6, at 455–56).

other work.[129] To briefly illustrate the complexities suppose that title to Blackacre was held as follows: *A* holds fee title to the surface estate; *B* holds title to a severed estate in oil and gas; and *C* holds title to a severed estate in pore space.

All three owners, *A*, *B*, and *C*, have the right to use and occupy the surface of the land. As owner of the surface estate, *A*'s rights are comprehensive, meaning that *A* may use and occupy the surface for any lawful purpose, limited only by *A*'s duty as the servient estate owner not to unreasonably interfere with the implied surface easements of *B* and *C*.[130] Pursuant to their easements, *B* and *C* each has the right to use and occupy the surface estate as reasonably necessary for the enjoyment of his or her respective property (the oil and gas for *B* and the pore space for *C*).[131] Conceptually, the parties' easements cover the surface *estate*, which encompasses the surface itself as well as any elements of the subsurface that are not titled in either *B* or *C*.

With three rights holders in the surface estate, the potential for disputes is great. Under general principles of easement law, the rights of *B* and *C* will take priority over *A*'s competing surface uses, subject to a potential duty to yield to *A*'s preexisting surface activities under the accommodation doctrine.[132] When disputes occur between *B* and *C*, first priority would ordinarily belong to the first easement holder to establish use of the surface.[133] *B* and *C* may also find themselves at odds over the placement of wellbores in the subsurface. It is even possible that *B*'s stimulation of a wellbore (e.g., through hydraulic fracturing or "fracking") might impact one of *C*'s wellbores. These subsurface disputes should probably also be adjudicated under the general standards giving priority to the first easement holder to establish a use.[134]

Further subsurface disputes are foreseeable. Suppose *C* began injecting carbon dioxide for permanent storage into a porous formation underneath Blackacre and *B* later wishes to drill a well through the carbon-bearing formation to access oil or gas reserves in a deeper stratum. The likely common law rule (though it worth noting the law is not well developed on this point) is that each severed estate enjoys reciprocal rights of access and subjacent support. Thus, each estate has an easement in the property of the other entitling the dominant estate both to support from lower strata owned by the servient estate and access to lower strata through formations owned by the servient estate.[135] Under this reciprocal

[129] Schremmer, *supra* note 13, at 651–53, 687–703.
[130] *Id.* at 688–89.
[131] *Id.*
[132] *Id.*
[133] *Id.* at 690–92.
[134] *Id.* at 697–98.
[135] *Id.* at 692–93.

arrangement, *B* would be entitled to access its property in lower formations by drilling through the formations where *C* is sequestering carbon dioxide. In turn, *C* would enjoy a support easement in *B*'s lower formations and the right to drill through *B*'s property in higher strata to access *C*'s property in lower strata.[136]

Suppose instead that *C* wishes to inject carbon dioxide into the pore space of a formation where *B* is already injecting or wishes to inject saltwater for disposal. Both estates would have the right to inject into the pore space, *B* as a function of its easement rights in the surface and *C* because the pore space is the subject matter of *C*'s estate. No easy answers to this priority question are to be found in general easement principles or analogies to oil and gas law.[137] The law would need to discover a method of ordering this kind of competition for pore space.[138]

Finally, both *B* and *C* may wish to explore the subsurface to evaluate its qualities for oil and gas and carbon sequestration, respectively. In doing so, either estate holder may discover, incidentally or intentionally, relevant information about the value of the other's estate. Once again, existing legal principles are not well adapted to answer this question, and the law may need to determine how to limit and order the exploration rights of multiple subsurface estates.[139]

F. Surface Disturbance and Resource Degradation

Another, final consequence of recognizing a severed estate in pore space is physical in nature. Separating ownership of natural resources from land may aggravate disturbance and degradation of the land's surface and other resources, resulting from development. Some surface disturbance and degradation are unavoidable in the development of natural resources, particularly those located under the soil. This is true even if the owner of the land also owns and develops the minerals. However, the severance of a resource disentangles the resource developer's interests from those of the surface owner.[140] The owner of land is likelier to take greater care in using it for resource development than a stranger who is interested only in the resource and not also the land. It would be only natural for a developer having no property interest in the surface to countenance greater disturbance of the land than the landowner would in exploiting the same resource.

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[136] *Id.* at 698–700.
[137] *Id.* at 693–96, 700–01.
[138] In all likelihood, *B* and *C* should be treated as correlative rights holders in the pore space and priority would go to the first rights holder to establish a lawful use of the common porosity. *Id.*
[139] *Id.* at 701–03.
[140] DuVivier, *supra* note 6, at 417; Smith & Diffen, *supra* note 54, at 179–182.

The Queen's Bench in *Rogers v. Brenton* foresaw this very problem when it considered the fact that a perpetual tin estate would "cumber [the surface] with the machinery, buildings and refuse stuff which the operations below occasion; and all this without the least regard to the convenience or interests of the owner."[141] Oil and gas development also furnishes a useful illustration of this concern. The surface disturbance and pollution caused by oil and gas development has been well documented.[142] Often, when the mineral interest is owned in a separate, perpetual estate, over time the relationship between the mineral owner and the owner of the servient surface estate becomes attenuated, such that the surface owner lacks any memory of a time when the owner or his or her predecessor also owned (and presumably sold off) the mineral rights. Likewise, the mineral owner may have no relationship with the surface owner beyond its legal relationship and thus has little incentive to consider the surface owner's preferences and expectations in using, or abusing, the surface.[143] The situation usually comes to a head when a surface owner demands compensation for damage caused incidentally by the mineral owner in use of the surface to develop the minerals.[144]

The stakes are high in these disputes because the surface effects of oil and gas development can be intense. Examples of surface effects from litigated cases include "the destruction of crops, the killing of cattle, the depletion of water supplies, and the interference with roads and residences."[145] These effects often outstrip those that a surface owner would cause to his or her own surface in developing the underlying minerals. In one starkly illustrative case, the plaintiff surface owners complained of a number of surface activities that one can scarcely imagine a landowner undertaking on its own land: "positioning a drill rig adjacent to a home, splattering the doors and windows of the home

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[141] Rogers v. Brenton, 116 Eng. Rep. 10, 20, 10 Q.B. 26 [1847].

[142] *E.g.*, Laura H. Burney, *A Pragmatic Approach to Decision Making in the Next Era of Oil and Gas Jurisprudence*, 16 J. ENERGY, NAT RES. & ENVTL. L. 1, 56–60 (1996) (collecting authorities).

[143] *See generally* Schremmer, *supra* note 120, § 5.04 (discussing relations between surface and mineral owners in the second decade of the twenty-first century).

[144] Mineral owners insist that they have the right to cause damage within the scope of their estate's appurtenant implied easement, *see* John F. Welborn, *New Rights of Surface Owners: Changes in the Dominant/Servient Relationship Between the Mineral and Surface Estates*, 40 ROCKY MTN. MIN. L. INST. §§ 22, 22.06, 22-18 (1994), while surface owners complain that such damage is an externality of mineral development that the developer should bear instead of the surface owner who does not necessarily participate in the profits of development. John S. Lowe, *The Easement of the Mineral Estate for Surface Use: An Analysis of Its Rational, Status and Prospects*, 39 ROCKY MTN. MIN. L. INST. §§ 4-1, 4-35 (1993). On the mineral–surface owner debate, see Burney, *supra* note 132, at 76–81.

[145] Burney, *supra* note 142 at 58–59 (citing cases).

with slush and grease, and keeping the family awake with deafening, all night drilling."[146]

In addition to surface disturbance and pollution, activities by severed estate owners may also occasion degradation of the land and its resources. For the same reasons that separate ownership of natural resources encourages their efficient development, separate ownership might also hasten their depletion and exhaustion.[147] Here, water provides a useful example. Although riparian water rights traditionally were inalienable except to other owners of riparian land, many states and the *Restatement* have abandoned the traditional approach in favor of free alienability of water rights to nonriparians.[148] The intensity of water use from a particular source, however, is apt to increase when the right to use it is transferrable to those who value it the highest.[149] Permitting the transfer of riparian water to lands that are not appurtenant to the source therefore risks depleting the source faster than if only appurtenant tracts could draw from it.[150]

Since the restraints on alienating riparian rights began to loosen both under the common law and riparian water codes,[151] riparian water has become increasingly scarce in the eastern United States.[152] Although drought conditions have contributed to this problem, so too has the growing use of water away from riparian lands.[153] At least one recent commentator has linked the loosening of the appurtenancy restrictions to increasing water scarcity.[154]

Thus, at least in theory, allowing separate ownership of pore space from land may aggravate the impacts of surface use by pore space developers and accelerate the depletion of pore space capacity for fluid storage, transmission, and disposal by increasing

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[146] DuVivier, *supra* note 6, at 399–400 (citing Grimes v. Goodman Drilling Co., 216 S.W. 202 (Tex. App. 1919)).
[147] M. Alexander Pearl, *The Tragedy of the Vital Commons*, 45 ENVTL. L. 1021, 1060–62 (2015).
[148] *See* RESTATEMENT (SECOND) OF TORTS § 856.
[149] Pearl, *supra* note 147, at 1060–62; *see also* Richard A. Epstein, *Why Restrain Alienation?*, 85 COLUM. L. REV. 970, 981 (1985) ("Better use for the buyer, however, may also be a more intensive use, which means that any sale of riparian rights may diminish the correlative rights of other claimants to the common pool.").
[150] Williams v. Wadsworth, 51 Conn. 277, 304 (1884); *see also* Arun Agrawal, *Common Resources and Institutional Sustainability*, in THE DRAMA OF THE COMMONS 41, 62–63 (Elinor Ostrom et al. eds., 2002) (discussing the effects of small group size on the conservation of common-pool resources).
[151] *See* Olivia S. Choe, *Appurtenancy Reconceptualized: Managing Water in an Era of Scarcity*, 113 YALE L.J. 1909, 1929–30 (2004).
[152] *Id.* at 1910–11.
[153] *Id.*
[154] *See generally id.*

competition for pore space.[155] To some degree, severance may hasten the need for a scheme of conservation regulation aimed at preventing waste and protecting correlative rights in pore space,[156] as well as remedial legislation to protect surface resources from unnecessary and undue degradation.[157] Whether these costs are likely or significant enough to warrant caution in adopting a pore space estate into a jurisdiction's property law is a matter of judgment, but to allow severance without accounting for these costs would be palpably unwise.

IV. TAKEAWAYS

Only time will tell whether property law in most jurisdictions embraces a severed estate, as it has a severed estate in minerals. There is no single correct answer to the question of whether jurisdictions should do so.[158] It is a matter of judgment, to be exercised either by legislatures or courts. This Article has tried to inform the exercise of that judgment through a delineation of the legal significance of separate ownership of pore space and the legal and practical consequences that may follow a decision to allow it.

It is not the purpose of this Article to illuminate the doctrinal framework constraining common law courts in exercising this judgment when called upon to do so. Nor is the goal to define the proper role of consequential or policy reasoning in making the decision.[159] I have been content to offer several examples of when courts did take the consequences into consideration in deciding the severability of customary tin rights,[160] oil and gas,[161] and water under the prior appropriation doctrine.[162]

In summary, here are three takeaways from the discussion for courts and lawmakers to consider in deciding whether to recognize the severability of pore space. First, the costs and complications of recognizing a perpetual, freehold estate in pore

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[155] Schremmer, *supra* note 21, at 59–61 (discussing accelerating competition for pore space capacity); Wiseman, et al., *supra* note 21, at 1–6 (same).
[156] *See* Schremmer, *supra* note 111, at 1069–79 (discussing the design of pore space conservation statutes).
[157] *See* Schremmer, *supra* note 13, at 670–72 (noting the inapplicability of many surface-owner-protection statutes to activities related to development of pore space).
[158] *Cf.* John Finnis, *Natural Law and Legal Reasoning*, 38 CLEV. ST. L. REV. 1, 11–13 (1990).
[159] I present a full account of the common law doctrines that structure and constrain judicial recognition of new estates in land in other, forthcoming work. Joseph A. Schremmer, *Custom and Separate Ownership of Natural Resources* (manuscript on file with author).
[160] Rogers v. Brenton, 116 Eng. Rep. 10, 20–23, 10 Q.B. 26 [1847].
[161] Frost-Johnson Lumber Co. v. Salling's Heirs, 91 So. 207, 242–45 (La. 1922).
[162] Basey v. Gallegher, 87 U.S. 670, 679 (1874).

space counterbalance and may even outweigh the benefits in doing so. While a freehold interest in pore space may facilitate the sale of and investment in pore space by developers who are eager to put the resource to beneficial use, the perpetual nature of a freehold estate may also "lock up" severed pore space from development if the estate is held by one or more owners who either cannot or will not invest in its development or transfer the rights to another who would. If pore space continues to increase in value in certain regions, a perpetual interest in pore space may invite speculators, who could hold the interest indefinitely under no compulsion to develop it. The development of reservoir storage space might also be hampered by the potential for fragmentation of freehold ownership of pore space, as has happened with oil and gas resources across the country. Finally, perpetual separate ownership of pore space is likely to make development of pore space, surface resources, and other natural resources like oil and gas more complicated and costly by multiplying and intensifying surface-use and multiple-mineral development problems.

Second, many of the costs and complications of a freehold estate would be ameliorated by limiting pore space interests to a defeasible, use-it-or-lose-it term. Courts and lawmakers persuaded that severance of a freehold estate in pore space would be suboptimal needn't prohibit separate ownership of pore space altogether, as North Dakota has done.[163] Instead, limiting the duration of severed interests in pore space to the period of their use would help encourage development of pore space resources, avoid speculation in pore space, provide a self-executing mechanism for reuniting title to pore space with the overlying surface, and even moderate tensions between pore space developers and surface owners. It is easy to see how legislatures may limit pore space interests to defeasible terms, but common law courts have the power to do so, as well.[164]

Limiting pore space estates would come at a cost of its own. It would entail questions about what activities satisfy the limitation, which creates the opportunity for disputes and ultimately requires legislative or judicial definition. Despite these additional costs, Louisiana's experience with the mineral servitude furnishes some evidence that a use-limited interest in pore space would serve the

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[163] N.D. CENT. CODE § 47-31-05 ("Title to pore space may not be severed from title to the surface of the real property overlying the pore space. An instrument or arrangement that seeks to sever title to pore space from title to the surface is void as to the severance of the pore space from the surface interest.").

[164] *See, e.g.*, Rogers v. Brenton, 116 Eng. Rep. 10, 20–23, 10 Q.B. 26 [1847]; Drake v. Earhart, 23 P. 541, 542 (Idaho 1890); *see also, e.g.*, Frost-Johnson Lumber Co. v. Salling's Heirs, 91 So. 207, 242–45 (La. 1922) (applying civil law).

interests of development and preserving land titles from excessive burdens better than a perpetual estate.

Third and finally, prohibiting severance of pore space rights while permitting creation of easements in pore space would do little, if anything, to ameliorate the costs and complications of allowing severance of pore space. The legislative response to wind severance revealed this tendency. Several states, apparently concerned about the consequences of a severed estate in wind, legislatively prohibit it but allow the creation of wind easements.[165] The more effective approach, employed by a few states, is to limit the rights that may be given in wind to a term-limited leasehold[166] or to provide for automatic termination or a presumption of abandonment of a wind easement after a period of nonuse.[167] Like freehold estates, commercial easements may be perpetual in duration and most are transferable and divisible, making them capable of fragmentation.[168] Unlike possessory estates (but like profits), easements are subject to termination by abandonment or prescription by the servient estate owner, but without a statutory presumption or a self-executing procedure for determining abandonment, these common law modes of termination often prove unworkable.[169] Accordingly, perpetual easements would be nearly as capable of hampering development of a natural resource as perpetual estates are, and should be either avoided or duration-limited to avoid the same negative consequences of perpetual severance.

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[165] *E.g.*, N.D. CENT. CODE ANN. § 17-04-03; S.D. CODIFIED LAWS §§ 43-13-17 & -19; MONT. CODE. ANN. § 70-17-404; KAN. STAT. ANN. § 58-2272; 60 OKLA. STAT. ANN. § 820.1; WYO. STAT. ANN. § 34-27-103 & -102(a)(i). Others simply void any attempted severance. *E.g.*, NEB. REV. STAT. ANN. § 66-912.02

[166] *E.g.*, COLO REV. STAT. § 38-30.7-103; S.D. CODIFIED LAWS §§ 43-13-19, -16.

[167] N.D. CENT. CODE ANN. § 17-04-03.

[168] 3 TIFFANY, *supra* note 35, § 761.

[169] Polston, *supra* note 106, at 560–61.