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MISMATCHED PROPERTY RIGHTS

Application of Natural Resources Property Theory to Hidden Resources

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The visualization of property and resources is a defining foundation of the construction and application of a property rights framework. When humans encounter resources they cannot see— or hidden resources—, they have difficulties imagining an appropriate property regime. These hidden resources include subsurface resources (oil and gas reservoirs, groundwater, pore space), biological resources (migration paths, plant and animal dormancy cycles), informal and unrecognized land titles, and extraplanetary resources (asteroid mining and water). As a result, we often apply an existing two-dimensional property framework from visible resources to three and four-dimensional hidden resources. This article argues that lacking the ability to see resources—resource blindness—directly impacts our ability to use, manage, and conserve them. Conversely, resource sight—the ability to see resources—can tremendously aid the development of an effective and efficient property rights framework. This article also contends that hidden resources are best governed when owners and users understand the resource's scientific properties. And those properties are likewise better gathered when the natural resource is visible to the human eye. Finally, if resource sight cannot be acquired, this article proposes avoiding resource conflicts by creating small groups of local and knowledgeable community property owners to advise in the resource's management and encourage cooperative development.

Keywords: property; resources; subsurface; rights; environment

1. Introduction

In their influential article, *Contracting for Control of Landscape-Level Resources*, Bradshaw and Lueck caution that though "[l]and itself is managed on a parcel-by-parcel basis …[,] resources can seldom be effectively managed, exploited, or conserved in the same way." (Bradshaw and Lueck 2015). Their observation not only applies to surface natural resources property and ecosystems, but also to other forms of property that are hidden from sight or invisible. These types of hidden properties include (a) subsurface natural resources property, like oil and gas reservoirs, groundwater, and pore space, (b) certain wildlife resources, such as migration paths[1] and dormant plant and animal cycles (c) property rights for parties without formal title,[2] (d) atmospheric resources, such as wind and solar radiation, and even (6) extraplanetary resources, like asteroid mining[3] and water.[4] Currently, many of these hidden properties are governed under a similar property framework as surface property. This governance likely evolved because of the familiarity

[1] Karen Bradshaw, Professor of Law, Arizona State University, Co-Organizer and Commenter, Mismatched Property Rights to Landscape-Level Resources: Legal and Customary Solutions (Jun. 2019).

[2] Karen Bradshaw, Professor of Law, Arizona State University, Co-Organizer and Commenter, Mismatched Property Rights to Landscape-Level Resources: Legal and Customary Solutions (Jun. 2019).

[3] *See* Andrew Zaleski, How the Space Mining Industry Came Down to Earth, Fortune (Nov. 24, 2018), http://fortune.com/2018/11/24/asteroid-mining-space-planetary-resources/ (describing how satellites use "mid-wave infrared imager" to detect water sources outside of Earth).

[4] *See* Rhett Larson, If There is Water on Mars, Who Gets to Use It?, Slate (Nov. 2, 2015), https://slate.com/technology/2015/11/the-tricky-question-of-water-rights-on-mars.html.

of the surface property framework and because these hidden properties' scientific, social, or behavioral characteristics were unknown at the time of the origination and evolution of those property rights.

Although there is broad application of the concept of hidden property, this article focuses on the natural resource subset of hidden property. Namely, I propose that the misapplication of surface property framework to hidden subsurface resources results in property conflicts, in addition to difficulty managing and conserving resources.

Natural resources are best governed when owners and users understand the resource's scientific properties. Those properties are likewise better gathered when the natural resource is visible to the human eye. This reliance on sight heavily influences the creation of our property framework. As a result, humans do not possess good ability to manage or govern property they cannot see. The inability of humans to "see" certain property systems such as subsurface oil and gas reservoirs, porous rock spaces, groundwater, and even above-ground wind and atmosphere—or *hidden resources*—creates difficulties in the conservation, management, and use of these property systems. This lack of *resource sight*—or *resource blindness*—causes humans to apply existing (and often ineffective) surface property framework to these hidden resources.

I propose that subsurface natural resources property should not be governed by the same property framework as surface property. Rather, because subsurface resources are often hidden resources, subsurface property requires its own custom framework and governance structure that best suits the properties of the resource and the needs of the resource owners. Further, I explore the idea that optimal subsurface resource management requires an understanding of the underlying resource itself and thus most benefits from the governance of small, knowledgeable communities who participate in that resource commons. To that extent, this article serves as an introduction to the problem of hidden resources, specifically focusing on an American petroleum example. Although I am aware of the unique nature of American oil and gas ownership—it can be privately-, as well publicly-owned—its example highlights the importance and necessity of resource sight. This article also proposes a possible analytical framework for these hidden resources by recounting the historic mining districts. This framework is but one example of a natural resource community with resource sight that developed customs and solutions to the conflicts inherent in mining. It is my intent first to present these initial arguments and insights in this article. I will then continue researching other natural resource conflicts and solutions to further develop these concepts in my later work.

2. Natural Resources Property Theory and Hidden Resources

From an evolutionary perspective, humans rely on their sight to perceive immediate threats and protections. The species's reliance on sight is evident, in part, from the anatomy of this sophisticated and highly-developed visual organ. Thus it is logical that human concepts of property and ownership would be heavily informed by visual sight. Although human eyesight benefitted from stereoscopic vision, which gives the ability to perceive three-dimensional objects, humans rely on the processing power of the brain to interpret two-dimensional input and create the third dimension, or depth. This ability to see is not only an important genetic trait, but was vital in our construction of natural resources property and ownership concepts. Riparianism, which allocates property rights to those who live close to water is one example of this *resource sight*. The metes and bounds system, which is a two-dimensional method of describing land that typically uses physical geographic features, is another example.

Unfortunately, this existing surface property framework generally arises from a two-dimensional surface property footprint that is unwieldy in resources that are three- and often four-dimensional in nature. So although, in nature, a river is three-dimensional (and four-dimensional if looking at flow rate over time), we proscribe riparian ownership rights by viewing the river from a two-dimensional aerial perspective and determining ownership based on proximity to the river. Likewise, the metes and bounds system provides a two-dimensional perimeter that marks the boundaries of a tract. Another limitation is that humans are three-dimensional beings that are unable to perceive the fourth dimension. Time is a construct we created, but cannot naturally understand. And because of *resource blindness*, humans do not even have the ability to view any dimension of resources that lie within the earth's crust and at greater depths. Humans rely on technology to facilitate data collection and interpretation, in addition to sensory events such as a natural oil seep, indicating that oil may be present below the surface, or on felt tremors, which indicate subsurface seismic activity.

There is great disadvantage then in using surface property framework in the subsurface. For *hidden resources*, ownership is often determined by extending a two-dimensional plat or tract downwards and establishing boundaries of resources that naturally transverse these artificial boundaries. The constraints of these artificial boundaries result in conflicts between owners, weakening of correlative rights, and increased resource utility inefficiencies (see e.g., Bradshaw and Lueck 2015). To address conflicts, courts or legislatures set limitations or create exceptions that only increase confusion and add an additional layer of complexity to resources, which holistically, are integrated and dynamic systems.

This complex resource property framework becomes further complicated over time—resources are depleted, which increases resource conflicts; and technology to exploit and use resources increases, which increases the value of resources, thereby leading to resource conflicts. The current ex post facto approach to hidden resource management requires constant and vigilant assessment of property right protections, while still balancing the traditional values of conservation and production. A more suited approach is a systems approach, whereby the natural resources are viewed as a dynamic, integrated system. But while social property systems are a natural part of ecosystems and socio-biological groups, (Bradshaw 2018), they are not the norm of modern societies, which favor individual or small community property rights. And, as discussed, there is great difficulty assigning individual property rights to a vast, hidden resource. Not only is there extreme difficulty of humans to perceive natural systems, but the larger challenge is how to deal with the existing discrete property rights. Simply layering resource system property rights above existing discrete ownership rights would create a muddled and fractious system of rights. And eliminating all existing discrete ownership rights and providing resource system property rights faces too many practical hurdles such as condemnation and constitutional takings issues. Moreover, it is impossible or, at the very least, imprudent to promote a resource system without first comprehending each resource component. I.e., the human body could not be well understood as a system unless each organ was first identified and understood—and organs must be viewed from the macroorganic level to the microcellular level. Lack of a robust understanding of the organic components results in an incomplete understanding of the resulting externalities. Likewise, harmonious conservation, management, and use of subsurface natural resources requires a thorough and in-depth knowledge of the geological and scientific nature of the resource, in addition to its role in the resource system (see Bradshaw and Lueck 2015).

3. Hidden Resources and The Impact of Resource Blindness

As stated, vision plays a defining role in the creation and development of property rights. Sight allows an owner or community to define boundaries that other owners are also able to see. Recognition of and respect for these boundaries are other considerations supported by a visual-based property rights system. But *resource sight* also refers to the ability to visually perceive natural resources property in three-dimensions, as well as four. Much of natural resources property is fugacious in nature—it is transient and not fixed. Resources such as water, oil and gas, and porous space either possess fluid dynamic properties or are affected by these properties. And a study of fluid dynamics is a study of movement over time, which requires study of the resource in four dimensions.

The migration of fluid in the subsurface, resulting from changes in natural or artificial pressure differential, is still difficult to model even with the advances in subsurface modeling. Over a century ago—when laws were developing with respect to subsurface resources—it was almost impossible for scientists, let alone lawmakers and legislators, to understand how these resources behaved. Thus the property system that developed treated these hidden resources the same as those above ground. To further examine these ideas, I focus on the oil and gas reservoir as an example of hidden resources.

3.1. The petroleum example

Petroleum hydrocarbons are one of the most widely-used energy sources in the world. Crude oil—the liquid form of petroleum—is the single largest transportation fuel and natural gas is largely used for electric power generation. Although petroleum was first discovered in the late 1800s, it came of age during World War II with its use in battle machinery and then with the proliferation of automobiles. And due to economic and environmental benefit, natural gas is replacing coal as the preferred global fuel for power generation. Petroleum hydrocarbons are found in subsurface reservoirs, within the porous space of reservoir rock. These reservoirs formed from ancient marine seas that covered the earth millions of years ago. The petroleum deposits formed slowly over geologic time and with planetary heat and pressure. Petroleum hydrocarbons—so named for the eponymous chains of hydrogen and carbon—are not static; rather they are fugacious resources that move in response to pressure differentials and geologic shifts.

But geoscientists and petroleum engineers did not understand reservoir behavior or have tools for reservoir modeling until well after petroleum was discovered. Thus the development of petroleum law—referred to as "oil and gas law" in Canada and the United States—reflected this lack of understanding. Arguably, the unfamiliarity with petroleum reservoirs and fluid migration and the lack of knowledge of subsurface geology combined with the sudden urgency for legal governance contributed to a piecemeal approach to oil and gas law that prevents efficient use and conservation. Another concurrent origin of traditional American natural resources law is that it mainly promoted development and use of the resource. Resource nonuse constituted a form of waste and property ownership rights favored those who utilized the resource; the rule of capture best exemplifies this value. Conservation values arising out of natural resources law tended to address correlative rights and not environmental conservation.

4. Lateral Subsurface Resources and Ownership Conflicts

The lack of resource sight and physical comprehension of oil and gas led to the development of law that conflicts with its inherent characteristics. At the time of petroleum discovery, the law in place related to water and wild animals and there was not an understanding of subsurface petroleum behavior or fluid migration or production. The law that was applied during the late nineteenth century and the early twentieth century adopted the rule of capture, derived from the law regarding *ferrae naturae* and the doctrine of extralateral rights. (Kramer and Anderson 2005). Lawmakers and owners also promoted property boundaries using the downward extension of surface property rights to delineate unseeable property in the subsurface. (Kramer and Anderson 2005). These anthropogenic boundaries ignore the geologic natural boundaries of the reservoirs, which can extend over tract, county, state, and even national borders.

Generally, American oil and gas law provides for individual property ownership, which differs from the international model of crown or state ownership for oil, gas, and other minerals. In the United States, public ownership (by the federal, state, or tribal governments) accounts for roughly 40% of oil and gas property; while, private or *fee* ownership accounts for the remaining 60%. Moreover, the surface can be severed from the subsurface, which results in different owners and sometimes differing incentives. To provide for access and utilization of the subsurface after severance, the subsurface is characterized as the dominant estate and allowed reasonable use of the immediately overlying surface. Conversely, the surface estate is considered the servient estate and burdened by this easement of use. To ensure considerate use of the surface by the subsurface owners, American oil and gas law adopted the accommodation doctrine under *Getty Oil Co. v. Jones*,[5] which provides that the dominant estate must accommodate a preexisting use of the surface estate provided that such accommodation is reasonable.

Interestingly, while oil and gas, groundwater, and pore space reservoirs may be characterized as flat discs (Bradshaw and Lueck 2015), the mechanisms by which these resources are captured are long and skinny tubes (Bradshaw and Lueck 2015; see generally Epstein 2019). These tubular mechanisms include longwall mining, oil and gas wells for drilling and production, and injection wells for porous spaces. The interplay between the flat discs and the long and skinny tubes create additional complexity to resources that extend vertically and horizontally.

Because of their geologic interconnectivity, subsurface resources encounter both vertical and lateral conflicts. In oil and gas production, horizontal wells and hydraulic fracturing are used to efficiently and economically produce petroleum in certain types of formations. Horizontal wells consist of a vertical wellbore that is drilled and completed to the target reservoir depth. A horizontal wellbore is then drilled from the end point of the vertical well. The horizontal wellbore undergoes hydraulic fracturing to increase production. During the hydraulic fracturing process, high volumes of water, along with a proppant—often sand—and some chemicals are blended and injected at high pressure into the horizontal wellbore. The fluid emerges out of perforations in the horizontal wellbore and creates fractures or cracks in the surrounding rock formations. The proppant is left within the rock formations, holding it open and preventing the formation fractures from closing. Once the recoverable hydraulic fracturing fluid is flowed back through the well, petroleum production begins. Although this combination of horizontal wells and hydraulic fracturing works very well to produce shale and other types of conventional formations, production declines quickly: this decline requires additional drilling to sustain production and, relatedly, shareholder or investor approval.

Increased crude oil prices and an influx of investment capital in the United States has encouraged oil and gas operators to drill and hydraulically fracture as quickly as possible. The speed at which these transactions occur result in conflict and contest over property rights. Regulatory agencies, which oversee production and completion, may be under-resourced or subject to regulatory capture and thus unable to resolve conflicts. These agencies may also be limited in jurisdiction to determine property rights contests. In the United States, oil and gas law is a unique blend of property law, contract law, and torts. It is mostly state common law for private mineral ownership and federal common law for oil and gas on federal lands. Thus civil courts

[5] 470 S.W. 2d 618 (Tex. 1971).

have remarkable authority over the development and application of oil and gas law. Of these civil courts, the Texas courts hold sway over its siblings due to its position as the nation's largest state producer of oil and gas. Many other oil and gas producing states look to the Texas courts as an exemplar.

4.1. Lateral conflicts in the oil and gas commons

The increase in petroleum demand and corresponding price increase results in increased exploration and production activity. These oil and gas commons owners—owners of the mineral interest or owners of an oil and gas lease—compete for access to the subsurface by drilling large numbers of horizontal wells and conduct more hydraulic fracturing operations. The resulting property conflicts occur when wells cross over or across other owners' mineral interests or interfere with their operations. Indeed, these conflicts in oil and gas property and their possible resolutions have been examined by scholars applying correlative rights doctrine, modern property theory, and even communitization of the subsurface. One such illustrative examination is David Pierce's *Carol Rose Comes to the Oil Patch: Modern Property Analysis Applied to Modern Reservoir Problems*,[6] which applies Carol Rose's contemporary property theories, including evolutionary property rights and property non-absolutism to subsurface petroleum conflicts.[7]

A recent Texas Supreme Court case illustrates one such convoluted subsurface conflict and the importance of acknowledging the complexity of hidden resources and their corresponding resource sight. In *Lightning Oil Company v. Anadarko E&P Onshore, LLC*,[8] the court agreed that Anadarko could enter Lightning Oil's subsurface interest without Lightning Oil's consent. Anadarko had argued that it only required the consent of the surface interest owner overlying Lightning Oil's interest to access the subsurface. Lightning Oil vigorously disagreed, stating that Anadarko would be committing trespass if it drilled through Lightning Oil's mineral interest. In siding with Anadarko, the high court asserted that the surface owner also owns the subsurface structures and spaces, while the mineral interest owner owns only the petroleum hydrocarbons. Following *Lightning*, owners of oil and gas rights are unsure of their ownership status and rights with respect to adjacent—and often competing—oil and gas rights owners.

4.2. The ad coleum doctrine and the rule of capture

In deciding subsurface conflicts, courts rely on the antiquated property doctrine governing surface property—the ad coelum doctrine and the rule of capture. Both doctrines originate from the perspective of surface observers and have been applied to subsurface property.

During the nineteenth and twentieth centuries, in the United States, natural resources law promoted the development and extraction of natural resources, such as agriculture, coal, livestock, oil and gas, hard rock minerals, and timber. The promotion of this resource wealth was critical to development of a relatively-fledging country looking to establish, maintain, and protect geographic boundaries. With its basis in British common law jurisprudence, American courts looked to British notions of resource property law to form its own body of law. The common law ad coelum doctrine served as the foundation for this body.

Generations of property law students have learned that aged maxim, which declares that: *Cujus est solum eius est usque ad coelum et ad inferas* (Lashbrook 1946). This translates to: "He who owns the soil owns everything above and below, from heaven to hell." (Lashbrook 1946). Borrowed from ancestral law, its origin predates Lord Coke and likely arose under Roman law.

> The maxim had its origin in England and followed the body of common law from that country into the jurisprudence of the United States. In order to understand why the maxim is important we must trace it to its origin and then follow it back down through the courts as it has been applied to specific cases. Although the courts have never hesitated to deny its application -to cases involving aviation, it is still being offered as a plea when property owners believe they are being damaged by the operation of aircraft over their property or by the proximity of airports to their homes. (Lashbrook 1946).
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> About 1200 this maxim was being cited in discussing rights under the Justinian Code. It is supposed to have been adopted by Lord Coke from a glossator on Justinian's Digest of Roman Law. Eugene

6 19 Penn St. Envtl. L. Rev. 241 (2011).

7 *See generally* Carol M. Rose, *Property in all the Wrong Places?*, 114 Yale L.J. 991, 1017 (2005) *and* Carol M. Rose, Property and Persuasion: Essays on the History, Theory, and Rhetoric of Ownership (Westview Press, 1994).

8 *Lightning Oil Co. v. Anadarko E&P Onshore, LLC*, 520 S.W.3d 39 (Tex. 2017).

> Sauze, in 1916, traced the maxim to Franciscus Accursius of Bologna (circa 1200). Blackstone restated and discussed the maxim in his famous Commentaries and many of our modern courts have applied it in real property cases. (Lashbrook 1946).

The ad coelum doctrine continues to provide jurists and scholars with an ancient, but basic, understanding of property ownership in a modern age (Lashbrook 1946). And many legal scholars have argued for and against its continuing applicability, use, and, indeed, whether it is even a legal doctrine (Merrill and Smith, 2001; Sprankling 2008). But despite its classification critics, the ad coelum doctrine successfully developed into the governing resource property framework—dictating notions of ownership, use, development, protection, and transfer.

With the current advance of technology and demand for oil and gas production, conflicts between correlative rights owners and adjacent owners have increased. Upon examination of subsurface trespass and other property claims, courts have simultaneously rejected and embraced the doctrine. In the novel hydraulic fracturing case of *Coastal Oil & Gas Corp. v. Garza Energy Trust*,[9] the influential Supreme Court of Texas established that the rule of capture protected an operator, whose hydraulic fractures crossed a lease line, thus neatly escaping the need to determine whether the crossing was a physical trespass. In considering the place of the ad coelum doctrine, the court declared that:

> [F]rom the ancient common law maxim that land ownership extends to the sky above and the earth's center below, one might extrapolate that the same rule should apply two miles below the surface. But that maxim—cujus est solum ejus est usque ad coelum et ad inferos—'has no place in the modern world.' Wheeling an airplane across the surface of one's property without permission is a trespass; flying the plane through the airspace two miles above the property is not. Lord Coke, who pronounced the maxim, did not consider the possibility of airplanes. But neither did he imagine oil wells. The law of trespass need no more be the same two miles below the surface than two miles above.[10]

And although the Supreme Court of Colorado held that the ad coelum doctrine did not apply to water recharge rights,[11] it did confirm the same doctrine in oil and gas and mineral rights, which had been established almost a century earlier.[12] Conversely, other jurisdictions rely on the ad coelum doctrine as "the common law rule"[13] or have even codified the doctrine.[14]

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[9] 268 S.W.3d 1, 11–12 (Tex. 2008).

[10] *Coastal Oil & Gas Corp. v. Garza Energy Trust*, 268 S.W.3d 1, 11 (Tex. 2008).

[11] *Bd. of County Com'rs of County of Park v. Park County Sportsmen's Ranch, LLP*, 45 P.3d 693, 710 (Colo. 2002) (rejecting "the Landowners' claim that the cujus doctrine provides them with a property right to require consent for artificial recharge and storage of water in aquifers that extend through their land" and holding that "[w]ater is not a mineral" so "[t]he law of minerals and property ownership [it] relied on in *Walpole* and *Wolfley* is inapplicable to water and water use rights.") (citations omitted).

[12] *Bd. of County Com'rs of County of Park v. Park County Sportsmen's Ranch, LLP*, 45 P.3d 693, 700–01 (Colo. 2002). The court stated:

> To support their theory, the Landowners invoke our decisions in *Walpole v. State Board of Land Commissioners*, 62 Colo. 554, 163 P. 848 (1917) and *Wolfley v. Lebanon Mining Co.*, 4 Colo. 112 (1878). The Landowners invoke *Walpole* and *Wolfley* for the assertion that their "fee ownership includes the space underneath the land" and therefore they have a right to withhold consent and require compensation for [the] project. In *Walpole*, we invalidated a State Land Board mineral reservation the Board had made in the course of selling and conveying title to a parcel of school trust land property. In holding under the law existing at that time that the Board had authority only to convey the entire fee interest, we said:
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> > Land has an indefinite extent upward and downward from the surface of earth, and therefore includes whatever may be erected upon it, and whatever may lie in a direct line between the surface and the center of the earth. *Walpole*, 163 P. at 849–50.
>
> In *Wolfley*, we said: "At common law a grant of land carries with it all that lies beneath the surface down to the center of the earth." 4 Colo. at 114.

Bd. of County Com'rs of County of Park v. Park County Sportsmen's Ranch, LLP, 45 P.3d 693, 700–01 (Colo. 2002) (partial citations omitted).

[13] *Faith United Methodist Church & Cemetery of Terra Alta v. Morgan*, 745 S.E.2d 461, 467–68 (W. Va. 2013) (stating that the "common law rule—cujus est solum ejus est usque ad coelum et ad inferos—is that a land owner with a fee simple title owns everything over the land and under it to the center of the earth. This rule extends to the minerals, be they solid (like coal), fluid or fugacious minerals (like oil and gas)."

[14] *Alyce Gaines Johnson Special Tr. v. El Paso E & P Co., L.P.*, 773 F. Supp. 2d 640, 645 (W.D. La. 2011), *aff'd*, 438 Fed. Appx. 340 (5th Cir. 2011) (holding that "[a]s the Louisiana Civil Code makes clear Louisiana property law embraces the colorful Latin maxim of cujus

Without doctrinal guideposts or legislative or regulatory anchors, courts drift aimlessly upon a sea of fact-determinative cases, like those involving hydraulic fracturing and horizontal drilling trespass claims. It is more evident that the ad coelum doctrine does not work well for lateral resources or lateral ownership rights. However, I believe this doctrine should not be disregarded as antiquated. Though simplistic, it has worked and continues to work remarkably well for vertical long and skinny resources—like a vertical oil and gas well.

The often-accompanying rule of capture is a foundational doctrine of natural resources law, in particular water law and oil and gas law. The rule of capture is a rule limiting liability for trespass and allows captured resources from another owner's tracts, as long as the capture is legal. Many articles have examined both the historical origin and the importance of the rule of the capture in the resource context (Daintith 2010; Bradshaw and Lueck 2015). I point to the rule as providing a geologically-informed benefit—resources with fluid properties migrate from areas of high pressure to areas of low pressure. Thus the rule of capture, even though based on a surface property observation of wild animals, works well in the subsurface to protect property owners from claims of trespass. However, the rule of capture, like the ad coelum doctrine, works in simple situations when applied to the subsurface. It should not act as an all-encompassing protective talisman that saves trespassers from their torts.

4.3. Disconnect between resource and ownership

Without an understanding of the subsurface resource characteristics, hidden resources are difficult to govern. And a piecemeal approach to property rights enforcement results in further and future conflicts. This piecemeal system does not appear to favor the mineral interest owner's rights over an encroaching mineral interest owner. Arguably under *Lightning*, the court created a priority system of ownership rights. That priority system resembles the surface water appropriation system, whereby first in time users are given senior rights over junior users. After *Lightning*, if an adjacent mineral interest owner obtains the adjacent surface owner's permission, the adjacent mineral interest owner can drill through the subsurface of the adjacent owner's mineral tract. Although some believe that the encroachment does not harm the mineral interest owner's property rights to access their own subsurface, that belief is not correct. From my training and experience as a petroleum engineering, I know that the reason this belief is incorrect is due to well construction process.

Oil and gas wells are constructed from layers of steel and cement. Once a well is drilled, steel pipe of varying diameter is inserted and cemented in place. Other smaller diameter pipe may be nested inside the larger pipe and also cemented in place. After cementing, it is almost impossible to remove. Thus if a competing adjacent owner drills first through the other owner's subsurface, the original owner is crowded out and precluded from drilling through that cement and steel. And often, the targeted resource plays possess less than 100 feet of net pay (economically recoverable hydrocarbons), which means that someone else's well can remove much of the target pay from the original owner's property. Gamesmanship also occurs when adjacent owners wish to drill the (non-producing) vertical wellbore on their neighbor's tract so that all of the (producing) horizontal wellbore will be theirs to maximize production.

Other consequences of resource blindness include the mismatch of pore space ownership. Under the traditionalist property framework, pore space often belongs to the surface owner. This ownership regime only makes sense if there is resource blindness. Here, giving pore space to the overlying surface owner is easy: that is, ascertaining ownership is easy. However, pore space is an inherent character of many subsurface resources and is, itself, a subsurface resource. In petroleum engineering, two of the defining quantitative factors of oil and gas reserve calculation are porosity and permeability. Both are factors of the reservoir rock. Porosity is the measure of void space of the reservoir rock and is calculated to determine how much hydrocarbon the rock contains. Permeability is a factor that determines how easily the hydrocarbon will flow from that rock. In order for fluid to flow, there must be porous space. Without space to move, the hydrocarbon is trapped. Likewise, groundwater resources are quantified by their porosity and permeability and also require void space in order to flow. Porous space is an integrated component of both resources. Separately, disassociated pore space may be used to store waste fluids or carbon dioxide in carbon capture sequestration processes. The use of pore space as liquid or gaseous subsurface storage requires injection

est solum ejus est usque ad coelum et ad inferos ("for whoever owns the soil, it is theirs up to Heaven and down to Hell")), *referring to* La. Civ. Code Ann. art. 490 ("Unless otherwise provided by law, the ownership of a tract of land carries with it the ownership of everything that is directly above or under it. The owner may make works on, above, or below the land as he pleases, and draw all the advantages that accrue from them, unless he is restrained by law or by rights of others.").

wells to flow waste fluids, such as carbon dioxide, from the surface into the subsurface porous rock. However this pore space is being used, it is clearly a subsurface use that is different from the surface use.

5. Potential Subsurface Property Conflict Solutions

Revealing hidden resources may improve their success in property rights characterization. However, revealing these hidden resources may not be possible due to technology or cost constraints. So instead, hidden resource property rights conflicts and other inefficiencies and externalities should be mitigated. This conclusion applies to lateral hidden resource conflicts.

Contracts are the simplest mitigative solutions to these lateral property conflicts (Bradshaw and Lueck 2015).[15] If an adjacent mineral interest owner wishes to cross the tract of another, they should receive permission. That permission could take place in the form of a permission to cross, such as an easement, which is also a traditional property servitude, or a right of way. Cooperative contract solutions include the conflicting mineral interest owners participating in a participation agreement, such as a joint operating agreement. Though contracts are neat solutions, their drawbacks include the time necessary to negotiate them, any inequity in bargaining advantage, and the possibility of contract negotiation failure. Driven by economics and the all-pervasive rule of capture, operators favor a faster method of accessing mineral acreage. Often, this method is akin to the adage of "asking forgiveness rather than permission."

Finally, under certain state regulatory systems and on federal lands, compulsory pooling may be used to force holdout mineral interest owners to participate in oil and gas development by an oil and gas operator (see Bradshaw and Lueck 2015). Although compulsory pooling provides owners with the ability to incorporate mineral acreage from unwilling participants, it is limited to: (1) states or federal land systems that allow for compulsory pooling and (2) mineral (oil and gas) owners and not oil and gas leasehold owners. Thus pooling may not be an option for private mineral development, in particular in states like Texas, which lacks a robust compulsory pooling statute.

5.1. The mining district example

A historical examination of mining governance reveals a solution that is plausible because it requires neither a broad property framework nor reliance on a legislative or regulatory solution. Regional mining was often governed by small communities of mining owners—mining districts. Each district participated in establishing property regimes for the local mining resource. Local regulation and governance of subsurface resources may be a better solution to subsurface property conflicts. And mining law, one of the oldest forms of natural resources law, offers an exemplar solution to the hidden resource problem.

Mining is the extraction of solids from the subsurface. These solids are generally categorized as coal hydrocarbons or hard rock minerals. Coal is a sister to oil and gas and the coalification process is similar to petroleum hydrocarbon formation except that coal is formed in ancient areas of peat and bog. Hard rock minerals may form under a variety of geological processes and are usually mined using placer mining or lode mining. Minerals are deposited in a lode or vein in rock. Placer minerals are found when natural erosion processes such as water flowing over rock wear away the rock and reveal the mineral either in place or in the loose gravel or surface soil (e.g., panning for gold). Lode mining is subsurface mining where the lode or vein travels subsurface. The rock must be mined and quarried and then is processed at the surface. Because of technological limits, lode mining required men to dig through the subsurface or through mountainous regions with valuable mineral deposits to mine the valuable minerals. The doctrine of extralateral rights was formed to govern property ownership of lodes that cross the two-dimensional surface boundaries (Lowe et al. 2018).[16] Eventually, this doctrine would form one of bases of the seminal rule of capture. The doctrine of extralateral rights was formed after the California Gold Rush began, in 1848 (Colby 1916). It allowed pursuit and exploitation of a lode that crossed out of an owner's tract into another's adjacent tract without obtaining the adjacent owner's permission (Colby 1916). This pursuit was often limited by a certain amount of feet horizontally and vertically (Colby 1916).

Mining law and the use of local mining districts, specifically, presents itself as an appropriate solution to the hidden resource governance problem because the mining property owners acquired resource sight. Although mining dates back to Prehistory, human technology limited the gathering and use of minerals at and beneath the earth's surface. As mining techniques advanced, surface mining and underground mining

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[15] Bradshaw and Lueck (p. 2511) state: "The need for contract—or some form of governance arrangement—to control landscapes emerges from tension between manmade property divisions, such as land parcels, and natural resources."

[16] Discussing *Del Monte Mining & Milling Co. v. Last Chance Mining & Milling Co.*, 171 U.S. 55 (1898).

revealed the unique geology and subsurface structures that carried the valuable minerals. These miners were able to observe visually the paths of lodes and veins, in addition to deposits such as coal seams, all embedded within seemingly unyielding enclosures. By opening the earth and immersing themselves in the visual experience of the resource, miners acquired resource sight. They became aware of the characteristics of the mined resources and adapted existing property rights doctrine to the resource instead of adapting extraction of the resource around the existing property law at the time. The extralateral right is the property right that embodies the acquisition of resource sight.

The history of the mining districts appears to originate in thirteenth century Germany (Colby 1916). There, recorded materials contain mining district notes (Colby 1916). Development of mining districts also occurred in England and in various regions of South America (Colby 1916). Interestingly, the mining district concept traveled to the United States after the opening of the American West and the corresponding California Gold Rush (Colby 1916). As land was opened up for mining, Appalachian coal miners, in addition to immigrant miners from Germany, England, and other regions around the world brought their knowledge and custom of mining doctrine to the western United States (Colby 1916). Particularly in the states of California, Arizona, and Nevada, these immigrant miners formed local mining districts to govern their subsurface resources (Colby 1916). This governance included adoption of the extralateral right, in addition to the setting of property boundaries in mining claims (Colby 1916).

Following the American Civil War, the federal government enacted mining legislation to capitalize on the newly-discovered wealth and pay its substantial war debts (Colby 1916). First, the Act of 1866 was enacted, followed by the General Mining Act of 1872, which, as amended, is still in place today.[17] The General Mining Act essentially codified the extralateral right, which arose out of the governance and property framework by local mining districts.

A more perfect solution to subsurface natural resource rights may be informal communities of mineral owners, who congregate and discuss their subsurface resources and plans regarding reservoir development. These owner communities would be made up of property interest owners in a common geologic reservoir. Aggregating commons owners together into a community increases capital and project efficiencies, but also has obvious collusion and antitrust concerns that would need to be addressed (Bradshaw and Lueck 2015).[18] These communities could have an advisory role without any legal authority or status. But custom and norm are heavy influencers in the development of property framework. Its use should not be discounted. Possible practical application includes using the already-existing petroleum geology field designation at the state and federal regulatory levels—e.g., state oil and gas regulatory commission and the federal U.S. Geological Survey or other agencies within the Department of Interior. Owners within these fields could organize a community and conduct informal discussions regarding cooperative field development.

Finally, a critical challenge is whether the formation of local governance communities, like the mining districts, is possible when community owners operate under variable social rules, norms, and customs.[19] Notably, one large limitation is that these local subsurface owner communities are made up of similarly-situated owners—they all mostly desire similar development and exploitation outcomes. External stakeholder input, such as local residents, environmentalists, industry, regulators, and government remains critical in the development and conservation of resources.

6. Conclusion

Subsurface resources like oil and gas, groundwater, pore space and other hidden resources cannot be efficiently managed using existing surface property framework. These resources require a custom governance solution that derives from their geological origins and that evolves with advances in technology. For humans, examining a single fluid-laden rock does not give them knowledge of how the fluid moves within a larger reservoir rock structure. Digging one water well does not provide knowledge of the aquifer geography; likewise, drilling one oil and gas well does not provide knowledge of the oilfield. It is only the slow aggregation of data from each data point and with the eventual evolution of technology, like seismic, that provides more knowledge of the resource. For although this paper identifies the challenges of subsurface property regimes, more research should be done on how to acquire resource sight or how

[17] 30 U.S.C. 22 et seq., as amended.

[18] Observations from Karen Bradshaw, Professor of Law, Arizona State University, Co-Organizer and Commenter, *Mismatched Property Rights to Landscape-Level Resources: Legal and Customary Solutions* (Apr. 12, 2019 & Jun. 2019).

[19] Observations from Karen Bradshaw, Professor of Law, Arizona State University, Co-Organizer and Commenter, *Mismatched Property Rights to Landscape-Level Resources: Legal and Customary Solutions* (Apr. 12, 2019).

to overcome the limitations of resource blindness when (de)constructing hidden resource property frameworks.

Resources and their owners and users exist in a series of relationships, largely identified as resource systems. But referring back to the discussed physiology analogy, we tend to either (1) examine each resource without understanding its relationships with other resources and with the corpus as a whole or (2) examine the effects or externalities of resource use without understanding the resource and its relationships. Analyzing a more efficient and effective governance system will require thinking about these rights independently, collectively, and in terms of priority.[20] And property rights are essentially priority rights. Ownership is comparative in nature: it is based on whose right is superior to another's.

Competing Interests

The author has no competing interests to declare.

References

Bradshaw, K. (2018). Animal Property Rights. *University of Colorado Law Review*, *89*, 809 et seq.

Bradshaw, K., & **Lueck, D.** (2015). Contracting for Control of Landscape-Level Resources. *Iowa Law Review*, *100*, 2507–2549.

Colby, W. E. (1916). The Extralateral Right: Shall it be Abolished? *California Law Review*, *4*, 361 et seq. DOI: https://doi.org/10.2307/3474397

Daintith, T. (2010). *Finders Keepers? How the Law of Capture Shaped the World of Oil Industry*. New York: RFF Press. DOI: https://doi.org/10.4324/9781936331765

Epstein, R. A. (2019). Property Rights: Long and Skinny.

Kramer, B. M., & **Anderson, O. L.** (2005). The Rule of Capture – An Oil and Gas Perspective. *Environmental Law*, *35*, 899 et seq.

Lashbrook, L. D. (1946). The "Ad Coelum" Maxim as Applied to Aviation Law. *Notre Dame Law Journal*, *21*, 143–154.

Lowe, J. S., Anderson, O. L., Smith, E. E., Pierce, D. E., Kulander, C. S., & **Ehrman, M. U.** (2018). *Cases and Materials on Oil and Gas Law*. St. Paul: West Academic Publishing.

Merrill, T. W., & **Smith, H. E.** (2001). What Happened to Property in Law and Economics? *Yale Law Journal*, *111*, 389, n.1. DOI: https://doi.org/10.2307/797592

Pierce, D. E. (2011). Carol Rose Comes to the Oil Patch: Modern Property Analysis Applied to Modern Reservoir Problems. *Penn State Environmental Law Review*, *19*, 241 et seq.

Rose, C. M. (1994). *Property and Persuasion: Essays on the History, Theory, and Rhetoric of Ownership*. Boulder: Westview Press.

Rose, C. M. (2005). Property in all the Wrong Places? *Yale Law Journal*, *114*, 991 et seq.

Sprankling, J. G. (2008). Owning the Center of the Earth. *UCLA Law Review*, *55*, 982–83.

[20] Observations from Karen Bradshaw, Professor of Law, Arizona State University, Co-Organizer and Commenter, *Mismatched Property Rights to Landscape-Level Resources: Legal and Customary Solutions* (Apr. 12, 2019).

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