PROPERTY RIGHTS IN A VACUUM: A MOON ANARCHIST'S GUIDE TO PROSPECTING

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Soon there will be private industry on the moon, but the question of how property rights will be apportioned, transferred, and adjudicated is still unanswered. Further complicating the matter is the founding document of space law, the Outer Space Treaty, which disallows sovereign appropriation of space resources but remains silent on whether the same prohibition extends to private companies. Since the ratification of this seminal document, no major legislation has been passed except for the "Space Act," a U.S. statute that takes the decidedly pro-American-business stance that the Outer Space Treaty's silence on private appropriation was intended to be permissive rather than prohibitive. The Artemis Accords, drafted in 2020 by NASA and signed by eight developed countries, comports with this view. This Note looks at how U.S. companies might be able to honor the spirit of the non-appropriation clause while still creating opportunities to transact business on the Moon. It begins with a historical overview of Western ideas of property, including a discussion of the relational aspects of property rights and the tragedy of the commons, as well as a brief discussion of the Mining Law of 1872 and the concept of pedis possessio. *The Note then advocates for an approach that combines the "multiple use" permitting system employed by the Bureau of Land Management with the enforcement mechanism of a self-regulatory organization, as well as dispute resolution inspired by international arbitration.*

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INTRODUCTION

The U.S. government is preparing to launch another mission to the Moon by 2024, this time with an eye toward eventually developing an orbiting space station.[1] China and India have made similar overtures.[2] Private industry titans are currently readying their own Moon missions,[3] and NASA is preparing to launch a series of missions with the Artemis rover, which will gather samples in order to provide a clearer picture of the resources available on the Moon for mining.[4] Perhaps the most lucrative of these resources is Helium-3, which has been heralded as a potentially abundant source of clean, efficient energy (think of a power source with an energy output similar to nuclear fusion, but with none of the usual risks).[5] Acquiring such an energy source might, all hyperbole aside, help to literally save our species from itself while making some enterprising individuals very wealthy in the process.[6]

Further into the future, the United States hopes to develop the capabilities of mining both asteroids and Mars too, though these are likely to be much trickier

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1. *See* Frans von der Dunk, *The Artemis Accords and the Law: Is the Moon 'Back in Business'?*, BIG Q (June 2, 2020), https://www.thebigq.org/2020/06/02/the-artemis-accords-and-the-law-is-the-moon-back-in-business/; Mike Wall, *SpaceX's Starship May Start Flying Moon Missions in 2022*, SPACE.COM (Nov. 19, 2019), https://www.space.com/spacex-starship-moon-missions-2022.html; *Gateway*, NASA, https://www.nasa.gov/gateway (last visited Jan. 30, 2021).

2. *See* Matthew Rosendahl, *Galactic Preservation and Beyond: A Framework for Protecting Cultural, Natural, and Scientific Heritage in Space*, 43 WM. & MARY ENV'T L. & POL'Y REV. 839, 839 (2019); Von der Dunk *supra* note 1.

3. Mike Wall, *Moon Rush: These Companies Have Big Plans for Lunar Exploration*, SPACE.COM (Jan. 17, 2018), https://www.space.com/39398-Moon-rush-private-lunar-landings-future.html; *see also* Jeffrey Kluger, *Elon Musk Told Us Why He Thinks We Can Land on the Moon in 'Less Than 2 Years,'* TIME MAG. (July 18, 2019), https://time.com/5628572/elon-musk-Moon-landing/; Wall, *supra* note 1.

4. Alan Campbell & Seamus Tuohy, *Another Moon Landing Sooner than You Think!*, HACK THE MOON, https://web.archive.org/web/20200513172326/https://wehackthe Moon.com/tech/another-Moon-landing-sooner-you-think (last visited Jan. 13, 2021); *see also Artemis Program*, NASA, https://www.nasa.gov/artemisprogram (last visited Oct. 11, 2020).

5. Lori Ioannou, *Billionaire Closer to Mining the Moon for Trillions of Dollars in Riches*, CNBC (Jan. 31, 2017), https://www.cnbc.com/2017/01/31/billionaire-closer-to-mining-moon-for-trillions-of-dollars-in-riches.html.

6. *See id.*

endeavors and will potentially require the ability to refuel in space, either on the Moon or in orbit.[7] At a 2019 Space Mining Summit at the University of Arizona, those in attendance included prominent venture capitalists and representatives from major earthbound mining conglomerates.[8] Suffice it to say that there is big money at stake, and the big players are (cautiously) watching.

Many consider lunar mining endeavors to be the first step towards humanity becoming a significant extraterrestrial presence. There are several reasons for this outlook. First, some think that since we have been there already, we know for sure that it can be done.[9] This fact alone elevates it in feasibility above other missions, such as those to Mars.[10] Why take on the infinitely more difficult prospect of going to Mars when it has been over a half-century since we have even had a manned mission to any celestial body?[11] Second, we have a good idea of what sort of resources are up there and roughly where they should be distributed—and further efforts to narrow our broad understanding are already underway.[12] Third, the Moon could provide plentiful sources of the types of elements that would be necessary for travel to other destinations in space—water and hydrogen are two of the main ones.[13] Fourth, it could serve as a base of operations for a variety of space ventures.[14] Because it has no atmosphere, launching spacecraft from the Moon costs a fraction of what it does from Earth. The ice on the moon could be turned into rocket fuel for spacecraft that could take us to far-off destinations like Mars or other asteroids,[15]

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7. Neel V. Patel, *Here's How We Could Mine the Moon for Rocket Fuel*, MIT TECH. REV. (May 19, 2020), https://www.technologyreview.com/2020/05/19/1001857/how-moon-lunar-mining-water-ice-rocket-fuel/; Cecilia Jamasmie, *Mining Robots Key to Colonizing Mars—Elon Musk*, MINING DOT COM (Oct. 24, 2016), https://www.mining.com/mining-robots-key-to-colonizing-mars-elon-musk/; Neel V. Patel, *Elon Musk Unveils SpaceX's Timeline for Sending People to Mars*, INVERSE (June 19, 2017), https://www.inverse.com/article/33146-elon-musk-spacex-timeline-mars-mission-new-space.

8. Literature on file with author.

9. *Cf.* Sarah Scoles, *Everyone Wants to Go to the Moon Again—Logic Be Damned*, WIRED (Sept. 26, 2018), https://www.wired.com/story/everyone-wants-to-go-to-the-moon-again-logic-be-damned/ (stating that "it's harder [to go to Mars], and we haven't done it yet").

10. *See id.*

11. *See id.*

12. *See Resource Prospector*, NASA, https://www.nasa.gov/resource-prospector (last visited Apr. 16, 2020).

13. Loren Grush, *Why Mining the Water on the Moon Could Open up Space Exploration*, VERGE (Aug. 23, 2018), https://www.theverge.com/2018/8/23/17769034/nasa-Moon-lunar-water-ice-mining-propellant-depots.

14. Edd Gent, *Moon Bases Being Planned Now May Show Us How to Live off-Planet*, NBC NEWS: MACH (Mar. 13, 2018), https://www.nbcnews.com/mach/science/Moon-bases-being-planned-now-may-show-us-how-live-ncna855826.

15. *Id.*; *cf.* Gary Li et al., *Mining the Moon for Rocket Fuel to Get Us to Mars*, OBSERVER (May 15, 2017), https://observer.com/2017/05/mining-the-Moon-for-rocket-fuel-to-get-us-to-mars-spaceflight-deep-space-nasa/ (discussing the use of ice on the Moon as a propellant for rockets).

and the soil can be used to 3D-print components for the bases on the moon.[16] In short, the Moon could become a major hub for space travel and commerce, and initial manned missions could serve as much-needed "practice" for future missions to other celestial bodies such as Mars.

Yet even with all this promise and interest in traveling to the Moon, we still lack a cohesive property law framework to support these endeavors. The United States (or any other country) does not have clear rights to erect structures, extract minerals, or occupy airspace encircling the Moon. It is likewise unclear what property rights apply to private entities.[17]

A good deal has been written about the current state of the international legal framework for property rights in space, much of it centering around the disagreements and conflicting interpretations of space treaties between nations, including the conflict between the U.S. Space Act and the Outer Space Treaty ("OST").[18] That subject is not the main focus of this Note, but Part I will begin with a brief overview of where things currently stand in the international diplomatic community. Liability is also a hugely important topic on which much has already been written but which will not be addressed in this Note.[19]

Part II will briefly discuss some of the western philosophical underpinnings that support the way we think about property rights in the United States. It will give an overview of three "definitional" approaches to property rights.[20] In so doing, this

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16. The European Space Agency did an experiment in 2013 to determine whether the soil of the moon could be used to make 3D-print building materials. Using volcanic soil with a "99.8% resemblance to lunar" regolith, they ultimately succeeded in creating building blocks that they believed could withstand the harsh environment of the moon. *Building a Lunar Base with 3D Printing*, THE EUR. SPACE AGENCY (Jan. 1, 2013), http://www.esa.int/Enabling_Support/Space_Engineering_Technology/Building_a_lunar_base_with_3D_printing; *see also* Chloe Cornish, *Interplanetary Players: A Who's Who of Space Mining*, FIN. TIMES (Oct. 18, 2017), https://www.ft.com/content/fb420788-72d1-11e7-93ff-99f383b09ff9 (discussing the mining of minerals on the moon).

17. *Cf.* Debra Werner & Jeff Foust, *Jury Awards Intuitive Machines $4.1 Million in Cash and Moon Express Equity*, SPACENEWS (Jan. 26, 2018), https://spacenews.com/jury-awards-intuitive-machines-4-1-million-in-cash-and-Moon-express-equity/ (discussing lawsuit over contract and intellectual property between two companies involved in lunar transport); Andrew R. Brehm, Note, *Private Property in Outer Space: Establishing a Foundation for Future Exploration*, 33 WIS. INT'L L.J. 353, 355 (2015).

18. *See, e.g.*, Kurt Taylor, *Fictions of the Final Frontier: Why the United States Space Act of 2015 Is Illegal*, 33 EMORY INT'L L. REV. 653, 655 (2019); Justin Rostoff, *"Asteroids for Sale": Private Property Rights in Outer Space, and the Space Act of 2015*, 51 NEW ENG. L. REV. 373, 374 (2017).

19. The OST and the Liability Convention do not contemplate liability for private actors, only for nations. This leaves nations to sort out what sort of common law liability to ascribe to its citizens in space. *See generally* Dylan R. Conroy, *The New Space Race: America's Journey to Stay Ahead of the International Community Through Proposed Legislation*, 6 ST. THOMAS J. COMPLEX LITIG. 1, 5 (2019); Trevor Kehrer, *Closing the Liability Loophole: The Liability Convention and the Future of Conflict in Space*, 20 CHI. J. INT'L L. 178, 180 (2019).

20. Glen Anderson, *Towards an Essentialist Legal Definition of Property*, 68 DEPAUL L. REV. 481, 484 (2019).

Part will attempt to give a broad answer to the even broader question of "What are property rights?" and use that as a baseline for discussions of the common law issues most likely to attend lunar property disputes.

In Part III, this Note will then develop the main thesis that the best property-rights framework for the Moon is one that focuses on apportioning multiple use licenses, rather than actual ownership of parcels of land. This would hopefully allow for industrial growth during this goldrush-like era, while also at least partially reconciling the Space Act with the OST prohibition on lunar sovereignty and (perceived) individual ownership of lunar land.[21] Though some sovereignty may be inevitable in this approach, there may be ways of limiting it by creating a largely nonsovereign regulatory body to oversee licensing and disputes.[22]

In searching for the right framework(s), this Note will explore and address several potential common law paradigms, including Common Property solutions, as well the Law of the Range and the Mining Law of 1872. Mining law is much too complex to cover exhaustively here, but because it is so important to any discussion of lunar mining, this Note contains some background on the current regime, as well as a concept—*pedis possessio*—which many believe will have great significance on the Moon.[23]

Finally, this Note argues for an approach that melds the Mining Law of 1812 with the approach to property licensing for specific uses found in the Taylor Grazing Act.[24] This approach is ideal because it is practical and flexible, and it reconciles the Space Act with the OST by allowing for private entities to profit on the Moon, while not allowing for actual individual ownership of parcels of land. In conjunction with this approach, there would be an industry-led regulatory body to oversee licensing and permits and to adjudicate disputes, thus keeping sovereign involvement as low as possible.

This approach would not give actual ownership of parcels of land to private or state-run entities, but would rather give the rights to extract resources, build recreational structures, or erect scientific research stations on said parcels. Entities could build such structures as were necessary to these ends. Such a regime would give entities a right of exclusion, which is essential to property rights, but it would not give them a right of alienation.[25]

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21. *See infra* Part I.

22. *See infra* Section III.B.

23. *See, e.g.*, Louis de Gouyon Matignon, *Pedis Possessio and Asteroids*, SPACE LEGAL ISSUES (Sept. 6, 2019), https://www.spacelegalissues.com/pedis-possessio-and-asteroids/.

24. 43 U.S.C. §§ 315–315r (2018).

25. Broadly speaking, alienation is the legal right for an entity to sell or otherwise transfer property to another entity. *Power of Alienation*, BLACK'S LAW DICTIONARY (11th ed. 2019). The right of exclusion, on the other hand, is the right to keep others out of one's property. Anderson, *supra* note 20, at 485.

I. INTERNATIONAL BACKGROUND

Much has been written about the complex international situation surrounding the issue of property rights (and sovereignty in general) in space.[26] The following is a brief overview of the international paradigm, followed by several suggestions and critiques about the OST and the ways in which it is commonly interpreted by the international community.

A. The Outer Space Treaty of 1967

There is really only one important piece of international legislation, and that is the OST, formed in 1967 and signed by the United States and 105 other nations.[27] The OST is both the founding document of space law and the only one with broad international support—some have even colloquially referred to this treaty as the "Constitution of Outer Space."[28] A key passage of the OST is what is referred to as the "common heritage" policy. This phrase refers to the notion that any property retrieved by a sovereign in certain areas is "the heritage of [all] mankind" and should therefore be divided amongst all of Earth's peoples.[29] This or similar language is also seen in the Antarctic Treaty and the Law of the Sea.[30] In the 1979 Moon Treaty, there was an attempt to expand this notion to preclude property rights for private entities as well.[31] In contrast with the OST, only 16 countries signed it.[32] It is worth noting that none of these countries are particularly likely to find themselves in space any time soon. While the OST does not allow for sovereign property rights in space, it does not explicitly address whether private entities are likewise prohibited.[33]

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26. *See, e.g.*, Rosendahl, *supra* note 2, at 839; Kurt Anderson Baca, *Property Rights in Outer Space*, 58 J. AIR. L. & COM. 1041, 1041 (1993); Abigail D. Pershing, *Interpreting the Outer Space Treaty's Non-Appropriation Principle: Customary International Law from 1967 to Today*, 44 YALE J. INT'L L. 149, 149 (2019); Henry R. Hertzfeld & Frans G. von der Dunk, *Bringing Space Law into the Commercial World: Property Rights Without Sovereignty*, 6 CHI. J. INT'L L. 81, 81 (2005).

27. Jill Stuart, *The Outer Space Treaty Has Been Remarkably Successful—but Is It Fit for the Modern Age?*, CONVERSATION (Jan. 27, 2017), https://theconversation.com/the-outer-space-treaty-has-been-remarkably-successful-but-is-it-fit-for-the-modern-age-71381.

28. *Id.*

29. There are conflicting views of the common heritage approach. For instance, some developing nations have advocated for an interpretation that provides for equitable distribution of all resources collected (though precisely what that would look like is unclear). Some developed nations reject the common heritage approach entirely, while others maintain that the states who collect the resources (i.e., the developed space-faring nations) should be the ones to determine what is "equitable." Harminderpal Singh Rana, *The "Common Heritage of Mankind" & the Final Frontier: A Revaluation of Values Constituting the International Legal Regime for Outer Space Activities*, 26 RUTGERS L.J. 225, 229–31 (1994); *see also* Taylor, *supra* note 18, at 660–61 (noting the "five tenets" of the common heritage approach and its overall controversial standing).

30. *See* Rana, *supra* note 29, at 235–38.

31. Brehm, *supra* note 17, at 358.

32. *Id.* at 359.

33. *Id.* at 356.

B. The Space Resource Exploration and Utilization Act of 2015 ("Space Act")

The U.S. government has taken the view that the omission of a clause forbidding private property rights in the OST was intended to be "permissive" rather than prohibitive, so it created the Space Act.[34] Signed into law in November of 2015 by President Obama, the act was intended to clarify the United States' view of private property rights in outer space.[35] The Space Act facilitated "commercial exploration for and commercial recovery of space resources by United States citizens" and also promoted the right of U.S. citizens to engage in prospecting for outer space minerals, using language that suggests support for a *pedis possessio* (literally, "foothold") approach to assaying.[36] Further, the Act explicitly authorized individuals to "possess, own, transport, use, and sell" space resources.[37]

One criticism that has been leveled at the Space Act's interpretation of the OST's non-appropriation clause is that, in order for a private entity to achieve property rights they must be granted by some entity, and that entity is usually a sovereign.[38] This implies that the sovereign possessed or created said property rights in the first place.[39]

C. The Artemis Accords and the Problem of Sovereignty

Developing a property-rights regime in space may require a new and more flexible framework that does not hew to such rigidly formalistic ideas of sovereignty. Just because there is an agency that oversees and delegates parcels of land for various uses, that does not mean that said agency will be appropriating those resources, nor does it mean it would need to claim actual ownership of any of the parcels of land from which the resources may be extracted. And there is always the possibility that such an agency could take the form of a self-regulatory organization ("SRO"), so that any disputes would be solved largely without the interference of a sovereign government, except where appeals were necessary.[40]

Moreover, in May 2020, a group of seven developed countries signaled their willingness to look past this sovereignty question by signing the Artemis Accords.[41] These accords are a series of bilateral agreements that bind signatories to

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34. *See* Andrew Lintner, *Extraterrestrial Extraction: The International Implications of the Space Resource Exploration and Utilization Act of 2015*, 40 FLETCHER F. WORLD AFF. 139, 152 (2016).

35. Craig Foster, *Excuse Me, You're Mining My Asteroid: Space Property Rights and the U.S. Space Resource Exploration and Utilization Act of 2015*, U. ILL. J.L. TECH. & POL'Y 407, 420 (2016).

36. *Id.* at 420–21. For a discussion of the concept of *pedis possessio*, see *infra* Section III.C.

37. Foster, *supra* note 35, at 421.

38. *See* Taylor, *supra* note 18, at 656 ("Sovereign recognition of ownership is essential to private ownership of something in outer space.").

39. *See id.* at 656–57 ("Private ownership of something cannot exist without first being granted by a sovereign.").

40. *See infra* Section III.B.

41. *See* David P. Fidler, *The Artemis Accords and the Next Generation of Outer Space Governance*, COUNCIL ON FOREIGN REL. (June 2, 2020), https://www.cfr.org/blog/artemis-accords-and-next-generation-outer-space-governance.

abide by certain principals.[42] The accords were drafted by NASA as prerequisites to any country's participation in the Artemis project, and they largely track the existing U.S. conception of the OST as it pertains to appropriation of Moon resources.[43] That is because the United States is far and away the global leader in space exploration and thus has significant leverage to enforce its demands.[44]

Though some indirect influence on private entities is likely, the accords do not explicitly govern them.[45] But perhaps the most important thing to take from these accords is that they move the ball forward and could potentially serve as a guiding framework for future legislation and endeavors.[46] NASA will likely adhere to them in negotiating contracts with private entities, and the U.S. government may choose to enforce them legislatively with non-NASA-affiliated private entities.[47] Moreover, future international agreements with nonsignatory countries may be pressured or inspired to model their own legislation after them.[48]

Furthermore, the accords could serve to reassure private entities who were reluctant to enter the fray because they did not know whether future laws would allow for appropriation of space resources.[49] The accords serve as further indicia of the United States' unequivocal support for private enterprise, both on sovereign and private levels.[50]

Whether the combination of the Space Act and the Artemis Accords is enough to reassure potential commercial investors that space mining is a safe bet, or whether the overall riskiness of such endeavors will discourage such attempts, is an open question that is still being borne out. The question of how and when commercial property rights will come to exist in space is up in the air, but it seems very likely that it will happen one way or another. After all, it is hard to imagine that U.S. interests will see fit to leave such vast amounts of potential treasure in the ground, regardless of what celestial body that ground may be located on. With that in mind, the United States will need to consider how to allocate rights and privileges and adjudicate domestic disputes once they inevitably arise.

II. A HISTORICAL OVERVIEW OF PROPERTY RIGHTS

What is property? And, more importantly for the purposes of this Note, what does it mean to have a "right" to it? These questions are ones that philosophers have long engaged in, and like most philosophy, it is not so much the answering as it is the asking of the question that is fruitful. The three "definitional" frameworks discussed herein were recently analyzed in Glen Anderson's article, *Toward an Essentialist Legal Definition of Property*, and they provide an excellent jumping-off

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42. *See The Artemis Accords*, NASA, https://www.nasa.gov/specials/artemis-accords/index.html (last visited Nov. 16, 2020).
43. Von der Dunk, *supra* note 1.
44. Fidler, *supra* note 41.
45. *Id.*
46. *See id.*
47. *Id.*
48. *Id.*
49. *See* Von der Dunk, *supra* note 1.
50. *See id.*

point for discussing property rights in general and, more specifically for our purposes, in space.[51]

Taken together, these approaches constitute a historical and practical overview of how our Western conception of property rights has changed over the years. There are numerous other approaches to property rights, but these frameworks are particularly useful for several reasons. First, they begin with the "classical" view of property rights and then build out from there to encompass the ineffable and transient aspects of property. Second, they also provide the foundation for discussion of the distinctions between "use" and "ownership" and illustrate the ways in which they can blur together. This is particularly helpful in Part III of this Note, which discusses the way that multiple use permits could create a sort of ad hoc right of alienability.

We begin with the "exclusionary approach," which shapes the broad contours of what sort of control an entity may exert over real property.[52] Then, the "Bundle of Sticks" approach asks the question, "Are not property rights a bit more complicated than that?" In fact, calling them "rights" is reductive, when they are more accurately described as a "bundle of rights and responsibilities" that exist independently of both property and the entity exercising them.[53] Finally, the "Social Constructivist" approach adds one final layer to all of this by positing that all of our taxonomizing and philosophizing about property rights does us no good if there is not a societal structure that will uphold it, and that societal structure itself influences property rights significantly.[54]

A. The Exclusionary Approach

This is a theory put forth by eighteenth-century philosopher William Blackstone,[55] which can be boiled down to three basic elements. The first is "dominion," which Blackstone defined as the control that one person (be they natural or corporate) has over a "thing."[56] The second is "exclusion"—a legally enforced ability to prevent others from using or enjoying a particular "thing."[57] The third is "external things," or put another way, "corporeal objects," which include land and chattels.[58] Though this Note will not discuss this last category in depth, it is important to note that Blackstone was firmly grounded in the world of the physical—intellectual property was not something he was contemplating with this theory.[59]

One criticism of Blackstone's approach is that it is fairly absolutist, yet property rights are themselves frequently less than absolute.[60] For instance, one might have a legal right of action against trespassers (a right of exclusion), but the

51. *See* Anderson, *supra* note 20, at 492–93.
52. *Id.* at 485.
53. *See id.* at 497–98.
54. *See id.* at 505–06.
55. *Id.* at 485.
56. *Id.*
57. *Id.*
58. *Id.*
59. *Id.* at 489–90.
60. *Id.* at 485.

law may at the same time grant an easement to a utility company to service a telephone pole.[61] Or a person's use of a parcel of land might give way to ownership in the eyes of the law, thus blurring the distinction between use and ownership.[62]

To place Blackstone's taxonomy within the realm of outer space: imagine a fictional corporation called "Planetary Express," which has dominion over a parcel of land on the Moon.[63] That dominion could take the form of actual ownership in fee simple absolute,[64] or it could take the form of a right to occupy the space for certain purposes.[65] The corporation may or may not also have a right of exclusion—that is, a legally cognizable right to keep others out. Keep Planetary Express in mind as we add another layer onto our understanding of property rights.

B. The "Bundle of Sticks" Approach

Wesley Hohfeld's theory of legal relations has long been a beloved topic of discussion amongst legal scholars[66] and is frequently taught as part of first-year property classes in law schools around the country.[67] The basic idea is that property exists separately from the rights associated with it and that for each piece of property a person owns, they have some collection or permutation of rights and burdens associated with it. In other words, there is no inflexible concept of "Ownership" with a capital "O," but rather "ownership," a collection of rights that change based on the property and the individual(s) in question.

There is, on the one hand, a piece of property and, on the other, a "bundle" of rights and responsibilities associated with those rights.[68] Animals are perhaps the clearest example—the owner of a horse has both the right to its use, as well as the right to exclude others from using it, but they also have responsibilities to keep the animal fed and well-cared for, else they be punished by the applicable laws against animal cruelty.[69] There are countless other examples of property with countless arrangements of rights and responsibilities—this is perhaps the blessing of the bundle of rights approach as well as the curse.[70] Many feel that it is so flexible as to

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61. *Id.*

62. This refers to a doctrine called "adverse possession" and it occurs where a person in possession of land owned by someone else acquires valid title to it by meeting certain common law requirements including openly using or occupying the land for a statutorily determined period of time. *See Adverse Possession*, BLACK'S LAW DICTIONARY (11th ed. 2019).

63. All references to Planetary Express and Mom's Friendly Robot Company are taken without permission from the television series Futurama. *Futurama* (Fox television broadcast 1999–2003; Comedy Central television broadcast 2008–2013).

64. "In fee simple absolute" is a legal term that means one has complete ownership over an estate forever with no special limitations attached to it. *See Fee Simple Absolute*, BLACK'S LAW DICTIONARY (11th ed. 2019).

65. *See infra* Section III.B.

66. *See, e.g.*, Anderson, *supra* note 20, at 492–504; Walter Wheeler Cook, *Hohfeld's Contributions to the Science of Law*, 28 YALE L.J. 721, 721 (1919).

67. Curtis Nyquist, *Teaching Wesley Hohfeld's Theory of Legal Relations*, 52 J. LEGAL EDUC. 238, 238 (2002).

68. Anderson, *supra* note 20, at 497–98.

69. *See id.* at 498 (citing Backhouse v. Judd, [1925] SASR 395 (Austl.)).

70. *See id.* at 498–99.

be without meaningful substance or application,[71] while others feel that its flexibility makes it practical for a wide variety of applications.[72]

Let us again return to Planetary Express and add a few sticks from the bundle. Imagine for the sake of argument that Planetary Express claims a parcel of land on the Moon and that they are allowed to do so in fee simple absolute. Now they wish to build a manufacturing structure on that parcel of land. If they were on Earth, they would have certain property rights, such as the right to exclude trespassers and the right to alienation,[73] as well as certain responsibilities.[74] One such responsibility might be an obligation to follow local anti-pollution laws.[75] On the Moon, however, the anti-pollution laws (assuming for the sake of argument that we have Moon laws at this point) would likely be far different, or perhaps even nonexistent because the Moon has no atmosphere and no wind, so any pollution more or less stays exactly where it is, absent some effort to move it.[76] This illustrates the way in which the bundle of sticks is constantly morphing and changing depending on the property and the individual and how likely it is that we will need to be flexible in our interpretation of property rights in space.

C. Relational Aspects of Property

This Section is dedicated to a doctrine called "social constructivism," first put forth by Kevin Gray in 1991.[77] Essentially, it comports with Blackstone and Hohfeld on the fundamentals but diverges by positing that trying to pin down property rights with any specificity is futile because, in the end, it is dependent on shifting societal mores, norms, and technological innovations;[78] put another way, property "is a vacant concept—oddly enough rather like thin air."[79]

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71. The bundle of rights approach has been accused of lacking cohesiveness—a "'laundry list' of substantive rights with limitless permutations." It purports to delineate property but instead merely abstracts any such distinction. *Id.* at 499; *see also* Jane B. Baron, *Rescuing the Bundle of Rights Metaphor in Property Law*, 82 U. CINCINNATI L. REV. 57, 63 (2013).

72. On the other hand, some view the flexibility of the bundle of sticks approach as its most crucial asset. The differences between a computer, a coffee cup, and a horse are significant, and the only definitional approach that is flexible enough to grapple with those difference is the bundle of sticks. Anderson, *supra* note 20, at 499.

73. *See* John G. Sprankling, *The Emergence of International Property Law*, 90 N.C. L. REV. 461, 499–500 (2012).

74. For instance, a person owes a duty (responsibility) of care towards those persons that an individual invites on his or her land. RESTATEMENT (THIRD) OF TORTS § 51 (AM. L. INST. 2013).

75. *See, e.g.*, Pollution Prevention Act of 1990, 42 U.S.C § 13101 (2018).

76. *See generally* Geoffrey A. Landis, *Degradation of the Lunar Vacuum by a Moon Base*, 21 ACTA ASTRONAUTICA 183, 183–87 (1990).

77. Kevin Gray, *Property in Thin Air*, 50 CAMBRIDGE L.J. 252, 299 (1991) ("By lending the support of the state to the assertion of control over access to the benefits of particular resources, the courts have it in their power to create "property." But of critical importance in this definitional process is obviously the care with which the courts determine which resources are recognisably [sic] non-excludable.").

78. Anderson, *supra* note 20, at 499.

79. Gray, *supra* note 77, at 252.

Though we may agree on what property is, what juristic rights look like, and the push and pull between those rights—all of this depends on a society that will legitimate both the rights themselves and the holders of those rights. Throughout history we have seen countless examples of marginalized persons whose property rights were taken or modified in ways that now seem unconscionable but back then were acceptable to those in power. *Johnson v. M'Intosh* is a famous case involving the rights of indigenous peoples who had occupied certain lands for centuries.[80] Therein, Chief Justice Marshall wrote a devastatingly racist opinion in which he gave the Plankishaw Indians the right to occupy their lands, subject to eviction by the government, but did not recognize their ownership.[81] Though this opinion did bestow some important legal rights upon Native Americans,[82] it also gave legal justification to the United States to seize their land and redistribute it as it saw fit.[83] This is one of the purest examples of how a dominant culture's conception of "property" can eclipse those of another culture.

III. COMMON LAW APPROACHES TO PROPERTY RIGHTS

It is important to reiterate at this juncture that the aforementioned ideas are just that: ideas. How they are implemented and adjudicated is another matter entirely. That is the subject of this Part, which will examine several common law approaches to property. If the former Part was about what property rights *are* at a base level, then this Part is about how property rights are *administered*. We look to these approaches to see how the United States and, in some cases, other countries have dealt with property rights in the past, in the hope it will provide some lessons and guiding principles for the United States in the future.

Common property is the first of these, and it takes several forms.[84] We see it all the time in open access areas—in grazing pastures, state parks, and public beaches, to name a few.[85] Another form of common property called the "commons" is owned by multiple private entities and shared amongst all of the owners.[86]

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80. 21 U.S. 543, 543 (1823).

81. *Id.* at 586.

82. Joseph William Singer, *Indian Title: Unraveling the Racial Context of Property Rights, or How to Stop Engaging in Conquest*, 10 ALB. GOV'T L. REV. 1, 5–6 (2017).

83. Eric Kades, *History and Interpretation of the Great Case of* Johnson v. M'Intosh, 19 LAW & HIST. REV. 67, 70 (2001) ("*Johnson v. M'Intosh* was part and parcel of a complex, multifaceted machine of efficient expropriation.").

84. Shi-Ling Hsu, *A Two-Dimensional Framework for Analyzing Property Rights Regimes*, 36 U.C. DAVIS L. REV. 813, 816 (2003).

85. *See id.*

86. Here it is important to note the distinction between the aforementioned "open access" areas and "commons" which is a term that refers to parcels of land owned in part or in whole by a number of different parties, rather than owned or operated by a single (often government) entity but enjoyed by a number of individuals who have no ownership interest in the land. *See id.* at 816–17.

A. Common Pool Resources

The popular and frequently misapplied theory of the "Tragedy of the Commons" illustrates how public land can be abused if not regulated properly.[87] The classic illustration goes like this: if a group of herdsmen are grazing on public land, then there is an incentive for each of them to add to their herd to maximize profit, because mathematically they receive +1 profit for each cow but they only feel -0.1 of the negative effect of overgrazing.[88] However, because *everybody* is incentivized to add to their herd, they will deplete the resources over time rather quickly.[89] Put another way, "no individual . . . will restrict his effort or rate of output unless all others take the same measures, for, to the individual, restraint means loss of harvest [and] not deferment."[90] This theory points to the inherently shortsighted nature of users of commonly owned land and supports the idea that a completely unregulated commons is not a viable framework in situations where resources are scarce or in competition.[91] Therefore, the solutions that proponents of this theory usually propose are either regulatory agencies or divvying parcels up into discrete units for sale.[92]

But economic theorist Elinor Ostrom posited that the "tragedy" of the commons is only one potential outcome and the solution is not necessarily regulation or private sale.[93] Another solution to the problem is the Common Pool Resource ("CPR") approach, which eschews any right of exclusion in preference of shared use of public lands and the resources therein.[94] She argues that "a legitimate alternative" to these solutions would be a "decentralized, polycentric legal order[]."[95] "In polycentric law, there are multiple providers of law within a given area," and the individuals using the land "may choose which" provider to adhere to.[96] When disputes arise over land, if laws conflict, then bargaining will commence between the parties.[97] The point then is not so much that there is one single rule of law for a given situation but that there are laws at all, rather than a free-for-all. Moreover, Ostrom advocates for a less pessimistic view of humanity—people have, and will continue to, come up with novel and nontraditional solutions to problems

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87. *See generally* Garrett Hardin, *The Tragedy of the Commons*, 162 SCIENCE 1243 (1968).

88. *See id.* at 1244.

89. *See id.*

90. Harry N. Scheiber, *The "Commons" Discourse on Marine Fisheries Resources: Another Antecedent to Hardin's "Tragedy,"* 19 THEORETICAL INQUIRIES L. 489, 499 (2018) (quoting FRANCIS T. CHRISTY JR. & ANTHONY SCOTT, THE COMMON WEALTH IN OCEAN FISHERIES: SOME PROBLEMS OF GROWTH AND ECONOMIC ALLOCATION 219–21 (1965)).

91. *See* Hardin, *supra* note 87, at 1248.

92. *See* Jason Brennan, *Elinor Ostrom, Governing the Commons*, *in* THE OXFORD HANDBOOK OF CLASSICS IN CONTEMPORARY POLITICAL THEORY 4 (Jacob T. Levy ed., 2015).

93. *See id.* at 2.

94. *See* Carol Rose, *Surprising Commons*, 2014 BYU L. REV. 1257, 1274 (2017).

95. Brennan, *supra* note 92, at 3.

96. *See id.*

97. *See id.*

of scarcity when faced with otherwise disastrous consequences.[98] CPRs have often worked without even a hint of so-called tragedy, and Ostrom gives many such examples throughout history.[99]

One of the hallmarks of successful CPRs is that those participating have a say in the rules.[100] This allows for flexibility and a sense of democracy that is lacking where government agencies or regulators are involved.[101] Another characteristic is graduated sanctions for deviation from the rules.[102] This means that those who break the rules should be punished but should also be allowed to rehabilitate.[103] Finally, these CPR systems tend to work best where there is no interference from governments and the owners are left to adjudicate their own disputes and discipline their members as they see fit.[104]

The Moon provides an ideal proving ground for CPRs. There is, at this time, no government to speak of, meaning no interference into the inner workings of CPRs. Further, while the Artemis accords contemplate certain small sovereign zones on the moon, CPRs need not exist inside of these, and there is currently nothing to suggest they would be regulated by any government. As such, American companies could conceivably create their own CPRs with their own rules to deal with the problems of scarcity and competition.[105]

However, one particular problem with CPRs is that they are, in a sense, *defined* by their flexibility.[106] As with the bundle of sticks approach, this can be a good thing. But it also means that what works for one CPR in one particular region will not likely work elsewhere because each CPR is the product of its unique environment—that is, a CPR often comes about in an organic and piecemeal fashion, with rules and policies arising as responses to very specific problems in the community.[107] In other words, CPRs do not provide an easily duplicable blueprint. Moreover, economists and theorists do not like CPRs because it is hard to extract any wisdom from them—they cannot take a successful approach and apply it elsewhere.[108] Simply put, they are not prescriptive. Much like discovering a new

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98. *See id.* at 6. Ostrom has many such examples, the most famous of which involves a medieval Swiss village. *Id.* In the summer, the villagers "grazed their cattle on" common pastures. *Id.* At the end of the summer, "[c]heese was distributed to the villagers in proportion to the number of cows they had sent to the communal summer pasture." *Id.* Naturally, this creates the perfect conditions for Hardin's "tragedy," as it incentivizes each villager to send as many cows as they can to the pasture. *See id.* But instead the villagers came up with a simple and effective solution to this potential problem: each villager could only graze as many cows on the pasture as they could afford to feed through the winter from their private grain supply. *Id.* Thus, the added costs of feeding the cow in the winter outweighed the benefit of extra cheese in the fall. *Id.* at 6.

99. *Id.* at 6.

100. *Id.* at 7.

101. *See id.*

102. *See id.*

103. *See id.*

104. *See id.*

105. *See infra* Section III.B (discussing self-regulatory organizations).

106. *See* Brennan, *supra* note 92, at 7.

107. *Id.*

108. *See id.*

species, social scientists happen upon them in their native habitats and marvel at their ingenuity and uniqueness. In many ways, Ostrom argues that when small groups of individuals engage in anarchic experiments, they often create a system of rules and penalties through trial-and-error that works very well for their purposes.[109]

So, what about the Moon? It could be said that we are starting with the antithesis of what Ostrom speaks of—there are no indigenous or native peoples on the Moon who have evolved a set of rules and regulations to govern their land. And there likely will not be until corporations and governments first establish an infrastructure—and even then, maybe never.[110]

The riskier it is, the more likely it may be to see only the corporate juggernauts (and perhaps government organizations like NASA, if they are properly funded) venture to the Moon. Smaller startups cannot or likely will not be willing to shoulder such a catastrophically huge risk. The possibilities of this are frightening: the riskier and more anarchic the Moon is, the likelier we may be to cede lawmaking to large corporations whose self-enrichment is their primary driving force. Unlike the early gold rushes, where a person could strike out into the wilderness with nothing to their name but a pickaxe, the Moon would be gated so that only the ultra-wealthy would have access to its riches. Such a framework is decidedly undemocratic and does not even come close to respecting the Heritage of All Mankind spirit.

Finally, Ostrom's solutions to CPR problems are demonstrably not always ideal from a market efficiency standpoint.[111] She is largely unconcerned with efficiency, believing instead that if a CPR regime generally works and has been implemented successfully, then it is sufficient.[112] That is to say, sometimes privatization or government control would result in a more equitable and efficient framework, while also allowing for flexibility and growth.[113]

There is also the possibility that perhaps, if the Moon is as bountiful as many believe it is, there will be no real problem of scarcity, and therefore there will be no "tragedy" to speak of. While this is certainly plausible in the beginning, history is full of examples of humans being surprised to learn that they have suddenly depleted or destroyed some resource that hitherto seemed limitless.[114] Even now,

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109. *See id.*

110. We simply do not know if humans can survive in the atmosphere of the Moon without major health problems—long-term exposure to the partial gravity of the Moon has never been attempted. Furthermore, there is deadly radiation that must be blocked and pervasive Moondust that wreaks havoc on everything from machinery to spacesuits to human tissues. The latter two problems present major engineering challenges, but the former is an unknown with no potential solution. In short, there may quite simply never be a permanent human presence on the Moon. This of course does not mean there won't be industry, science, or even tourism, but it does mean that there may not be any civilization or society as we know it. *See* Elie Dolgin, *Moondust, Radiation, and Low Gravity: The Health Risks of Living on the Moon*, IEEE SPECTRUM (June 27, 2019), https://spectrum.ieee.org/aerospace/space-flight/Moondust-radiation-and-low-gravity-the-health-risks-of-living-on-the-Moon.

111. *See* Brennan, *supra* note 92, at 10.

112. *See id.*

113. *See id.*

114. Rose, *supra* note 94, at 1260–62.

climate change—one of the reasons given for attempting to colonize other celestial bodies in the first place—surprises us on a regular basis.[115] What makes us think the Moon will be any different?

Furthermore, CPRs have a few things in common. First, they limit access to their resources to those within their communities.[116] Second, transportation of resources in and out of the regime is difficult, so that group membership is kept stable.[117] Third, the rules and conventions of the group are usually very complex, which prevents easy entrance and exit.[118] Fourth, the rewards and penalties (besides access to the resource in question) are likely to be largely indirect—prestige, disapproval, or shunning.[119]

Initially, it is difficult to see how intentionally creating a CPR-like system would work on the Moon. Though early access would be potentially limited due to risk and the necessity to have a massive bankroll, that would be a byproduct not a goal. Limiting access is the last thing we would want to perpetuate because access to the market is key in making Moon ventures viable—why else would private entities want to do it? And while transfer and movement might certainly not be easy at first, the goal would be to make it easier as technology advanced. Furthermore, it would seem to behoove us to have both a statutory and common law regime that is as understandable and as simple as possible. Could we see a CPR on the Moon once colonization begins? It is certainly possible, and it will be fascinating to watch how new societies—which has been defined as a "cooperative venture for mutual advantage"—develop in different ways.[120]

In sum, while we may learn something from the CPR model—namely that in small communities it may be preferable to allow for experimentation and self-government—it is unlikely to be a sustainable model writ large, and it is unclear how one would even go about intentionally creating such a structure.

And yet, there is potential for a commons approach in a more general sense. One element found in many commons, including CPRs, is communal use of resources without the necessity for exclusion or alienation of actual parcels of land. Such an approach could work well on the Moon, where scarcity might not be a problem in the foreseeable future, but certain areas may have better access to resources than others. The problem to keep in mind, which might be solved by proper regulation, is the "surprise of the commons," wherein we learn that a hitherto

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115. Rose gives many examples of such surprises, but the climate change example is perhaps the most salient in these times. On an individual level, any single polluting actor is only negligibly responsible for carbon emissions, but taken together, the effect is devastating on the environment. Similar are examples of overfishing or ocean pollution. In all of these instances, the net effect of these individually inconsequential actions will likely lead to tragedy on a massive scale—the very resources being exploited will be obliterated and humanity will be threatened. Yet, on an individual level, these actors are incentivized by short-term profits to continue their irresponsibly destructive behavior. *See id.* at 1262–63.

116. *Id.* at 1276.

117. *Id.*

118. *Id.*

119. *Id.*

120. JOHN RAWLS, A THEORY OF JUSTICE 84 (Otfried Höffe ed., 1971).

"unlimited" resource is found to be quite decidedly limited.[121] The "open access" or "tragedy" approach to the commons has been proven in many cases to be particularly susceptible to creating that scenario.[122] Finally, let us look to an unlikely regulatory framework of the commons that has enjoyed longstanding success in the United States: the Law of the Range.

B. Law of the Range

The Law of the Range, created by the Taylor Grazing Act, took a decidedly different approach to the commons from CPRs; namely, it got rid of them.[123] Areas that used to be "commons" were taken over by the Bureau of Land Management ("BLM") and turned into "public property."[124] Anybody who wished to use this land needed to obtain a permit from the BLM.[125] The land would be open to many uses including "outdoor recreation, range, mineral, and timber production, watershed and wildlife habitat protection, and promotion of scenic, scientific and historic values."[126] Yet there could be no privatization of individual parcels, no alienation, and no zoning. Mining, grazing, recreation—all might (and often did) coexist on the same land.[127]

In many ways, the Taylor Grazing Act was a response to the early notions of the wild-west cowboy economy and unfettered exploitation of natural resources.[128] Or, to put it in terms we have already explored: it was a preemptive response to the tragedy of the commons.[129] The BLM dispensed permits and monitored the range—if grazing exceeded the carrying capacity, the BLM could suspend or revoke the permit and allow the land to revitalize itself for however long was necessary before issuing more.[130] It could also require the implementation of certain practices, such as a pasture rotation system to lessen the impact on any one pasture.[131] Leases and permits carried with them different rights in relation to various individuals, be they miners, fisherman, grazers, and so forth.[132] But they were not alienable, meaning nobody owned them in fee simple, and the BLM could revoke or redistribute permits and leases as it saw fit.[133]

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121. *See* Rose, *supra* note 94, at 1260.

122. *See id.* at 1260–62.

123. *See* John S. Harbison, *Hohfeld and Herefords: The Concept of Property and the Law of the Range*, 22 N.M. L. REV. 459, 467 (1992).

124. *Id.* at 469.

125. *Id.*

126. *Id.* at 463.

127. *Id.* at 465–66 ("The claims of permittees to exclude others are far from absolute. In fact, these rights vary according to the identity of the person the permittee might wish to exclude.").

128. *See id.* at 467.

129. The enforcement of the legislation by the BLM has been a decidedly mixed bag, meaning the overall goal of preventing such a "tragedy" has not happened, but it has allowed the BLM to rehabilitate and "recharge" areas that have been over-exploited or depleted. *See infra* notes 145–47.

130. Harbison, *supra* note 123, at 472.

131. *Id.*

132. *Id.* at 463–65.

133. *See id.* at 459–60.

Examining these multiple use permits lends itself particularly well to a Hohfeldian analysis.[134] Think of a permit as a bundle of sticks—each one contains a right to occupancy and a right to exclude, but it also carries responsibilities as well. First, there are responsibilities to the BLM: to pay for the permit and not to exceed the carrying capacity of the allocated parcels, which is monitored by the BLM.[135] Second, there are responsibilities towards the licensee's neighbors: for instance, not to allow one's cattle to trespass on their grazing parcels or interfere with their operations.[136] These multiple use permits are also an example of social constructivism in several ways.[137] First, they are dependent on an overarching entity that decides who does and does not get permits.[138] Second, they are relational—they allocate property rights to individuals, but they acknowledge that those property rights are in relation to others on the land.[139] In fact, it has been said that, while "*all* property rights are relational," multiple use permits are "more relational than others."[140]

Furthermore, a group allotment, where multiple people use the same parcel or allotment of parcels, might not grant rights of exclusion between those who are licensed to use the parcel. However, it *would* grant rights of exclusion to the licensed users of the lease against interlopers from neighboring parcels or from outside of BLM land.[141]

The Taylor Grazing Act is still in effect today.[142] It remains a promising framework for dealing with situations in which multiple entities wish to use large open swaths of land for a variety of uses.[143] It takes into consideration problems of scarcity and overuse, and it provides a system of checks and balances to correct for them. It should be noted that implementation of the Act by the BLM has not always been excellent.[144] Due to mismanagement, it has not been particularly successful in restoring overgrazed lands, nor has it completely solved the problem of continued overgrazing.[145] However, this has more to do with the mismanagement of the BLM than it does the Grazing Act, which would likely be more successful if more effectively managed.[146] And one can only speculate as to how much worse things would be now if it were not in effect. Furthermore, it has provided a system of "weak" property rights for grazers to adjudicate disputes.[147]

This begs the question: could it be used on the Moon? The similarities are not hard to see. Superficially, both the Great Plains and grasslands, as well as the

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134. *See supra* Section II.B.
135. *See* Harbison, *supra* note 123, at 470–75.
136. *See id.* at 477.
137. *See supra* Section II.C.
138. Harbison, *supra* note 123, at 462.
139. *Id.* at 464.
140. *Id.* (emphasis added).
141. *Id.* at 477.
142. 43 U.S.C. § 315 (2018).
143. *See* Harbison, *supra* note 123, at 470.
144. *Id.* at 469–70.
145. *Id.*
146. *Id.* at 470.
147. *Id.* at 474.

Moon, contain vast expanses of flatland, punctuated by ranges of mountains. This geography encompasses a variety of different resources, and there would be many parties with multiple potential uses for it in mind.

We have already seen one such use: scientific research. Several Moon missions, both manned and unmanned, have made it to the Moon,[148] and it is unlikely that scientists will want to discontinue their studies. Mining is the next potential use that we may encounter, and recreation may not be far behind it.[149]

So why not appoint a U.S. agency to oversee these lands? One potential hurdle is that this would likely be construed by some as creating sovereignty on the Moon. Therefore, private industry should create a Self-Regulatory Organization ("SRO") to allocate permits and leases to use various areas of the Moon. The model would be a (hopefully better managed) Bureau of Land Management, and the founding document would be modeled after the Taylor Grazing Act.

Much like SROs in other arenas (for instance, the U.S. stock market),[150] disputes arising under the regulation of this SRO could be handled first and foremost by the SRO itself, but it could also be appealed to U.S. courts.[151] In this way, the United States would not have any cognizable property interest on the Moon, nor would it be the main source of adjudication or regulatory enforcement. It would instead lend legal legitimacy to claims and disputes, and could step in as final arbiter where absolutely necessary. This, of course, creates a sort of "quasi-sovereignty," but one could argue that some form of sovereignty is inevitable if we are going to have laws on the Moon—indeed, some would argue that the existence of property itself *depends* on recognition by a national government.[152]

Another sensible approach to the matter might be to amend the OST to allow for such sovereign regulation. If it is true that the OST was intended to be permissive towards private property rights (as assumed by the Space Act and Artemis Accords), then such an amendment would be in line with the actual intent of the document, as well as that of the Space Act.[153] What it would take to implement such an amendment is a subject beyond the scope of this Note, but it would likely be no small endeavor, given the political and international socioeconomic interests of different world powers with wildly varying timelines for space exploration. And yet, even if it be purely aspirational, it is something to work towards because it would create unity and goodwill between the United States and the signatories to the

148. *Moon Missions*, NASA SCI.: EARTH'S MOON, https://moon.nasa.gov/exploration/moon-missions/ (last visited Jan. 24, 2020).

149. We may soon see Blue Origin's "Blue Moon" lander dropping off groups of tourists to take rover rides around the Apollo crater. *See Meet Blue Moon*, BLUE ORIGIN, https://www.blueorigin.com/blue-moon/ (last visited Nov. 17, 2019).

150. MARC I. STEINBERG, SECURITIES REGULATION 6 (7th ed. 2017).

151. *See id.*

152. John G. Sprankling, *The Emergence of International Property Law*, 90 N.C. L. REV. 461, 464 (2012).

153. *But see* Taylor, *supra* note 18, at 677.

OST, where currently there is division and no small amount of concern about the Space Act.[154]

Regardless of international relations, lunar property interests could take the form of multiple use permits. As previously discussed, such permits were initially created to deal with highly complex relational property rights situations on open grasslands. The Moon is likely to be the most complicated version of this we have ever seen.

C. Mining Law and the Doctrine of Pedis Possessio

It is clear that much of the interest in the Moon has to do with extracting the many resources beneath its surface.[155] As a result, mining is likely to be a major part of any potential lunar economy. However, before one can mine, one must first prospect.[156] But what are the rules pertaining to prospecting? The following is a brief overview of the Mining Law of 1872 ("Mining Law"), the concept of *pedis possessio*, and how each relates to the Moon.

Early mining law was written with a mind towards the lone prospector, striking out on a mule into the wilderness and literally breaking ground with a single pickaxe, thus establishing a right to a claim.[157] At that point in time, resources on Earth were presumed to be practically inexhaustible.[158] The Mining Law allowed any person who happened upon resources and made an effort to develop them to stake a claim therein.[159] There was a presumption that any federal lands were open to this purpose unless they had been expressly restricted for mining purposes by Congress.[160] This presumption still exists, though subsequent legislation has resulted in a greater number of restricted areas and a smaller scope of minerals.[161]

The Mining Law still governs "hard-rock mining" here on Earth.[162] Under the Mining Law, miners can coexist in BLM grazing land, which is somewhat problematic because the purpose of mining and the purpose of grazing are not

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154. Such concerns include the worry that legislation is being pushed through too quickly, that embracing the philosophy of the Space Act will lead to land grabs whereby only developed countries will have access to said land, and that no licensing regime is currently in place. Foster, *supra* note 35, at 422–23. The Artemis Accords represent an incremental step towards international cohesion, but the fact that there are only eight signatories means that for the majority of the world, these fears are far from assuaged (and may even be exacerbated by the emboldening nature of the Accords, taking, as it does, such a permissive view of the non-appropriation clause of the OST). For a discussion of the impact of the Accords, see *supra* Section I.C.

155. *See* Ioannou, *supra* note 5.

156. *Prospecting and Exploration*, ENCYC. BRITANNICA, https://www.britannica.com/technology/mining/Prospecting-and-exploration (last visited Nov. 23, 2020).

157. Laura S. Ziemer, *The 1872 Mining Law and the 20th Century Collide: A Rediscovery of Limits on Mining Rights in Wilderness Areas and National Forests*, 28 ENV'T L. 145, 146 (1998).

158. *Id.*

159. *Id.*

160. *Id.*

161. *See id.* at 147.

162. *Id.*

particularly compatible—mineshafts endanger livestock, explosions scare them, shade trees may be cut down, and so forth.[163] Even so, the Mining Law and Taylor Grazing Act have coexisted side by side, if not in harmony, then at least in a state of relative compatibility.[164]

If a prospector today stakes a claim on public-domain land, he is entitled under § 26 of the Mining Law to certain rights which are defined in part as:

> [an] exclusive right of possession and enjoyment of all the surface included within the lines of their locations, and of all veins, lodes, and ledges throughout the entire depth . . . [b]ut their right of possession to such outside parts of such veins or ledges shall be confined to such portions thereof as lie between vertical planes drawn downward as above described.[165]

In other words, a miner has a right to enjoy and possess what lies between the boundaries of her claim, both horizontally and vertically. This description notably leaves out any right of alienation or the ability for a miner to follow lodes or veins outside the margins of her own claim. The right to possess and enjoy does not necessarily give rise to the right of alienation, as was previously discussed in the context of the Native Americans in the *M'Intosh* case.[166] Of course, one could imagine a number of Coasean bargaining solutions[167] to this problem in which a party transfers the right to possess and enjoy a parcel for a determined sum while also promising that they will not themselves enter upon or attempt to exploit said parcel. This might create a level of "ad hoc alienability" sufficient to allow some level of real estate transference for mining purposes.

It is worth mentioning that the actual act of staking a claim is a complex and multifaceted area of the law. *Pedis possessio* is an oft-used, but little discussed, concept that attempts to solve problems such as: "What constitutes occupancy of a claim?" and "What constitutes 'actively working' said claim?"[168] It was initially developed in ancient Rome, and in its early (and less developed) form, it meant that whosoever entered onto public land in good faith could lay claim to it as long as they maintained *continuous exclusive occupancy* and worked towards discovery of minerals.[169] In reality though, it means quite literally "foothold;" this is a misnomer. While it does require literal boots on the ground, it also requires the occupant to be actively working towards the discovery of minerals.[170] Thus, the emphasis is on the activity being performed, rather than mere occupation.

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163. *See* Harbison, *supra* note 123, at 488, 493.

164. *Id.* at 474.

165. 30 U.S.C. § 26 (2018); *see also* Ziemer, *supra* note 157, at 147.

166. *See supra* notes 81–84 and accompanying text.

167. The Coase Theorem "holds that when there are conflicting property right[s], bargaining between the parties involved will lead to an efficient outcome regardless of which party is ultimately awarded the property rights as long as the transaction costs associated with bargaining are negligible." Prateek Agarwal, *The Coase Theorem*, INTELLIGENT ECONOMIST (Aug. 8, 2017), https://www.intelligenteconomist.com/the-coase-theorem/.

168. *See* Foster, *supra* note 35, at 418.

169. *Id.* at 417–18.

170. *Id.* at 418.

IV. APPLICATION

The preceding Sections provide what could prove to be an effective framework for dealing with the transfer of property and the adjudication of property disputes. The following is an application of that framework to a potential scenario that would be almost certain to arise at some point if the Moon should become occupied by private entities. Let us return now to the fictional example of Planetary Express, a burgeoning new corporate entity that has just begun an exciting foray into lunar commerce with the mining of Helium-3.[171] What might that look like initially under the various frameworks discussed above? What about after 25 years? 100? First, consider what might happen in a true gold rush, no rules, no powers, no sovereignties situation.

If Planetary Express were the first entity to reach the Moon with the capability to effectively mine resources, it might bask in a period of unfettered access to the riches contained on the Moon. With the Space Act on its side, the United States might enjoy the potentially immense boom in the economy resulting from the mining. Moreover, environmentalists would be excited to begin the transition to the arguably far superior fusion power,[172] which would potentially put us on a path towards "solving" global warming. It would also potentially create huge numbers of jobs and line the pockets of the entrepreneurs who got on board with lunar mining from the start.[173]

Planetary Express, aided by the language of the Space Act, believes that it has rights to stake a claim (referred to herein as Moonacre) for the resources its miners (or perhaps mining robots) extract from the ground. It is unclear whether it owns the actual ground itself, but for the time being it doesn't particularly care—there is nobody there to effectively challenge its supremacy, and it is making too much money to get bogged down in the theoretical. Plus, it undoubtedly owns the actual mining structures it has erected, and it has the right to kick out anybody who tries to enter those structures. Thus, it effectively has a sort of ad hoc right of exclusion wherever it puts its mining rigs—assuming another entity does not already own or occupy those. The only thing it does *not* have is a right of alienation, but there is nobody around for Planetary Express to sell its land to, and even if it could, why would it? Helium-3 is the hottest commodity on the market right now, and Planetary Express is the only one who can get it. But this could no doubt change. An early monopoly might eventually give way to an increasingly more competitive market. As this happens, the value of certain parcels might become astronomically high.[174]

Let us say that, for whatever reason, Planetary Express has reached a point where it no longer has enough manpower or equipment to work Moonacre, and it wishes to transfer those rights to another entity for a profit. Or, perhaps, another

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171. *See supra* Section II.C.

172. *See supra* Introduction.

173. *See id.*

174. *See generally* Ronald H. Coase, *The Problem of Social Cost*, 56 J.L. & ECON. 837 (1960) (discussing the relative economic principles of land valuation in terms of cultivation or sale).

entity is simply willing to pay such a high price for one of their parcels that they can't say no. What could it do? Though it does not have a right of alienation, it does have the right for its miners to work Moonacre and to occupy the structures it has built upon it, and it has ownership in fee simple of the structures themselves. However, much like with the BLM, the land itself is not alienable. This may sound like a distinction without a difference, but it is at least an argument that such a transfer would not carry with it any implication of ownership of the land. In this way, it would resemble BLM-managed land on Earth. Let's look at how such a transfer might play out.

First, Planetary Express finds a buyer; let's call them Mom's Friendly Robot Company ("Mom"). Next, the companies have their lawyers draft a valid contract—not of *sale*, but of transference of the right of occupancy of Moonacre, as the case may be (the exact instrument is not particularly important). Thus, the use of land has been exchanged for currency and the deal is done. No entity owns the land, but multiple parties are able to use and profit from it.

This example illustrates the flexibility of the Hohfeldian bundles of rights. Here, simply saying "Planetary Express transfers Claim *X* to Mom" would not only be legally insufficient to convey title, but it would barely begin to describe what has occurred, which is a bargain for several very particular rights in the bundle—namely, the rights to possession, enjoyment, and exclusion.

It bears mentioning again that the workability of all of this is highly contingent on regulations and enforcement mechanisms. Here we again touch upon Gray's "essentialist" view in that all of our fancy rules about how to apportion property mean perilously little if we do not have a way of enforcing and agreeing to these rules.[175] Further, we need a society that gives power to that enforcement mechanism by way of acknowledgement of its authority. In the United States, one of those entities is the BLM. On the Moon, it would be something different, but perhaps, as previously discussed, it need not be *that* different.

Continuing the above hypothetical, let us imagine that a dispute arises between Mom and Planetary Express. Such a dispute could be a typical property dispute, like a mistaken-boundary claim. Who would adjudicate this dispute? Several options exist. First, the contract between the two companies could have an arbitration clause requiring an Alternative Dispute Resolution ("ADR").[176] There is already such a thing as "international arbitration," in which the adjudicator is a nongovernmental, nonsovereign entity made up of individuals from various nations.[177] It is not hard to imagine how this could be adapted for Moon purposes. Second, the parties might be subject to the oversight of an SRO (instead of, or in addition to, ADR) which, again, could be a nonsovereign entity that enforces a set of rules agreed to by the major industry players themselves, perhaps with some

175. *See supra* Part II.C.

176. *See generally Alternative Dispute Resolution*, CORNELL LEGAL INFO. INST., https://www.law.cornell.edu/wex/alternative_dispute_resolution (last updated June 8, 2017).

177. *What Is International Arbitration?*, INT'L ARB. INFO., https://www.international-arbitration-attorney.com/what-is-international-arbitration/ (last visited Nov. 18, 2020).

guidance by the U.S. government.[178] And third, if both of the above options failed to resolve a claim satisfactorily, in certain circumstances the entities might be allowed to appeal to the federal or state court systems. In such a situation, the court would consider the approaches based on the aforementioned common law principles and relevant Lunar Mining or Lunar Property Statutes, which would be informed initially by the Taylor Grazing Act and the Mining law of 1872.[179] This sort of governmental intervention could be described as "sovereignty-lite" because it would not confer any real property interest in the U.S. government, thus at least minimizing the problematic nature of sovereignty as per the OST.

CONCLUSION

Obviously, there is no catch-all common-law property paradigm for outer space. Much as here on Earth, there are a wide-ranging variety of issues that come into play with regards to property rights, especially when it comes to mining and natural resources.

This Note has considered a number of intriguing ideas and doctrines that could be put together to form a workable paradigm for the early stages of prospecting on the Moon. These would hopefully be flexible enough to give way to more permanent property rights doctrines as we move into becoming a more extraterrestrial society. Most of the ideas proposed in this Note are built on the bedrock of common property or "public lands," or—in slightly more evocative parlance—"wilderness." This word conjures up romantic images of vast expanses of untamed land, much like our forebears encountered during the early days of the Gold Rush.

Though there are myriad differences between the Space Race and the Gold Rush, the similarities are also significant.[180] Chief among them is the reality that the race has begun, and it is now incumbent upon lawmakers to catch up.[181] In the vacuum of current space law, private entities are unlikely to politely wait for legal scholars and politicians to craft a legal framework that is perfectly suited for the Moon.[182]

The framework proposed herein would allow for industrial growth during this gold-rush-like era, while also at least partially reconciling the Space Act with the OST's prohibition on sovereignty. While it would not totally be in line with that principle, it would keep sovereignty to an absolute minimum by providing that disputes first be adjudicated by a Self-Regulatory Organization, with the U.S. federal government or state governments providing a venue for appeals. Likewise, it would not give ownership of any parcels of land or any resources to the U.S. government. Instead, it would give ownership of resources to those who gathered them.

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178. *See* STEINBERG, *supra* note 149, at 6.

179. 30 U.S.C. §§ 21–54 (2018).

180. *See* Foster, *supra* note 35, at 409.

181. Michael Brooks, *Who Owns the Moon? We're Just Going to Have to Get up There and Find out*, NEW STATESMAN (Feb. 25, 2014), https://www.newstatesman.com/sci-tech/2014/02/who-owns-Moon-were-just-going-have-get-there-and-find-out.

182. *Id.*

The proposed approach, grounded in hypotheticals as it is, might very well not work in practice. But, in the early days of Moon prospecting, it (or something like it) might be the best way to spur commercial Moon endeavors, settle disputes among domestic entities, and lead to the development of a body of lunar law.