The Fragmentation of Property Rights in the Law of Outer Space

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Neither customary international law nor existing outer space treaties provide clear answers as to whether property rights can exist in outer space. In this Article, I will argue that under international law, there exists a fragmented system of property rights, namely, a right to use outer space with a limited right of exclusion. This interpretation is supported by an analysis of Roman private law and common law philosophical theories of property. However, I argue that this fragmented system of property rights is insufficient to deal with the problems of scarcity and unequal distribution of technology that arise from the unique context of outer space.

Keywords: Space law, property rights, Roman law, territorial sovereignty, national appropriation

1 INTRODUCTION

For thousands of years, philosophers have puzzled over what is meant by ‘property’ and whether a clear system for allocating and enforcing property rights is an essential precondition to a functioning society. More recently, the question has turned to place greater emphasis on who is entitled to have property rights over specified things – the individual, the State, or perhaps humanity as a whole? Earlier this year, the United States’ National Aeronautics and Space Administration (NASA) released a set of agreements that will govern the way that State Signatories (i.e., States participating in the US’ Artemis Program) are to explore the Moon, called the Artemis Accords. One of those principles is the extraction and utilization of space resources on the Moon, Mars and other celestial bodies ‘conducted under the auspices of the Outer Space Treaty, with a specific emphasis on Articles II, VI and XI’. Subsequently, the text of the Artemis Accords was released with eight State Signatories. The Signatories affirmed the possibility of

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2 Ibid., at 10.

space resource extraction and utilization in international law. The Outer Space Treaty refers to the Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies, which provides the foundation for the international law governing outer space. However, due to the fact that technology had not advanced far enough to contemplate the issue, there is very little clarity on the question of who is entitled to have property rights over celestial bodies in outer space, and so extract or utilize space resources.

Professor Bin Cheng introduced the traditional tripartite division of territory in international law as it applied to outer space, dividing the world into national territory, *res nullius*, and *res extra commercium*, and demonstrated how the divisions applied to territory in outer space following the entry into force of the Outer Space Treaty. To the tripartite division, Cheng added a fourth concept, *res communis omnium* or the common heritage of mankind, in response to the entry into force of the Agreement Governing the Activities of States on the Moon and other Celestial Bodies (Moon Agreement), although the application of the fourth concept is controversial. Each division represents a different approach to territorial sovereignty and national appropriation. Debate over which concept applies to outer space and celestial bodies is likely to become heated as States develop the technology to make those once inhospitable and unreachable places hospitable and reachable. The natural resources that might be found in space or on celestial bodies could be extremely valuable and useful for a variety of purposes on Earth and in space. The purpose of this Article is to examine how traditional theories of property interact with Cheng’s divisions to fragment traditional understandings of private property. Cheng’s position is that the exploitation of natural resources is implicitly part of the freedom of exploration and use of outer space. In support of Cheng’s position, I will argue that far from prohibiting private property, the existing international law framework creates a unique bundle of rights and
obligations that apply to property in space. However, I will also argue that this bundle is inadequate precisely because of the fragmentation of property rights.

In section 2, I will analyse the Roman law roots of Cheng’s divisions of territory, which has not been previously examined, and demonstrate how our modern concepts have evolved past their Roman roots to form the foundation of property rights in outer space. I will then briefly outline Cheng’s tripartite division and the current state of the law deriving from the Outer Space Treaty and the Moon Agreement. It is clear that there is a prohibition against national appropriation (what Cheng calls res extra commercium), but there it is unlikely that any concept of res communis exists to impose a kind of collective sovereignty over space resources. In section 3, I will compare the existing framework for property in outer space with some of the seminal theories of property rights that have been developed in the context of earthly resources. The essential characteristics of property have variously been put forward by natural law theorists, legal positivists and many others, as being a bundle of rights such as the rights to exclude, use, and alienate. I will conclude that the current system in outer space can sustain a kind of system of property rights, but that the rights are fragmented. Finally, in section 4, I will use the same arguments from section 3 to demonstrate why a fragmented system of property rights is inadequate in light of technological advancements and the inevitable increase in scarcity of resources. I conclude that without a comprehensive property law system, we risk repeating the mistakes of the past, such as over-exploitation of resources and an unequal division of the benefits of space.

2 RES EXTRA COMMERCIUM VS RES COMMUNIS OMNIIUM

2.1 From Roman law …

The concepts that Cheng deploys (that of res nullius, res extra commercium and res communis omnium) all come from the classical Roman classification of things.\(^{10}\) A ‘thing’ (res) simply meant anything that could be the object of a legal right or over which legal rights could be exercised, and thus extended to both physical objects and legal abstractions.\(^{11}\) The Romans classified ‘things’ according to a number of different principles, namely (1) according to the thing’s physical properties, (2)
according to how the thing might be transferred between people and more relevantly (3) according to whether the thing could be the object of private ownership. The law only acted on things as objects; the subjects of legal rights in relation to things could only be exercised by persons who have rights of ownership (dominium). The dominus has complete ownership of all rights over the thing. The dominium could be divided into fragments called servitudes, the most significant being the right to use the thing (usus, jus utendi), the right to obtain profits or to reap the fruits of the thing (fructus, jus fruendi) and the right to consume the thing (abusus, jus abutendi).

Things that could not be the object of private ownership were res extra commercium, literally, things outside commerce. To the extent that res extra commercium were permitted to be used or consumed by individuals, any usage rights were not exclusive to an individual but had to be shared. The sale of res extra commercium was ‘legally impossible’ because ‘[n]o mortal could effectively undertake to transfer or accept possession of a thing of supernatural concern’. Consequently, properly understood, res extra commercium are arguably not res at all, for strictly speaking they could never be the object of private property rights exercisable by individuals. Res extra commercium was in fact a broad category. In Justinian’s Institutes, they are classified into four types (1) things common to all humanity (res communes omnium), (2) things belonging to the State (res publicae), (3) things belonging to a group of people as a body corporate (res universitatis) and (4) things that belonged to no one (res nullius). These categories denote different rights, none of which are exercisable by private individuals. It is notable that the categories are primarily distinguished by the permissible economic uses of the thing. Of these, only res communis and res nullius are relevant to our analysis.

Res communis has perhaps the closest meaning to its modern definition in international law. Res communis referred to things that were held ‘common to all mankind’, so that all people might enjoy them equally. The rights and duties of a person in relation to res communis were freedom of access, freedom of use, and prohibition on appropriation. Justinian gives examples such as ‘the air, running water, the sea, and the shores of the sea’. Res communis are things that no one

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12 Ibid.
15 Melville, supra n. 11, at 217.
17 Sandars, supra n. 14, at 90.
19 Sandars, supra n. 14, at 90.
20 Capurso, supra n. 18, at 4.
21 Sandars, supra n. 14, at 90.
could claim either because of their inherent nature (e.g., reaching the stars was an imposibility), or because the State recognized that the use and benefit of certain resources should be shared in common. The seashore is a particularly interesting example, as Justinian seems to regard it as an exception to other things held in common: the seashore ‘is part of the law of nations … and therefore any person is at liberty to place on it a cottage … for the shores may be said to be the property of no man’. While the seashore is classified as res communis, a person may place a building on it, and have a right of exclusive enjoyment of that building and the shore it was on for as long as that building stood, but only if no other person’s interest was harmed. If the building were later destroyed, the place it occupied on the shore once again became res communis. As I will discuss later in this Article, this peculiarity is analogous to a first in time rule.

Res nullius was used by Justinian to refer to a specific type of thing, namely things that were consecrated, sacred, or otherwise of religious significance. Res nullius was also commonly used to refer to things that were yet to be appropriated by any person, but capable of being appropriated. Res nullius could be appropriated through acts of occupation (occupatio). Examples of res nullius included wild animals or fish, but interestingly did not extend to unoccupied islands. More correctly then, res nullius is not exactly a type of res extra commercium, as they could arguably be in commercium as soon as a person acquired it via occupatio. Justinian’s example of the appropriation of wild animals demonstrates that to convert res nullius into private property requires the person to be the first to capture the wild animal, thereby bringing it into their possession and depriving it of its ‘natural liberty’, with the intention of holding it as property.

Even in this brief description of res at Roman private law, it is possible to see many similarities with the modern conception of appropriation of space resources in international law. For example, modern space law distinguishes between appropriation of land or territory, appropriation of natural resources while in place, and appropriation of natural resources once extracted. Another example is that the rights and duties of a State under the Outer Space Treaty with respect to territory in outer space, specifically, freedom of exploration and use and a prohibition of

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23 Sandars, supra n. 14, at 92.
24 Ibid., at 90–91. So a person could not, e.g., build something that encroached upon another building, or build something that takes up all of the sea shore and blocked all access to the sea.
25 Melville, supra n. 11, at 220.
26 Ibid., at 221.
27 Sandars, supra n. 14, at 94–98.
28 Ibid., at 99–100; Lesaffer, supra n. 10, at 40–41.
29 Sandars, supra n. 14, at 94–95.
national appropriation, are analogous to the bundle of rights and duties associated with res communis.

2.2 To the Law of the Sea

The evolution of the divisions of things at Roman law took a somewhat circuitous route to the modern international law of outer space via the law of the sea. Grotius, writing *Mare liberum* in 1609, provided a seminal argument for the freedom of the seas based on Roman private law.\(^{30}\) Grotius defined the sea as *res nullius* or common property, which was a type of ownership that was ‘universal and indefinite’.\(^{31}\) From this, we can see that Grotius departs from Justinian’s classification of things: what Justinian calls *res communis*, Grotius calls *res nullius*. Instead, Grotius appears to use *res nullius* as an overarching category of things that are owned by no one. Grotius’ *res nullius* encompasses two categories: ‘wild beasts, fish and birds’ that can be made subject to private ownership and things that ‘have been rendered forever exempt from such ownership by unanimous agreement of mankind’, the latter being closer to Justinian’s *res communis*.\(^{32}\) Under Justinian, *res communis* refers to things which are common to all humankind and all persons have the right to use the thing, whereas *res nullius* refers to things which have no owner but is capable of becoming private property. Grotius acknowledges this difference in his treatment of the seashore as opposed to the sea to justify how the Romans treated the two differently:

The sea, on the other hand, differs by nature from the shore, in that the former (save for a very small portion thereof) cannot easily be built upon nor enclosed; and furthermore, even if this were not the case, the sea could hardly be so employed without hindrance to its common use.\(^{33}\)

The ability to fence off or enclose resources on the seashore would become the foundation of Grotius’ argument as to the different treatment of land as opposed to the sea. For example, bodies of water that were easily enclosable, such as lakes, small inlets or streams, Grotius maintains that this was a similar situation to the seashore, being the property of the encloser until the occupation

\(^{30}\) Hugo Grotius, *Mare Liberum* (Robert Feenstra ed., Brill 2009). Grotius made extensive use of Roman civil law in his arguments, quoting from many Roman sources from Cicero and Seneca to Justinian and Virgil to establish a natural law that the sea is to be held in common: ‘for nature does not merely permit, but rather commands, that the sea shall be held in common’ at 65.

\(^{31}\) Ibid., at 49, 53.

\(^{32}\) Ibid., at 63, 65.

\(^{33}\) Ibid., at 67, 69.
On the other hand, the open sea was common property, that is, no one could be excluded from using the thing. As Grotius poetically put it:

The subject of our discussion is the Ocean, which was described in olden times as immense, infinite, the father of created things, and bounded only by the heavens; the Ocean, whose never-failing waters fed not only upon the springs and rivers and seas, according to the ancient belief, but upon the clouds, also, and in a certain measure upon the stars themselves; in fine, that Ocean which encompasses the terrestrial home of mankind with the ebb and flow of its tides, and which cannot be held nor enclosed, being itself the possessor rather than the possessed.

The reason for the difference in treatment is primarily because of the physical nature of the sea as being boundless, constantly in flux and inexhaustible, as well as being significant for life, culture and religion. The sea cannot be occupied or enclosed, so to talk of possession of the sea was meaningless, for this is no physical way to enforce one’s right. As has been widely recognized, Grotius provides many of the foundational principles to the modern law of the sea. Outer space is not dissimilar to the sea, which is why many of the concepts developed in outer space law has as their closest analogy to the international law of the sea. The concept of res nullius has also been used to develop other principles in international law. For example, the doctrine of terra nullius, which was used to justify the acquisition of supposedly unoccupied land by imperial European powers, was developed by analogy from res nullius. Interestingly, res nullius was also used to argue against Spanish colonial occupation of the Americas on the basis that just because the land that had previously been undiscovered to Europeans was not equivalent to land that belonged to nobody, for it was clear that the land was actually inhabited. Accordingly, the legal method for acquiring the land could not be by first acquisition (occupatio) but instead by conquest or agreement.

2.3 To the law of outer space

Once travel into space became feasible, a new system needed to be established to deal with the new situation. Ironically, the new system shares many similarities to the old systems that applied to Rome or to the law of the sea. Cheng introduced the traditional tripartite division of territory in international law, dividing the world into national territory, res nullius, and res extra commercium. In relation to

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34 Ibid., at 71.
36 Ibid., at 81.
38 Ibid., at 24–25.
39 Cheng, supra n. 5.
the fourth division, *res communis*, Cheng argued that no such concept existed at customary international law until the Moon Agreement was concluded.\footnote{Ibid., at 80–81.} Using this framework, I shall analyse each in turn.

Prior to the entry into force of the Outer Space Treaty, outer space (the void between celestial bodies) constitutes *res extra commercium* under customary international law, by which Cheng means territory that is not subject to national appropriation.\footnote{Bin Cheng, *Recent Developments in Air Law*, 9 Current Legal Probs. 208, 215–217 (1956).} That is, it is a thing that anyone can use but no State can claim exclusive possessive rights over. The Justinian concept of *res extra commercium* is quite similar, as it refers to a general category of things that cannot be objects of private property. Outer space, like the sea, seemingly boundless and unable to be enclosed. Celestial bodies, on the other hand, were ‘land’ and as such there was no reason why States could appropriate the land following sufficient acts of occupation.\footnote{Cheng, *supra* n. 5, at 84.} This meant that prior to the Outer Space Treaty, celestial bodies were treated as *res nullius*, in the classical meaning of the term. Like classical Roman law, *res nullius* referred to territory that was not currently owned by any person or State, but States could potentially acquire sovereignty over celestial bodies according to the usual principles of international law.

On its face, the Outer Space Treaty changed international law with respect to celestial bodies. Article II provides:

> Outer space, including the moon and other celestial bodies, is not subject to national appropriation by claim of sovereignty, by means of use or occupation, or by any other means.\footnote{Outer Space Treaty, *supra* n. 4, Art. II.}

The effect of Article II is that both outer space and celestial bodies are declared to be *res extra commercium*. The difference between *res nullius* and *res extra commercium* is that while *res nullius* was susceptible to ownership by sufficient acts of appropriation, *res extra commercium* is not. Instead, *res extra commercium* could not ever be owned, although anyone could use it and the natural resources that were situated on it. Importantly, = the restrictions on ownership of outer space and celestial bodies were only that they were declared to be ‘not subject to national appropriation’. The exploration and use of outer space were explicitly recognized as being rights that all States were able to undertake. Article I provides that:

> Outer space, including the moon and other celestial bodies, shall be free for exploration and use by all States without discrimination of any kind, on a basis of equality and in accordance with international law, and there shall be free access to all areas of celestial bodies.\footnote{Ibid., Art. I.}
Further, Article III contemplates that States will carry on exploration and use of outer space and celestial bodies:

States Parties to the Treaty shall carry on activities in the exploration and use of outer space, including the moon and other celestial bodies, in accordance with international law.\footnote{Ibid., Art. III.}

Importantly, then, the Outer Space Treaty did not prevent States from the use or exploration of outer space or celestial bodies. It only prevented States from claiming national sovereignty over or appropriating the territory. Here, we must be careful not to confuse concepts. Appropriation in the international law sense refers essentially to sovereignty and territorial jurisdiction, while appropriation in the Roman private law sense refers to private property.\footnote{In one of the Outer Space Treaty discussions, the French delegate cautioned the conflation of the two concepts, saying ‘I am thinking in particular of the risks of ambiguity between the principle of non-sovereignty – which falls under public law – and that of non-appropriation, flowing from private law’. Comm. on the Peaceful Uses of Outer Space, Verbatim Rec. of the Forty-Fourth Mtg., U.N. Doc. A/AC.105/PV.44, at 41 (25 Oct. 1966).}

There are similarities though, the rights available to States to freely explore and use of space, with no State being able to exclude any other from accessing outer space are similar to the rights available to individuals in Roman law. These similarities are the reason the same term, \textit{res extra commercium}, is used to refer to both concepts.

2.4 The Moon Agreement and Back Again

\textit{Res communis omnium} has had a much more controversial entry into modern outer space law, also through the law of the sea. Cheng points out that under customary international law, there is no \textit{res communis omnium}.\footnote{Cheng, \textit{supra} n. 5, at 80.} In the discussion of the Outer Space Treaty, many delegates expressed concern with classifying outer space or celestial bodies as \textit{res communis}. For example, the Austrian representative opined that ‘International law … nowhere defined the status of a \textit{res communis omnium}’.\footnote{Comm. on the Peaceful Uses of Outer Space, Summ. Rec. of the Fifth Mtg. of the Legal Subcomm., U.N. Doc. A/AC.105/C.2/SR.5, at 6 (5 June 1962).} The Romanian representative expressed the concern that ‘The concept of \textit{res communis usus} might, if applied to outer space, be used to hinder the use of space for research by any State on the ground that it was common property’.\footnote{Comm. on the Peaceful Uses of Outer Space, Summ. Rec. of the Fourth Mtg. of the Legal Subcomm., U.N. Doc. A/AC.105/C.2/SR.4, at 10 (4 June 1962).} States, particularly the US and the Soviet Union who were the only States capable of space travel, appeared to be reluctant to restrict their own use and exploration of space.\footnote{See comments by the Czechoslovak representative at Comm. on the Peaceful Uses of Outer Space, Verbatim Rec. of the Sixteenth Mtg., U.N. Doc. A/AC.105/PV.16, at 12 (14 Sept. 1962); see also the
By *res communis omnium*, Cheng means territory that is the object of joint sovereignty of all States, meaning that any one State had an effective veto over other States’ the use of things found in space. This concept differs from the similarly named concept at Roman law, which refers to things as being common to all mankind but allowed individuals to use the thing without needing to seek permission from anyone else. The Roman concept is also known as the usufruct because it entitles individuals to two of the servitudes, *usus* (use of the thing) and *fructus* (enjoyment of the profits), but not *abusus* (alienate the thing by total consumption, destruction or transfer). Thus, it is more similar to the modern concept of *res extra commercium*, in the sense that it gives States the rights to use and profit of natural resources as long as there is no national appropriation. For this reason, some scholars prefer to use the term *res communis humanitatis* to distinguish the Moon Agreement sense from the Roman senses. Cocca argues correctly that *res communis omnium* in the Roman sense conferred only a private right on individuals to use the thing; to the extent that the thing was held in common, it was only for the benefit of each individual. In contrast, *res communis humanitatis* would refer to things that were held for the benefit of all humankind. The relevant servitude that sets *res humanitatis* apart from *res omnium* is the sharing of the benefits of using the thing among all States.

The Moon Agreement was the first and only outer space treaty to utilize the concept of *res communis* in its text. Article 11 provides:

The moon and its natural resources are the common heritage of mankind, which finds expression in the provisions of this Agreement, in particular in paragraph 5 of this article.

Paragraph 11 of Article 11 provides that States Parties undertake to establish an international regime to govern the exploitation of natural resources of the moon as such exploitation is about to become feasible. The ‘common heritage of mankind’ echoes the language of the Roman analogous concept as being ‘common to all mankind’. As stated previously, the concept of the ‘common heritage of mankind’ or *res communis* did not have any substantive content at customary international law, and so could really only extend to the bundle of rights and

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duties that the Moon Agreement bestowed on States. These included, among other things, sharing of the benefits of the exploitation of natural resources, freedom of exploration, a duty to provide information on space missions, and of course no national appropriation.

The problem is that the Moon Agreement currently is only ratified by eighteen States, none of which have independent spacefaring capabilities and is therefore considered a failure. Its flaw was most likely its ambition in declaring the Moon as res communis in general and in particular the fact that benefits of natural resources on the Moon were to be shared equally among all States, with special consideration to developing nations. Spacefaring powers quite rightly feared that the concept of the common heritage of mankind might mean their claims to resources or property are defeated, disincentivising investment in technologies that would have made resource extraction more feasible. As such, the Moon Agreement is only binding to States Parties to the Agreement, and likely does not represent progressive development of customary international law. Consequently, the concept of res communis as applying to outer space will likely only remain a theoretical concern unless the Moon Agreement somehow is reinvigorated.

A resurrection of the Moon Agreement is unlikely. In 2020, former US President Donald Trump signed an Executive Order on Encouraging International Support for the Recovery and Use of Space Resources, which clearly states the US’ position that the:

Moon Agreement [is not] an effective or necessary instrument to guide nation states regarding the promotion of commercial participation in the long-term exploration, scientific discovery, and use of the Moon, Mars, or other celestial bodies. Accordingly, the Secretary of State shall object to any attempt by any other state or international organization to treat the Moon Agreement as reflecting or otherwise expressing customary international law.

Further, the Executive Order provides that the uncertainty about the right to exploit and use space resources as a result of the Moon Agreement has discouraged commercial entities from investing and in participating in the enterprise of space exploration and research. However, the Executive Order does provide that the

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56 Cheng, supra n. 7, at 222.
57 Ibid., at 222–228. See also Moon Agreement, supra n. 7, Art. 11.
58 At the time the Moon Agreement was concluded, neither the US or the U.S.S.R., the only spacefaring nations at the time, ratified the Agreement: Glenn H. Reynolds, Outer Space: Problems of Law and Policy209 (2nd ed., Westview Press 1988).
60 Ibid.
62 Ibid., s. 1.
US will promote the right to engage in exploitation of resources ‘consistent with applicable law’, meaning the US intends to work under the Outer Space Treaty framework. 63 Similarly, the Artemis Accords do not declare an intention to work under the Moon Agreement framework, but instead provides that the extraction of resources on the Moon will be ‘conducted under the auspices of the Outer Space Treaty’. 64 The final text of the Accords provides that the Signatories ‘affirm that the extraction of space resources does not inherently constitute national appropriation under Article II of the Outer Space Treaty’. 65 Thus, subsequent practice on the part of the States Signatories to the Artemis Accords affirm the possibility of the extraction of space resources. The result is that the current state of international law declares that things in outer space or on celestial bodies remain res extra commercium, that is, not subject to national appropriation but free for each State (or citizen of a State) to use and exploit.66

3 PROPERTY RIGHTS IN OUTER SPACE

3.1 Fragmenting property rights

Considering the increased scrutiny of the exploitation of natural resources on the Moon, this next part aims to analyse the types of property rights and duties that exists under the international law concept of res extra commercium. The threshold issue is whether a system of private property can exist without national appropriation. In answering this question, it should be noted that appropriation by private individuals is also prohibited.67 As Article II explicitly prohibits national appropriation by any means,68 States cannot circumvent this by authorizing private individuals to appropriate, particularly as Article VI requires States to authorize and supervise activities of their citizens.69 However, appropriation is not identical to property rights. The former refers to jurisdiction and sovereignty of a State over territory, while the latter refers to the more limited concept of specific enforceable rights.70

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63 Ibid.
64 NASA, supra n. 1, at 10.
65 Artemis Accords, supra n. 2, s. 10.
69 Outer Space Treaty, supra n. 4, Arts II, VI.
This begs the question: there cannot really be property rights unless the rights are enforced by the State or some other institution. In Bentham’s positivist utilitarian account of property rights:

Property and law are born together, and die together. Before laws were made there was no property; take away laws, and property ceases.\textsuperscript{71}

There cannot be private ownership without some authority to give good title to the individual. But outer space is not a lawless place; at the very least, international law applies to outer space. Violations of international law can be dealt with in the usual way as on Earth. In addition, States retain a form of personal jurisdiction over their nationals and space objects. The national law of the relevant State still applies to nationals and space objects. Thus, the US can validly pass legislation such as the \textit{Commercial Space Launch Competitiveness Act} that purportedly entitles US citizens to ‘possess, own, transport, use, and sell’ space resources obtained in accordance with applicable international obligations.\textsuperscript{72} Read narrowly, the Act does not necessarily claim sovereignty over things that are \textit{res extra commercium}, but merely provides for certain kinds of rights that US citizens may exercise over space resources once obtained. Consequently, it is theoretically possible for private property rights to exist. The real question is whether the Outer Space Treaty can be interpreted to include those rights.

Cheng argues that the prohibition on national appropriation does not extend to space resources.\textsuperscript{73} This conceptualization is analogous to the Roman’s concept of \textit{res communis}.\textsuperscript{74} For the Romans, the prohibition on appropriation of \textit{res communis} was only one duty in a bundle of rights and duties, which also included freedom of access and use. Article I of the Outer Space Treaty protects the freedom of ‘exploration and use’ even as Article II prohibits national appropriation.\textsuperscript{75} As Goldman writes, the ‘general principle of non-appropriation is, in effect, circumscribed to an extent by treaty provisions designed to facilitate the exploration and use of outer space’ particularly as ‘use’ refers to the enjoyment of property.\textsuperscript{76} Dembling and Arons cited debates during the drafting of the Treaty:

Although there was some difference of opinion over the meaning of the word “use,” as distinguished from “exploration,” it appeared that most of the delegations agreed with the French delegate that “use” means exploitation.\textsuperscript{77}

\textsuperscript{73} Cheng, \textit{supra} n. 9, at 22.
\textsuperscript{74} Capurso, \textit{supra} n. 18, at 4.
\textsuperscript{75} Outer Space Treaty, \textit{supra} n. 4, Arts I, II.
Some guidance can be taken from samples taken from the Moon by the US and United Soviet Socialist Republics (USSR) for scientific investigation. The US and USSR took samples from the Moon and ostensibly ‘used’ the samples for scientific purposes, transporting them back to Earth (the servitudes of usus and fructus under Roman law), without objection from other States, likely because scientific sampling was expressly contemplated as part of the Outer Space Treaty. In 1993, Russia auctioned some of the samples, thus dealing with the samples as if it were their own to alienate and reap the profits of (abusus), also without objection. These examples of dealing with things demonstrate an intention to assert rights of ownership over the samples, putting them squarely in the category of res in commercio. However, this may not be sufficient to demonstrate examples of State practice, as they only relate to scientific use with only incidental commercial value, instead of commercial exploitation of resources.

Further clarity on what is meant by a right to ‘use’ at international law can be obtained by examining theories of private property. Blackstone famously defined property as the ‘sole and despotic dominion’ an individual may claim ‘in total exclusion of the right of any other individual in the universe’. However, it is difficult to characterize the control that a State or even an individual has over things in outer space as the sole, despotic dominion, instead a State’s control is fragmented. There are other rights commonly associated with property. Epstein proposes property lies in three attributes: the rights to possession, use, and disposition, which can be separated from each other. These roughly correspond to the main kind of servitudes at Roman law, usus, fructus and abusus. The ‘bundle-of-rights’ conception holds that property is best understood as a grouping of rights commonly associated with property. According to this conception, there is no essential core of property. Hohfeld’s concepts of jural relations allows property rights to be analysed and separated into relationships of claim or duty codified in law, conceptualizing property as being simply the term for a given set of

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78 Even under the Moon Agreement, States are able to exert rights of ownership over samples taken from the Moon for research purposes: see e.g., Carol R. Buxton, Property in Outer Space: The Common Heritage of Mankind Principle vs. the First in Time, First in Right, Rule of Property, 69 J. Air L. & Com. 689, 701 (2004).
relationships codified in law. In Hohfeld’s framework, the right to use is a privilege-right: a person who has a right to use a resource has the freedom to do what they wish with the resource from the right or claim of another. The correlative relation is no-right, meaning other States have no-right to control other State’s access to or use of outer space.

Is the right to use sufficient to form the basis of property rights in outer space? Merrill claims ‘the right to exclude others is a necessary and sufficient condition’ of the existence of property. States certainly do not have the right to exclude other States in outer space. The right to exclude is argued to be the most important of the property rights because it is ‘the arbiter of access to property’, making it possibly the strongest interest a person might be able to have in a thing in outer space. In Hohfeld’s framework, the right to exclude is a negative claim-right, because its content and enforcement relies on a legal duty on other persons to refrain from interfering with the right-holder’s property. However, this is a relationship of duty between the owner and everyone else; it does not give the owner a positive right to use their property. The absence of a right to exclude in outer space is not necessarily determinative. If the right to use is derived from Merrill’s right to exclude, the right to use simply becomes the space left over once everyone else is excluded and does not amount to a positive right to use.

Conversely, it may be possible to derive a right to exclude from the right to use in the context of outer space. In the Roman classification, the seashore was classified as res communi omnium, and much like outer space is now, means that it could not be the object of private property rights. Individuals could use the seashore but could not exclude others from using it. Recall, however, an exception existed: a person could place a building on the seashore and have exclusive occupation and use of that building as long as it did not unduly restrict others’ rights and for as long as the building stood. Grotius quotes Seneca and likens it to a theatre seat in Rome – seats are available to any person who cares to watch the theatre, yet the seat a one person occupies becomes theirs while they are seated on it. The same principle could be applied to outer space, if one places a physical structure on the Moon’s surface, no one else can place anything else in the exact same location purely because it is already physically occupied. As the French delegate recognized in the Outer Space Treaty negotiations, international law had to distinguish between acts of appropriation and mere occupation.

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89 Hohfeld, supra n. 86, at 38.
90 Grotius, supra n. 28, at 57.
in the exploitation of resources.\textsuperscript{91} States might well have the sole, despotic dominion over installations they put in outer space or on celestial bodies if no one else can displace them. This is because States retain jurisdiction and control over their objects sent to space, meaning no State can interfere with another’s space objects.\textsuperscript{92}

The closest analogy in space law is the allocation of geostationary orbits by the International Telecommunications Union (ITU). Geostationary orbits can be reserved or allocated as the need arises to States.\textsuperscript{93} States may take advantage of advance allocations: Tonga registered sixteen orbital slots with the ITU, which caused many objections by the international community due to perceived lack of genuine need for the slots.\textsuperscript{94} Tonga withdrew ten of its registrations.\textsuperscript{95} However, Tonga also leased or auctioned the rights for its allotments to private companies.\textsuperscript{96} The ability to sell and profit off a thing is one aspect of property rights, leading to the implication that a State can have property rights over geostationary orbits. As a result, the ITU requires that allocations must generally be used directly by States that apply for them.\textsuperscript{97} When a slot is used by a satellite, no other satellite can use that space and it effectively occupies the orbit,\textsuperscript{98} but as discussed earlier, this is not the same as asserting sovereignty over the orbit.\textsuperscript{99} The limitation is that the ITU still retains the right of disposal, as the allocations are time-limited.\textsuperscript{100} Occupation on the basis of a right to use is therefore a fragmented quasi-property right, and there does not appear to be any reason why it could not be extended from geostationary orbits to other interests in outer space. However, Baca points out that a facility on celestial bodies might also require permanent modifications to the land on which the facility is on, in a way that a satellite with a limited useful life does not.\textsuperscript{101}

\begin{itemize}
\item \textsuperscript{91} The French delegate said ‘while the principles established by the treaty would no doubt be easy to apply in the case of the exploration of space, their application would be more difficult when State activities involved exploitation, and particularly where simple occupation had to be distinguished from appropriation.’ UN GAOR, First Comm., 21st Sess., 1492nd mtg., at 430, U.N. Doc. A/C.1/ SR.1492 (17 Dec. 1966).
\item \textsuperscript{92} Outer Space Treaty, supra n. 4, Art. VIII.
\item \textsuperscript{94} Adrian Copiz, \textit{Scarcity in Space: The International Regulation of Satellites}, 10 Comm. L. Conspectus207, 208 (2002).
\item \textsuperscript{95} Ibid.
\item \textsuperscript{96} Cahill, supra n. 93, at 244.
\item \textsuperscript{97} Ibid.
\item \textsuperscript{98} Effectively a right to exclude also protected by ITU procedures: Baca, supra n. 88, at 1082.
\item \textsuperscript{99} Cf. Buxton, supra n. 78, at 705.
\item \textsuperscript{100} Baca, supra n. 88, at 1082.
\item \textsuperscript{101} Ibid., at 1083.
\end{itemize}
3.2 Acquisition and allocation based on use

We have so far established that in outer space, recognition of property rights is limited to a right to use. The question remains whether the right to use is an adequate basis to acquire property rights in outer space within the constraints of res extra commercium. Allocations based on the right to use, rather than the rights to exclude or dispose, results in a more efficient allocation of resources. Epstein considers that if instead, the law provided only for a right to exclude, then ‘the world will remain a tundra, in which [the right-holder] could keep [their] own place on the barren square of the checkerboard’. The right-holder must also have a privilege-right to use the property. Political philosophers such as Locke have put forward alternative justifications of property that demonstrate that the productive right to use is perhaps the essential part of property, for ‘As much land as a man tills, plants, improves, cultivates, and can use the product of, so much is his property’.103

Locke’s Labour Theory of Property is an understanding of property which is underpinned by an account of the moral significance of labour. Locke’s theory was an answer to a natural law conundrum: if God gave to humanity the whole world in common property, then how can individuals be said to have private property?104 This dilemma is a similar one to the issue in this Article, namely, where private property can exist if international law declares outer space to be res extra communis. Locke resolves:

Every man has a property in his own person … The labour of his body, and the work of his hands, we may say, are properly his. Whatsoever then he removes out of the state that nature hath provided, and left it in, he hath mixed his labour with, and joined to it something that is his own, and thereby makes it his property.105

Therefore, the basis for property rights is using the resource productively. The rights to exclude or dispose are important only insofar as it protects the owner’s right to use a resource for their own benefit. Further, property is a moral entitlement that stems from productive use. Mere enclosure is insufficient, so Tonga’s allocation of geostationary orbits would not, according to Locke be justifiable unless Tonga could use the orbits productively. A person cannot claim property over a resource by simply claiming a right to exclude all others from it, they must proactively cultivate it or put it to some use for it to be entitled to protection as property.

104 Ibid., at 286.
105 Ibid., at 287–288.
Locke has a proviso: one can only claim property ‘where there is enough, and as good, left in common for others’. This proviso bears striking similarities to the Roman’s treatment of structures on the seashore as being permissible only if it does not encroach on the common right to use the seashore or to access the sea. Any acquisition of property is a diminution of another’s rights to the common resource. The Lockean proviso can only make sense if other persons have some entitlement to the resource, otherwise it would not matter whether there is anything left over. Other individuals have privilege-rights in the use of common property and can justly complain if that interest in the use of land is violated or they are left worse off.

Hume takes a similar but positivist view to Locke: ‘A man’s property is some object related to him. This relation is not natural, but moral, and founded on justice.’ According to Hume, property developed as a way to ensure efficiency in a society to remedy two defects of resources: scarcity and instability, as without some means of enforcement, one’s use of a resource is vulnerable to disruption by other people through violence. Property rights relies on social norms, and eventually laws, to be enforceable. Because Hume’s account focusses on justifying property as being necessary for cooperation within a society, the use and consumption of resources is the justification for property. That is, property rights exist to protect the positive right of individuals to efficiently maximize their utility. A right to exclude provides no benefits for Hume’s society, but a right to use can. These philosophical justifications for the allocation property on Earth can provide an adequate basis for property in outer space based on the right to use.

4 INADEQUACY OF A FRAGMENTED SYSTEM

4.1 USING SCARCE RESOURCES

Thus far in this Article, I have concluded that there is a right to use outer space and celestial bodies that is consistent with the principle of non-appropriation and echoes concepts from Roman law. This right to use includes the exploitation of natural resources found in outer space, but it does not include other property rights such as the right to exclude others, except to the extent it can be derived from use. In this sense, property rights in outer space are fragmented. While a system of property based solely on a right to use might be sufficient for Grotius or the Romans, in this section, I will argue that it may not be appropriate to incorporate

106 Ibid., at 290.
108 Ibid.
it into outer space for two reasons, each derived from the concepts discussed above.

First, the problem of scarcity. Recall that the Romans regarded natural resources like wild animals and fish in the sea as being res nullius primarily because of their abundance, and that one could appropriate it by hunting it, for example, if it is an animal, thus making it one’s own property. The Romans treated running water, the sea and seashore as res communis because the sea and its shore is simply so vast that no one could ever hope to control its tempestuous nature and because the existence of their communities depended on it for their survival. To an extent, outer space is even more abundant than the ocean, and we are enticed into promoting a system of property rights in outer space because of the promise of the untold riches of asteroid mining. But as of yet, outer space resources are still much more scarce than terrestrial resources because everything is just so far away. It takes billions of dollars of investment and many years to send spacecraft to even the closest celestial bodies. In any case, we now know that fish stocks are not endless, and the ocean is not without bounds – uncontrolled excessive fishing might wipe out the previously abundant resource.

The rationale of scarcity underpins many ideas about property. Locke’s theory of property based on productive use assumed conditions where there was no first allocation of property and where resources were abundant:

Nobody could think himself injured by the drinking of another Man, though he took a good Draught, who had a whole River of the same Water left him to quench his thirst.

And the case of Land and Water, where there is enough of both, is perfectly the same.\(^{109}\)

Locke assumed that appropriation would only be justified if there was enough for everyone else to appropriate. Hume also thought that the primary purpose of private property was to allocate scarce resources justly.\(^{110}\) A consumable and exploitable resource such as natural resources in space or the finite number of allocations on the geostationary orbit requires cooperation among States in order to manage the sustainable use of the resource. As Laver recognizes, not only is ‘space’ in space a scarce resource, it is also exhaustible in that over-exploitation can result in irreversible tragedy.\(^{111}\) If States are able to use outer space resources at will, this leads to the risk of exploitation via a tragedy of the commons type situation. The tragedy is traditionally resolved either by cooperation or enforcement of a full system of property rights.\(^{112}\) An international system of cooperation to share the benefits of exploitation is unlikely, as demonstrated by the failure of

\(^{109}\) Locke, supra n. 103, at 291.

\(^{110}\) Hume, supra n. 107, at 488.

\(^{111}\) Laver, supra n. 66, at 360, 361.

\(^{112}\) Ibid., at 367.
the Moon Agreement, and a full system of property rights does not currently exist at international law, only the privilege-right to use sitting under the auspices of non-appropriation.

4.2 Inequality and Technology

The second problem associated with a framework based on the right to use is that it serves only to advance the interests of the most developed States. Romans could enjoy a freedom of the seas primarily because of their maritime dominance in the Mediterranean enforcing the freedom against any would-be challengers, so that any Roman citizen could enjoy freedom of movement in the seas. Grotius’ writings were written in the context of a struggle between the Dutch and Portuguese (and later the British) over rights to trade routes to Asia. But the barriers to outer space are even higher than the barriers to the high seas. Only a few, comparatively wealthier States have spacefaring capacity. If outer space is declared to simply be res extra commercium, the only States that could take advantage of the right to use outer space are the wealthier States, meaning poorer States could be locked out of using outer space if it is already overexploited by more developed States.

On one hand, developed States could argue they are entitled to exclusive use of the resources they acquire because of the time and money spent investing in the technology to use the resources. A requirement to share the benefits could deincentivizes investment in spacefaring technologies. But on the other, if outer space resources are truly the common heritage of all humankind, it is unjust that some States or individuals are denied the benefits of their common heritage simply because of a lack of capability. Thus, an ancient concept like res extra commercium may have the best intentions of sharing a resource to benefit all humankind, the political and economic reality is that it might instead convert common resources to private resources useable only by wealthy States if the only right associated with the common resource is a free-for-all right to use.

The considerations of inequality among States did not go unnoticed in UN debates around the law of the sea and outer space. Pardo, then Maltese Ambassador to the UN, was perhaps the strongest advocate for the inclusion of the fourth division, res communis omnium/humanitatis, applying to the deep seabed, which advocates for the sharing of the benefits of exploitation of resources extracted

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114 Ibid., at 281.
115 Buxton, supra n. 78, at 693.
from the deep seabed among all States.116 This proposal received widespread support among developing States, and the concept made its way into the Moon Agreement as well.117 Faced with signing up to a much more restrictive regime, it is natural that States with the capability to exploit outer space resources have not ratified the Moon Agreement, as the current regime under the Outer Space Treaty benefits them much more because it entitles them a right to use without needing to share the benefits with poorer States.118

5 CONCLUDING REMARKS

This Article sets forward an argument for how property rights might coexist under international law, which prohibits national appropriation. Honoré provides a catalogue of ‘standard incidents’ comprising the disparate rights that together are sufficient for property.119 Honoré characterized his conception of property as the ‘full liberal sense’ of property, meaning a legal system could conceivably not recognize the full set of rights and yet still call property ‘property’.120 What is essential is simply the fact that property is ‘the greatest possible interest in a thing which a mature system of law recognizes’.121 As we have established, States have the privilege-right to use space resources and a basic claim-right of exclusion, insofar as no one else can physically place a structure in the same place. Mere enclosure of ‘land’ in outer space is insufficient, it is only through use that States can have de facto dominion even without appropriating the resource. In Honoré’s words, this is the greatest possible interest currently recognized by international law and is sufficient for recognition as property.

However, just because a right to use is sufficient to be recognized as property does not entail that it is an adequate legal regime for property rights in outer space. Concepts of property and appropriation derived from ancient legal doctrines are no longer sufficient to deal with the problems of scarcity and technology that arise from the context of outer space. But how to deal with this problem is a vexed question, for the international community is effectively in a Prisoner’s Dilemma. The current status quo is inadequate, primarily because of the uncertainty inherent in the provisions of the Outer Space Treaty, and because a right to use does not incentivize sustainable management of outer resources. However, a move to a more cooperative regime will be resisted by wealthier States, evidenced by the

116 Ibid., at 694.
117 Christol, supra n. 59, at 164.
118 Laver, supra n. 66, at 367–368.
120 Ibid., at 147.
121 Ibid., at 108.
U.S.’ reluctance to acknowledge the Moon Agreement. Similarly, a move to fully incorporate the full set of property rights would be resisted by poorer States, because it may mean they never will be able to benefit from outer space if the wealthier States utilize their right to exclude. The lack of consensus on an alternative means that there the international community is left with the least best option of a fragmented system of property rights.