GALACTIC PRESERVATION AND BEYOND: A FRAMEWORK FOR PROTECTING CULTURAL, NATURAL, AND SCIENTIFIC HERITAGE IN SPACE

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INTRODUCTION

In July 2017, Moon Express, a private spaceflight company, announced plans to build an outpost on the South Pole of the Moon by 2020.[1] The goal? To mine the Moon for minerals and water that can then be sold for profit.[2] Indeed, the Moon has been found to possess resources with lucrative uses both in space and here on Earth.[3] The potential for huge rewards has incentivized several private and governmental actors to launch planned expeditions to the Moon, with China becoming the third nation to land a spacecraft there in 2013.[4] Both China and India have since announced plans to send robotic missions to the lunar surface,[5] and the United States recently renewed a pledge to once again land an astronaut on the Moon.[6]

The Moon is not the only celestial goldmine, either. Billionaire Elon Musk has stated that the exploitation of Mars will be necessary to create a self-sustaining colony on the Red Planet.[7]

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[1] Loren Grush, *To Mine the Moon, Private Company Moon Express Plans to Build a Fleet of Robotic Landers*, VERGE (July 12, 2017, 11:32 AM), https://www.theverge.com/2017/7/12/15958164/moon-express-robot-landers-private-mining-outpost.

[2] *Id.*

[3] These valuable resource are primarily water, helium-3, and rare earth metals. *The Lunar Gold Rush: How Moon Mining Could Work*, NASA, https://www.jpl.nasa.gov/infographics/infographic.view.php?id=11272 (last visited Mar. 20, 2018); *see also infra* notes 38-41 and accompanying text.

[4] Kenneth Chang, *The Google Lunar X Prize's Race to the Moon is Over. Nobody Won*, N.Y. TIMES (Jan. 23, 2018), https://www.nytimes.com/2018/01/23/science/google-lunar-x-prize-moon.html; Paul Rincon, *China Lands Jade Rabbit Robot Rover on Moon*, BBC NEWS (Dec. 14, 2013), http://www.bbc.com/news/scienceenvironment-25356603.

[5] Chang, *supra* note 4. For an overview of nations with lunar ambitions, see Benjamin D. Hatch, Comment, *Dividing the Pie in the Sky: The Need for a New Lunar Resources Regime*, 24 EMORY INT'L L. REV. 229, 237-43 (2010) (describing the ambitions of the United States, Russia, China, Europe, India, and Japan).

[6] *See* Joel Achenbach, *NASA, Heeding Trump, May Add Astronauts to a Test Flight Moon Mission*, WASH. POST (Feb. 15, 2017), https://www.washingtonpost.com/news/speaking-of-science/wp/2017/02/15/nasa-heeding-trump-considers-adding-astronauts-to-a-practice-moon-mission/?noredirect=on&utm_term=.e1c96b2bf384 (highlighting a recent push to make significant progress in putting an American astronaut on the Moon within Trump's first term).

[7] Robert Walker, *Is There a Fortune to be Made on Mars?*, FORBES (Sept. 26, 2016), https://www.forbes.com/sites/quora/2016/09/26/is-there-a-fortune-to-be-made-on-mars/#29edb5c76e28.

Certain ores could even be mined and sent back to Earth for profit.[8] And samples of Martian dust and rock could sell for high prices to researchers and collectors.[9] Although less imminent than planned settlement and exploitation of the Moon, the colonization of Mars has become an increasing reality. Several private and governmental bodies have already announced planned exploration and eventual settlement of our terrestrial neighbor.[10]

With galactic development on the horizon, legal scholars have argued that it is time to revisit international space law—grounded in Cold War fears of an arms race in space—to create the necessary incentives for private exploitation of our solar system.[11] As it stands, the 1967 Outer Space Treaty, the seminal treaty on space law, prohibits claims of national sovereignty or legal jurisdiction over any celestial body, creating legal barriers for those wishing to extract the vast resources beyond Earth.[12] This Article does not disagree with other scholars' arguments for the promotion of private industry in space—in fact, it endorses a new property paradigm to remove the existing obstacles to extraction of galactic resources. Instead, this Article considers

[8] *See id.* ("'It has been shown that if concentrated supplies of metals of equal or greater value than silver ... were available on Mars, they could potentially be transported back to Earth at high profit.'" (quoting Robert Zubrin, *The Economic Viability of Mars Colonization*, 48 J. BRIT. INTERPLANETARY SOC'Y 407 (1995))).
[9] *Id.* (predicting prices in the billions for the first kilograms that return to Earth).
[10] *See, e.g.*, Kenneth Chang, *Mars InSight: NASA's Journey Into the Red Planet's Deepest Mysteries*, N.Y. TIMES (Apr. 30, 2018), https://www.nytimes.com/2018/04/30/science/mars-insight-launch.html (describing NASA's latest mission to explore beneath Mars's surface); Ishaan Tharoor, *U.A.E. Plans Arab World's First Mission to Mars*, WASH. POST (July 16, 2014), https://www.washingtonpost.com/news/worldviews/wp/2014/07/16/u-a-e-plans-arab-worlds-first-mission-to-mars/ (describing the United Arab Emirates' plans to send an unmanned mission to Mars in 2021); Mike Wall, *SpaceX's Mars Colony Plan: How Elon Musk Plans to Build a Million-Person Martian City*, SPACE.COM (June 14, 2017), https://www.space.com/37200-read-elon-musk-spacex-mars-colony-plan.html.
[11] *See generally, e.g.*, John Adolph, *The Recent Boom in Private Space Development and the Necessity of an International Framework Embracing Private Property Rights to Encourage Investment*, 40 INT'L LAW 961 (2006); John B. Bilder, *A Legal Regime for the Mining of Helium-3 on the Moon: U.S. Policy Options*, 33 FORDHAM INT'L L.J. 243 (2010); David Collins, *Efficient Allocation of Real Property Rights on the Planet Mars*, 14 B.U. J. SCI. & TECH. L. 201 (2008); Jonathan Thomas, *Privatization of Space Ventures: Proposing a Proven Regulatory Theory for Future Extraterrestrial Appropriation*, 1 INT'L L. & MGMT. REV. 191 (2005); Hatch, *supra* note 4; John Myers, Comment, *Extraterrestrial Property Rights: Utilizing the Resources of the Final Frontier*, 18 SAN DIEGO INT'L L.J. 77 (2016).
[12] Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies arts. I, II, *opened for signature* Jan. 27, 1967, 18 U.S.T. 2410, 610 U.N.T.S. 205 (entered into force Oct. 10, 1967) [hereinafter Outer Space Treaty].

the impacts of galactic exploitation on celestial bodies and calls for the expansion of existing environmental treaties, particularly those relating to preservation of cultural and natural heritage,[13] to restrict exploitive activities within certain areas of celestial bodies that have significant cultural, scientific, or intrinsic value. This Article is not the first to consider environmental preservation in space, nor preservation of galactic heritage sites,[14] but so far most scholarship on this issue has focused on a regulate-as-you-go approach, or approaches that are without the cumbersome burdens of international treaty-making.[15] This Article adopts an alternative methodology.

Rather than considering whether and how nations should and could control the behavior of their nationals once they are beyond Earth's atmosphere, this Article calls for the laying of some ground rules before the extraction of celestial resources begins. Specifically, it calls for mirroring the Convention concerning the Protection of World Cultural and Natural Heritage (the "World Heritage Convention" or "WHC") and its underwater heritage companion (the "Underwater Heritage Convention" or "UHC") to establish an international body to promulgate

[13] This Article pays particular attention to the Convention concerning the Protection of World Cultural and Natural Heritage, *opened for signature* Nov. 23, 1972, 27 U.S.T. 37, 1037 U.N.T.S. 151 (entered into force Dec. 17, 1975) [hereinafter World Heritage Convention], and the Convention on the Protection of Underwater Cultural Heritage, *opened for signature* Nov. 2, 2001, 41 I.L.M. 37 (entered into force Jan. 2, 2009) [hereinafter Underwater Heritage Convention].

[14] *See, e.g.*, Mike Wall, *Moon History: Group Works to Protect Apollo Landing Sites*, SPACE.COM (Aug. 16, 2017), https://www.space.com/37799-apollo-landing-sites-preservation-for-all-moonkind.html (describing efforts by "For All Moonkind," a nonprofit, to draft a treaty based on the World Heritage Convention that would protect cultural sites on the Moon); *see also* Charles Cockell & Gerda Horneck, *A Planetary Park System for Mars*, 20 SPACE POL'Y 291, 291-95 (2004) (proposing a parks system on Mars to preserve areas of historic, natural, scientific, and future importance but not proposing a specific legal framework). This Article proposes something similar, but provides more detail on the legal conceptualization of these ideas and argues that preservation should be undertaken specifically within the UNESCO heritage framework. *See infra* Part V.

[15] *See generally, e.g.*, Lawrence D. Roberts, *Ensuring the Best of All Possible Worlds: Environmental Regulation of the Solar System*, 6 N.Y.U. ENVTL. L.J. 126 (1997); April Greene Apking, Comment, *The Rush to Develop Space: The Role of Spacefaring Nations in Forging Environmental Standards for the Use of Celestial Bodies for Governmental and Private Interests*, 16 COLO. J. INT'L ENVTL. L. & POL'Y 429 (2005) (arguing that each nation, particularly spacefaring nations, should take responsibility for its own nationals and avoid an international agreement for the time being); Kyle Ellis, Note, *Preserving Apollo: H.R. 2617 and the Creation of the Apollo Lunar Landing Sites National Historic Park*, 26 FORDHAM ENVTL. L. REV. 516 (2015) (calling for unilateral action by the United States to protect the Apollo landing sites and dismissing international treaties as an impractical option).

regulations for the preservation of galactic sites of universal cultural, natural, or scientific value. In these so-called "galactic heritage sites," nations would agree to restrict the activities of their nationals, enforced by existing norms, licensing regimes, and penalties. Although other areas of galactic bodies would be opened for the purposes of resource extraction and human settlement, these heritage sites would be largely off limits. The Moon has several cultural sites where nations have landed spacecraft and even human beings; Mars has areas that are favorable to the development and existence of life; and both bodies have natural landmarks that are scientifically and intrinsically significant. For these reasons, the time has come to preserve the heritage of our galaxy before it is too late.

Part I will analyze the cultural, natural, and scientific significance of the Moon, arguing why preservation of a lifeless body is worthwhile. Part II will consider the importance of preserving Mars, particularly its potentially life-harboring regions. And Part III will provide an overview of the sources of international law currently governing space and their shortcomings for the preservation of celestial bodies. Returning to Earth, Part IV will evaluate the heritage conventions as a framework for protecting our galaxy. Finally, Part V will propose a solution, explaining why international treaties on heritage preservation provide an ideal model for the protection of celestial bodies. Ultimately, this Article proposes a framework for galactic preservation that is cooperative and precautionary, and that brings clear ground rules to an area currently in legal flux.

I. HERITAGE ON THE MOON: THE CASE FOR PRESERVING A LIFELESS OBJECT

"Beautiful, beautiful. Magnificent desolation." These were the words of the second man on the Moon, Buzz Aldrin, as he stepped off the Apollo 11 lunar lander.[16] Although long eclipsed

[16] Adam Mann, *Space: The Final Frontier of Environmental Disasters?*, WIRED (July 15, 2013), https://www.wired.com/2013/07/space-environmentalism/.

by the famous "one small step" maxim, these words capture the competing perspectives on lunar preservation. One the one hand, the Moon is an atmosphere-less, lifeless object whose value is mostly gravitational, contributing to the tides on Earth and stabilizing our planet's rotation.[17] On the other hand, our Moon has immense cultural and natural significance, and is home to landmarks of human achievement.[18] Upon closer examination, the Moon's importance to humanity and its own unique identity implore the preservation of at least parts of the lunar surface.

A. Cultural Heritage on the Moon

The lunar surface is host to significant feats in human engineering and innovation. Most notably, the six Apollo landing sites record the extent of human exploration of our orbital partner.[19] Unmanned landing sites, including the landing sites of the Soviet Union's Luna and the United States' Rover and Surveyor missions, also stretch across the lunar surface.[20] Of these sites, the Apollo 11 and Apollo 17 landings memorialize particularly important events in human history, marking the first and last times humans stepped foot on a celestial body.[21] Fifty years

[17] *See* Hanne Jakobsen, *What Would We Do Without the Moon?*, SCIENCENORDIC (Jan. 12, 2012), http://sciencenordic.com/what-would-we-do-without-moon; *About the Moon*, NASA, https://moon.nasa.gov/about/in-depth/ (last visited Apr. 6, 2018) (noting that "many missions that have explored the moon have found no evidence to suggest it has its own living things").

[18] *See generally* EDGAR WILLIAMS, MOON: NATURE AND CULTURE (2014).

[19] *See Apollo Landing Sites*, NAT'L AIR & SPACE MUS., https://airandspace.si.edu/explore-and-learn/topics/apollo/apollo-program/landing-missions/sites.cfm. For descriptions of the Apollo program and landings, see WILLIAMS, *supra* note 18, at 155-168.

[20] *See* WILLIAMS, *supra* note 18, at 149-154 (describing the unmanned missions to the Moon launched by the Soviet Union and the United States between 1959 and 1967); *id.* at 176 (describing the LCROSS and GRAIL probes, which were crashed into the lunar surface after orbiting the Moon to collect data); *see also* NAT'L AERONAUTICS & SPACE ADMIN., NASA'S RECOMMENDATIONS TO SPACE FARING ENTITIES: HOW TO PROTECT AND PRESERVE THE HISTORIC AND SCIENTIFIC VALUE OF U.S. GOVERNMENT LUNAR ARTIFACTS 5 (2011), https://www.nasa.gov/sites/default/files/617743main_NASA-USG_LUNAR_HISTORIC_SITES_RevA-508.pdf [hereinafter NASA PRESERVATION REPORT].

[21] *Apollo 11 Landing Site*, NAT'L AIR & SPACE MUS., https://airandspace.si.edu/explore-and-learn/topics/apollo/apollo-program/landing-missions/apollo11-landing-site.cfm; *see also* NASA PRESERVATION REPORT, *supra* note 20, at 17. For a description of the Apollo 11 and 17 missions, see WILLIAMS, *supra* note 18, at 158-161, 165-68.

later, the original hardware and famous footprints of Earth's first visitors to the Moon remain at the Apollo 11 site.[22]

Many of the manned and unmanned landing sites also continue to produce important data. Specifically, sensitive retro-reflectors at three Apollo sites and two Soviet Luna landing sites allow scientists to measure the distance between the Moon and Earth, and artifacts left on the Moon's surface provide valuable information about the effects of long-term exposure to the lunar environment.[23] The Apollo missions also left behind seismometers to measure moonquakes.[24]

More recently, in 2013, China became the third nation to successfully land a spacecraft on the Moon, with the touchdown of its robotic Chang'e 3 Yutu (or "Jade Rabbit") rover.[25] Although less significant than the first manned and unmanned landing sites, Jade Rabbit could be preserved as part of the Moon's cultural heritage, representing the first time a nation other than a Cold War superpower has landed on the Moon.

The artifacts and equipment on the lunar surface highlight the Moon's cultural, historic, and scientific value. If one considers only the importance of the Moon to mankind, then the justification for preservation of at least some parts of it is amply supplied.[26] For if no part of the Moon is protected, human exploitation risks damaging or destroying important records of human achievement and useful scientific data. But the Moon is not only important because of its value to humans; our orbital companion also has an intrinsic, natural value that is worth protecting to some degree.

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[22] *See* NASA PRESERVATION REPORT, *supra* note 20, at 17. For an image of one of the footprints left by the Apollo 11 astronauts, see WILLIAMS, *supra* note 18, at 26.
[23] *See* NASA PRESERVATION REPORT, *supra* note 20, at 5, 19-20.
[24] WILLIAMS, *supra* note 18, at 160.
[25] *About the Moon*, *supra* note 17.
[26] *See* Valentina Vadi, *The Cultural Wealth of Nations in International Law*, 21 TUL. J. INT'L & COMP. L. 87, 96-97 (2012) (discussing the importance of cultural preservation as a means to record human advancement and achieve "cultural empowerment").

B. Natural Heritage on the Moon

Beyond the traces of human exploration on the Moon, the body is itself home to astonishing, though desolate, natural beauty. The Moon is a terrestrial body covered in craters, mountainous regions, valleys, and grooves.[27] Without weathering or any major seismological activity, these features have remained relatively intact, providing a geologic timeline of the Moon's past.[28] Today, there are an estimated 300,000 impact craters on the lunar surface.[29] The largest of these craters, the Aitken Basin, formed at the Moon's South Pole, and is 2,500 kilometers (1,553 miles) across.[30] The early volcanism of the Moon has also left distinctive, dark lava flows across its surface, called Maria (Mare in the singular), meaning "seas" after their water-like appearance.[31] The Maria are broken up by eighteen mountain ranges, several peaks of which reach over 3,000 meters (9,842 feet) in elevation.[32] The tallest lunar mountain is Mons Huygens at 4,700 meters (15,419 feet).[33] The combination of two Maria—Mare Serenitatis and Mare Imbrium—and the mountain range (Montes Appeninus) between them form the familiar "Man on the Moon."[34]

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[27] *See generally* WILLIAMS, *supra* note 18, at 18-23 (describing the geologic history of the Moon and its features); Charles Q. Choi, *Moon Facts: Fun Information About the Earth's Moon*, SPACE.COM (Sept. 8, 2017, 6:45 PM), https://www.space.com/55-earths-moon-formation-composition-and-orbit.html.

[28] *See* WILLIAMS, *supra* note 18, at 18-19. In fact, most of the large craters on the Moon were formed during the "heavy bombardment" period, some 3.6 billion years ago. *See* BERND BRUNNER, MOON: A BRIEF HISTORY 137 (2011).

[29] WILLIAMS, *supra* note 18, at 19. Unlike the mountains and hills on Earth, which have been formed over many millennia, the highland areas of the Moon were formed rapidly during asteroid impacts. *Id.*

[30] *Id.* (noting also that the South Pole-Aitken basin is the largest basin in the solar system).

[31] *See id.* at 19. There are twenty-two named "seas" and one named "ocean" on the Moon. *Id.* at 29.

[32] *Id.* at 22.

[33] *Id.* This is compared to Mount Everest, the tallest mountain on Earth, whose elevation "is widely recognized as 29,029 feet [8848 meters]." Bhadra Sharma & Kai Schultz, *How Tall is Mount Everest, For Nepal, It's a Touchy Question*, N.Y. TIMES (Feb. 3, 2018), https://www.nytimes.com/2018/02/03/world/asia/mount-everest-how-tall-nepal.html.

[34] WILLIAMS, *supra* note 18, at 29-30.

The Moon is also home to less familiar features. Rilles, for example, are grooves in the lunar surface formed by lava flows, the collapse of impact crater rims, and rifts.[35] The largest rille, Rimae Pettit, is 450 kilometers (280 miles) long.[36] More intriguing are the lunar swirls: light patches formed by "magnetic anomalies in the Moon's structure."[37]

Beneath its topographic features, the Moon's crust holds an abundance of natural resources. Although originally thought to be devoid of water, scientists have since confirmed that it does exist on the lunar surface, likely through the interaction of hydrogen in solar winds and oxygen in lunar soil.[38] The Moon also has an estimated 500,000 tons of helium-3, much more than the grams of helium-3 found on Earth—a large incentive for private and governmental exploitation.[39] And rare metals, such as titanium, are present in greater amounts than earthbound reserves.[40]

Evidently, the Moon possesses unique geologic and topographic features that are both familiar to the naked observer and unlike anything found on Earth. The absence of other life or the potential for it does lower the moral impetus to preserve all parts of the Moon, and the abundance of lunar resources incentivizes some degree of human exploitation, but the aesthetic and intrinsic value of the Moon's features are worth at least some degree of international protection.[41] After all, lifeless natural beauty, though lifeless, is beautiful nonetheless.

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[35] *Id.* at 22.
[36] *Id.*
[37] *Id.* at 22-23.
[38] *Id.* at 23-24. In fact, the ice at the lunar south pole "is estimated to be tens of feet deep and to cover a total area of thirty to fifty square miles." Roberts, *supra* note 15, at 133.
[39] WILLIAMS, *supra* note 18, at 25; *see also* Roberts, *supra* note 15, at 130 (noting that helium-3 on the Moon has "'10 times [the energy potential] contained in all the known economically recoverable fossil fuels on Earth'" (quoting RICHARD S. LEWIS, SPACE IN THE 21ST CENTURY 143 (1990))); Hatch, *supra* note 4, at 230-37.
[40] *See* WILLIAMS, *supra* note 18, at 25.
[41] *See id.* at 146-47 (calling for a "moderate biosphere-centric position" on space environmentalism that "rejects the notion that humanity and its activity are the sole items of value" and that "acknowledges that ... the environment as a whole ha[s] value in [its] own right in addition to [its] value for human purposes"); *see also* Charles S. Cockell & Gerda Horneck, *Planetary Parks—Formulating a Wilderness Policy for Planetary Bodies*, 22 SPACE POL'Y 256, 257-569 (2006) (arguing that there are twenty-two separate arguments for the preservation of lifeless areas on a

C. The Case for Preserving a Lifeless Body

Recognizing the inherent value of an environment is not a foreign concept in international environmental law. For example, the international community has treated Antarctica as a unique region of the Earth that, although mineral-rich, is worth some degree of protection.[42] The international community has also recognized the intrinsic value of certain species, proscribing their trade and overharvesting.[43] There is a similar argument to be made for the preservation of the Moon. Although it possesses abundant resources, the Moon has value independent of its economic potential, much like the value of Antarctica is recognized independent of its mineral wealth. Indeed, existing space treaties already recognize the Moon's intrinsic value, albeit ambiguously.[44]

Ultimately, a balanced approach to preservation of the Moon is necessary—one that promotes some degree of exploitation while protecting significant features, including our own

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planet, including: (1) the necessity of land preservation to a fully formed concept of "space civilization," setting humans apart from mere animals responding to their environmental conditions; (2) the intrinsic value of an area "independent of human valuation"; (3) expression of "respect for the options and choices of future people"; and (4) the unknown and indirect benefits a lifeless area may provide).

[42] *See* Protocol on Environmental Protection to the Antarctic Treaty art. 7, *opened for signature* Oct. 4, 1991, 30 I.L.M. 1455 (entered into force Jan. 14, 1998) [hereinafter Madrid Protocol] ("Any activity relating to mineral resources [in Antarctica], other than scientific research, shall be prohibited."). Indeed, "the Antarctic Treaty is closely linked to and served as a model for the 1967 Outer Space Treaty." Paul B. Larsen, *Application of the Precautionary Principle to the Moon*, 71 J. AIR L. & COM. 295, 297 (2006).

[43] *See* Roberts, *supra* note 15, at 148 (citing The Convention on International Trade in Endangered Species of Wild Fauna and Flora, *opened for signature* Mar. 3, 1973, 27 U.S.T. 1087, 993 U.N.T.S. 243 (entered into force July 1, 1975) [hereinafter CITES Convention]); *see also* CITES Convention, *supra*, at pmbl. ("RECOGNIZING that wild flora and fauna in their many beautiful and varied forms are an irreplaceable part of the natural systems of the earth which must be protected for this and the generations to come."); *see also* United Nations Convention on the Law of the Sea art. 119(1)(a), *opened for signature* Dec. 10, 1982, 1833 U.N.T.S. 397 (entered into force Nov. 16, 1994) (requiring fishing states to maintain and restore populations based not only on economic factors, but also the prosperity of the species themselves in the name of biodiversity).

[44] *See infra* Part IV. In fact, our environmental impact on the Moon has been part of the discussion since NASA's first missions there. *See* NEIL M. MAHER, APOLLO IN THE AGE OF AQUARIUS 104-105 (2017) (describing newspaper articles after the first Apollo landing lamenting about the trash astronauts left behind, with one writer quirking that "[the astronauts] should take an empty beer can with them, 'just for symbolism's sake.'" (quoting Rose DeWolf, *Astronauts Are Neat in Their Cabin, But Will Be Litter Bugs on the* Moon, EVENING BULL. (Phila.), July 17, 1969, at 1)).

history there.[45] An approach similar to the World Heritage Convention is therefore ideal, as it protects those areas with scientific and cultural significance to humanity, and those with natural importance to the Moon as a body, while opening the rest of the surface to human utilization and settlement. Looking farther into our solar system, Mars, with its potential for life, offers other justifications for preservation.

II. HERITAGE ON MARS: PRESERVING LIFE AND ITS POTENTIAL

Unlike the Moon, which has not and likely will not support life beyond the earthly beings who settle there, Mars likely has supported, does support, or could support extraterrestrial life.[46] The rare ability of Mars to harbor at least the precursors of life presents new arguments—both ethical and scientific—for its preservation.[47] Specifically, if Mars is capable of hosting life—either in the past, today, or in the near future—the interest in protecting that life or its potential would justify greater protection of large swaths of the Martian surface.[48] This Part considers the biological and natural importance of Mars and the corresponding need to preserve at least parts of it.

A. Biological Heritage on Mars

In 2015, scientists discovered "salty streaks" that suggested the existence of salt water on Mars and "raise[d] the tantalizing prospect of a viable habitat for microbial life" on the planet.[49]

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[45] *See* Roberts, *supra* note 15, at 148-157 (discussing the property and liability regimes for inhospitable environments like the Moon); *see also* Hatch, *supra* note 4, at 286-87 (describing the two extremes on the lunar resource management spectrum: unbridled exploitation or an all-out ban on non-scientific resource extraction).
[46] *See* Carl Zimmer, *Life on Mars?*, SMITHSONIAN MAG. (May 2005), https://www.smithsonianmag.com/science-nature/life-on-mars-78138144/.
[47] *See, e.g.*, Roberts, *supra* note 15, at 157-160 (arguing for more precaution in the exploitation of galactic environments with the potential to harbor life until more information about the existence of life in those environments is discovered).
[48] *Id.* at 159-60.
[49] David Rothery, *NASA: Streaks of Salt on Mars Mean Flowing Water, and Raise New Hopes of Finding Life*, CONVERSATION (Sept. 28, 2015), https://theconversation.com/nasa-streaks-of-salt-on-mars-mean-flowing-water-and-raise-new-hopes-of-finding-life-48182.

This was not the first discovery of water on Mars, either.[50] In 1970, the Mariner 9 rover discovered Martian river channels carved by liquid water billions of years before.[51] In 2000, images from the Mars Orbiter Camera showed deep grooves on the inside slopes of craters, which scientists believed were formed by water escaping the Martian crust.[52] Evidence shows that some of these grooves change each year, indicating that water still flows into them, though alternate explanations exist.[53] In 2008, the Phoenix lander discovered water-ice below the Martian surface, and droplets of liquid water formed on the lander's legs.[54] And, in 2011, the Mars Reconnaissance Orbiter transmitted images of "dark downhill streaks that come and go with the seasons," which NASA believes show water "seeping from the ground and wetting the surface enough to darken it."[55] Spectrometric analysis of the streaks showed that they contained salts that could allow water to flow in liquid form, even at Mars's subfreezing temperatures.[56]

The existence of water on Mars suggests that Earth is not the only planet in our solar system to host life, though further research is necessary.[57] One possibility is the existence of extremophile organisms, which are hardy enough to withstand the Martian environment, or of "'proto' life forms—organisms similar to viruses, enzymes and prions—similar to those that may have existed on Earth before bacteria."[58] Indeed, meteorites from Mars may have brought the beginnings of life to our planet, meaning "Martian landscapes could preserve a record of the

[50] *Id.*
[51] *Id.*
[52] *Id.*
[53] *See id.* (explaining that some of the "gullies" could have resulted from avalanches or "slabs of frozen carbon dioxide scooting downhill").
[54] *Id.*
[55] Rothery, *supra* note 50.
[56] *Id.*
[57] Rodrigo Ledesma-Aguillar, *Mars: Contamination, Planetary Protection and the Search for Life*, CONVERSATION (Sept. 30, 2015), https://theconversation.com/mars-contamination-planetary-protection-and-the-search-for-life-48363.
[58] *Id.*

emergence of life" in our solar system.[59] In any case, the potential for life and need for further research has already raised calls for preservation of those regions of Mars most favorable to biological development.[60]

Without preservation of sensitive and potentially life-harboring areas, human exploration threatens to introduce "microscopic stowaways" that survive on Mars and contaminate the unique Martian environment.[61] In fact, manmade objects already on Mars could well have carried microbes from Earth.[62] Any life that might exist on Mars likely is fragile, so the risk that objects from Earth could eliminate Martian life, or its precursors, warrants greater protections for potentially life-harboring areas of the Red Planet.[63] And, although some have pushed for the eventual "terraforming" of Mars,[64] preservation of its surface for the time being will be necessary to discover more about Martian life and its significance to our story. Moving forward, spacefaring nations must balance humanity's need for interplanetary existence with the duty to respect potential life on another planet.[65]

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[59] Michael P. Oman-Reagan, *Interplanetary Environmentalism*, SAPIENS (June 23, 2016), https://www.sapiens.org/column/wanderers/terraform-mars-anthropocene/.
[60] *See id.* (noting that the United States National Academy of Sciences and the European Space Sciences Committee "have already produced a report foreseeing 'special regions' of interest apart from sources of briny water, including methane-rich areas, shallow ice-rich deposits and subsurface cavities such as caves").
[61] *Id. See generally* Jeb Butler, Note, *Unearthly Microbes and the Laws Designed to Resist Them*, 41 GA. L. REV. 1355 (2007) (arguing for an international treaty to prevent interplanetary microbial contamination).
[62] *See* Oman-Reagan, *supra* note 60 (noting that the Opportunity and Curiosity rovers already on Mars could "be deemed unfit to travel to biologically promising areas due to the hazard of microbial contamination from Earth").
[63] *Id.*
[64] *See id.* (discussing plans for some space exploration companies to eventually terraform Mars to have a climate and landscape more similar to Earth).
[65] *Id.* For a discussion on the ethical debate surrounding human influence on Mars, see Paul York, *The Ethics of Terraforming*, PHILOSOPHY NOW (2002), https://philosophynow.org/issues/38/The_Ethics_of_Terraforming (arguing that terraforming of Mars is ethically dubious, even if Mars is lifeless). In 2003, concerns for life on one of Jupiter's moons, Europa, caused NASA to destroy its nuclear orbiter, Galileo, instead of crashing it into the moon. *See* Sergio Marchisio, *Protecting the Space Environment*, 46 L. OUTER SPACE 9, 14 (2003).

B. Natural Heritage on Mars

Like Earth and the Moon, Mars is home to geologic and topographic features that give it its unique identity. Recognizing those features that make Mars unique should also be a priority in future regulation of Martian exploitation.

The landscape of Mars is largely shaped by weathering from myriad forces, including volcanism, wind, glaciation, tectonic movements, ancient floods, and impact craters.[66] At its highest points, Mars is home to enormous mountains, including the largest volcanic mountain in our solar system, Olympus Mons, and mountains in the Tharsis region "that are so huge they deform the planet's roundness."[67] In fact, unlike the tectonic mechanisms on Earth, which move horizontally as plates crash into and move apart from one another, Martian tectonics work vertically, thrusting magma upwards and creating its volcanic giants.[68] Elsewhere, wind has formed other topographic features, including the Murray Buttes near Mount Sharp that provide both a record of Mars's geologic and climatologic history and breathtaking views that have been likened to national parks in the United States.[69] At its lowest, the Martian landscape cascades into a giant equatorial rift valley, Valles Marineris, which extends the distance of the continental United States and is deep enough in parts to fit the entire Grand Canyon and then some.[70]

Mars also has features unfamiliar to our planet. For example, the entire planet is, at times, covered in dust storms, creating dunes, streaks, and other landscapes.[71] At its poles, Martian ice caps form from both water—as on Earth—and carbon dioxide, the latter of which is released as

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[66] *Mars*, NAT. GEO., https://www.nationalgeographic.com/science/space/solar-system/mars/ (last visited Feb. 27, 2018).
[67] *Id.*
[68] *Id.*
[69] Hanneke Weitering, *Red Planet Hike: Mars Looks Like National Park in Awesome New Pics*, SPACE.COM (Sept. 12, 2016), https://www.space.com/34037-awesome-mars-landscape-photos-national-parks.html.
[70] *Mars*, *supra* note 67.
[71] *Id.*

gas during the Martian spring and summer.[72] The process of sublimation—the transition of frozen carbon dioxide and water directly into gas without a liquid intermediary stage—is responsible for linear gullies, something not seen on Earth, formed after glaciers carve pits in the Martian landscape and then dissipate, leaving no debris apron because there is no liquid.[73]

Familiar or otherwise, Mars is home to astonishing features that provide it with an individual identity. Although there is potential that the Red Planet may one day be terraformed into an Earth-like home for our species, such plans are a distant dream from the closer realization of Martian mining and human settlement. With exploitation on the horizon, the potential for life and the unique landscapes of Mars call for protecting our planetary neighbor's natural and biological majesty before it is too late. As it stands, international law falls far short of this goal.

III. CULTURAL AND NATURAL PRESERVATION IN INTERNATIONAL SPACE LAW

A. Existing Protections

Although space law is a relatively modern arm of public international law, its framework treaties have not been updated since the 1970s.[74] Currently, there are five main treaties governing outer space, namely: (1) the Treaty on Principles Governing the Activities of States in the Exploration and use of Outer Space, Including the Moon and Other Celestial Bodies ("Outer Space Treaty" or "OST");[75] (2) the 1968 Agreement on the Rescue of Astronauts, the Return of Astronauts, and the Return of Objects Launched into Outer Space ("Astronaut Agreement");[76] (3) the Convention on the Registration of Objects Launched into Outer Space ("Registration Convention");[77] (4) the 1972 Convention on International Liability for Damage Caused by Space

[72] *Winters on Mars are Shaping the Red Planet's Landscape*, SCIENCEDAILY (Oct. 27, 2017), https://www.sciencedaily.com/releases/2017/10/171027085533.htm.
[73] *See id.*
[74] Apking, *supra* note 15, at 448.
[75] Outer Space Treaty, *supra* note 12.
[76] *Opened for signature* Apr. 22, 1968, 19 U.S.T. 7570, 672 U.N.T.S. 119 (entered into force Dec. 3, 1968).
[77] *Opened for signature* Jan. 14, 1975, 28 U.S.T. 695, 1023 U.N.T.S. 15 (entered into force Sept. 15, 1976).

Objects ("Liability Convention");[78] and (5) the 1979 Agreement Governing the Activities of States on the Moon and Other Celestial Bodies ("Moon Treaty").[79] Of these five, the Astronaut Agreement and Registration Convention offer nothing substantive as far as galactic environmentalism.[80] And the Liability Convention, although providing a fault scheme for damage caused by spacecraft, does not consider liability for environmental damage on celestial bodies.[81] The Outer Space Treaty and Moon Treaty are, therefore, the primary sources of international environmental law in space.[82]

1. Outer Space Treaty

The Outer Space Treaty was the first of the five space treaties spearheaded by the United Nations Committee on the Peaceful Uses of Outer Space, and entered into force in 1967.[83] The OST's original goal was to prevent the United States or Soviet Union from expanding military operations into space, though it remains in effect long after the Cold War.[84] As of March 2018, the treaty has 105 States Parties, including all spacefaring nations.[85]

Substantively, only one provision of the OST, Article IX, provides any explicit obligation to protect celestial environments. Specifically, Article IX requires that States Parties avoid "harmful contamination" of celestial bodies when pursuing "studies" and to notify the international community when they "ha[ve] reason to believe that an activity or experiment

[78] *Opened for signature* Mar. 29, 1972, 24 U.S.T. 2389, 961 U.N.T.S. 187 (entered into force Sept. 1, 1972).
[79] *Opened for signature* Dec. 5, 1979, 18 U.S.T. 2410, 1363 U.N.T.S. 3 (entered into force July 11, 1984) [hereinafter Moon Treaty]; Apking, *supra* note 15, at 448.
[80] See Apking, *supra* note 15, at 448.
[81] *See id.* at 449.
[82] *See id.* at 448.
[83] Myers, *supra* note 11, at 91; *see also Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies*, U.N. OFF. FOR OUTER SPACE AFF., http://www.unoosa.org/oosa/en/ourwork/spacelaw/treaties/introouterspacetreaty.html (last visited Feb. 8, 2018).
[84] Ellis, *supra* note 15, at 523; *see also* Myers, *supra* note 11, at 94; Hatch, *supra* note 4, at 243-44.
[85] *See Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies*, U.N. OFF. FOR DISARMAMENT AFF., http://disarmament.un.org/treaties/t/outer_space (last visited Feb. 8, 2018).

planned by it or its nationals in outer space . . . would cause potentially harmful interference with activities of other States Parties in the peaceful exploration and use of outer space."[86]

Although not providing explicit environmental obligations, other provisions of the OST support environmentalism in space and respect for celestial environments. Article I, for instance, provides that "[t]he exploration and use of outer space, including the moon and other celestial bodies, shall be carried out for the benefit and in the interests of all countries,"[87] suggesting that a nation cannot use a celestial body in a way that detriments other states' interests. Article I also holds that space "shall be the province of all mankind,"[88] further affirming some degree of obligation to use celestial resources in a manner that is not detrimental to the greater interests of humanity. Finally, the OST requires that there be "freedom of scientific investigation in space,"[89] meaning scientific endeavor is at least a primary focus of space exploration. As discussed below, however, the OST's environmental provisions, both explicit and implicit, fall short of mandating any real protections for celestial bodies.[90]

2. The Moon Treaty

In contrast to its predecessor, the OST, the Moon Treaty calls for more stringent protection of our celestial neighbor.[91] First, its scope is much broader, applying to private exploitation as well as scientific research and exploration.[92] Specifically, the Moon Treaty expands upon the OST by

[86] Outer Space Treaty, *supra* note 12, at art. IX.
[87] *Id.* at art. I.
[88] *Id.*
[89] *Id.*
[90] *See infra* Part III.B.
[91] *See* Roberts, *supra* note 15, at 142.
[92] *Id.*

"explicitly stat[ing] that no entity or natural person may appropriate property in a celestial body or resource through its use."[93]

The Moon Treaty also provides more substantive protections of the lunar environment. Article 7(1), in particular, calls for States Parties to "prevent disruption of the existing balance of [the Moon's] environment, whether by introducing adverse changes in that environment by its harmful contamination through the introduction of extra-environmental matter or otherwise."[94] Importantly, the Moon Treaty allows States Parties to request that the Secretary-General of the United Nations designate certain "areas of the moon with special scientific interest ... as international scientific preserves for which special protective arrangements are to be agreed upon in consultation with the component bodies of the United Nations."[95] Finally, the Treaty requires that States Parties consider the interests of future generations in their space exploration activities.[96] Collectively, these provisions provide more substantial protections for the lunar environment than the OST; however, the Moon Treaty still suffers many shortcomings that have prevented its words from having much effect.[97]

B. Shortcomings of Existing Space Law: A Sputnik Treaty System in a SpaceX Galaxy

Although providing some protections of celestial bodies, the Outer Space Treaty and Moon Treaty suffer from severe flaws that have made them ineffective. Ambiguity and generality have handicapped the treaties, which is only compounded by their lack of enforcement. What remains are two treaties with aspirational ideals but unworkable standards.[98]

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[93] Ellis, *supra* note 15, at 526-27; *see also* Moon Treaty, *supra* note 80, at art. 7(1) (stating that "[n]either the surface nor the subsurface of the moon, nor any part thereof or natural resources in place," shall become property of any State or national or international organization).
[94] Moon Treaty, *supra* note 80, at art. 7(1).
[95] *Id.* at art. 7(3).
[96] *Id.* at art. 4.
[97] *See infra* Part III.B.2.
[98] *See generally* Roberts, *supra* note 15, at 139-144.

1. The Outer Space Treaty: Bark Without Bite

The Outer Space Treaty has been criticized both for its inadequate property regime and its ineffective environmental protections. Notably, the Outer Space Treaty's most substantive environmental provision—the Article IX anti-contamination obligation—has proven to be an inadequate means of environmental protection, lacking any procedural mechanism for enforcement.[99] Moreover, the OST does not apply to private exploitation, a key activity this Article seeks to address. In addition, Article IX's requirement that a State Party consult with the international community when it believes its activities might be harmful to another nation's interests naively depends on that State Party's willingness to voluntarily disclose information that likely goes against its own wellbeing.[100] And, even when a State Party does consult others, that consultation lacks the precedential value and normative formality to have any real bite.[101] If political and military considerations are involved, which is probable in space disputes, consultation is especially unlikely to be effective.[102]

The OST also suffers from ambiguity. In particular, Article IX's "harmful contamination" and "harmful interference" terms are not defined in the treaty and there is little indication of what they might mean elsewhere in the OST.[103] It is also unclear whether the obligation to do no harm is an obligation not to harm human interests in space or an obligation to the celestial bodies themselves.[104] Finally, internal conflicts between Article IX and other OST provisions that essentially create a galactic commons threaten to undermine any environmental protections the

[99] *See* Apking, *supra* note 15, at 448; *see also* Roberts, *supra* note 15, at 139.
[100] Apking, *supra* note 15, at 447; *see also* Roberts, *supra* note 15, at 139.
[101] *See* Roberts, *supra* note 15, at 140; *see also* Apking, *supra* note 15, at 447.
[102] *See* Roberts, *supra* note 15, at 140 (citing the protracted discussions in the dispute over the damaged caused by the loss of the Soviet nuclear-powered spacecraft Cosmos 954 as an example of consultation's inefficiencies).
[103] *See id.* at 139; *see also* Hatch, *supra* note 4, at 246 (hypothesizing that the OST's was intentionally written ambiguously so the two Cold-War superpowers would agree to sign).
[104] *See* Roberts, *supra* note 15, at 139.

OST does provide once resource extraction becomes economical.[105] If "harmful contamination" is ambiguous and unenforceable, the incentive of the commons is likely to override any obligation under Article IX, especially for private actors considered outside the treaty's scope.

Ultimately, the OST's biggest strength is its wide acceptance by the international community, including all spacefaring nations.[106] But the Treaty lacks any substantive obligations and those that it does have are ineffectively enforced or simply ignored.[107] As private and state actors begin to explore and extract galactic resources, it is only a matter of time before the OST becomes a relic of the Sputnik era.

2. The Moon Treaty: A Rejected Framework

Although the Moon Treaty has more concrete and robust requirements than the Outer Space Treaty, like its predecessor it fails to offer a new sovereignty or property ownership regime that overrides the galactic commons problem.[108] In addition, the Moon Treaty's requirement that States Parties take measures to avoid introducing adverse changes does not define "adverse changes," creating the same ambiguity problem as in the OST.[109] There is also the interesting question of whether the Moon Treaty permits changes that are adverse to the lunar environment but not adverse to humans.[110]

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[105] *See id.* at 141; *see also* Hatch, *supra* note 4, at 260 (predicting "the failure of the OST regime once the Moon becomes a resource base that is readily accessible").
[106] Roberts, *supra* note 15, at 140 (noting that the legitimacy of the OST appears to be the only "significant restraint upon the activity of the States Parties and their citizenry").
[107] For example, some have argued that the 1998 Space Station Agreement ignored the OST's provisions prohibiting extensions of sovereignty to space. *See* Ellis, *supra* note 15, at 539-40 (citing Mary B. McCord, *Responding to the Space Station Agreement: The Extension of U.S. Law into Space*, 77 GEO. L.J. 1933, 1939-42 (1988)). *But see* Robert Moenter, *International Space Station: Legal Framework and Current Status*, 64 J. AIR L. & COM. 1033 (1998) (arguing that the Space Station Agreement fits within the OST because Article VIII of the treaty permits extensions of national jurisdiction to spacecraft like the International Space Station).
[108] Roberts, *supra* note 15, at 143; *see also* Hatch, *supra* note 4, at 251.
[109] *See* Roberts, *supra* note 15, at 143-44 ("As in the Outer Space Treaty, the familiar 'harmful contamination' and the newer terminology of 'adverse changes,' remain undefined [in the Moon Treaty].")
[110] *See id.* at 144 (arguing that the later language in the provision suggests a human-centric perspective on what constitutes "adverse changes").

In any case, the Moon Treaty has proven ineffective not because of any one provision but because the international community has resoundly rejected it.[111] As of March 2018, the treaty had only eighteen States Parties, and no spacefaring nation has yet to ratify it.[112] Thus, even if the Moon Treaty provides some measure of environmental protection in space, its obligations are inapplicable to those most likely to send craft and crews beyond Earth's orbit.

IV. PROTECTION OF CULTURAL AND NATURAL HERITAGE ON EARTH

Although international environmental law has failed to lift off into space, earthbound protection of the environment—at least as far as preservation of important sites—has been more robust and successful. As this Part will discuss, the World Heritage Convention and the Convention for the Protection of Underwater Cultural Heritage both provide a framework upon which the international community can construct a future galactic preservation treaty. Subpart IV.A will describe these international agreements in succession while Subpart IV.B will consider the barriers to their expansion into space.

A. International Protection of Cultural and Natural Heritage on Earth

1. World Heritage Convention

The General Conference of the United Nations Educational, Scientific and Cultural Organization ("UNESCO") adopted the Convention concerning the Protection of World Cultural and Natural Heritage (the "World Heritage Convention" or "WHC") on November 16, 1972.[113] The idea for the WHC stemmed from the international response to the threatened destruction of

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[111] *Id.*

[112] *See Agreement Governing Activities of States on the Moon and Other Celestial Bodies*, U.N. OFF. FOR DISARMAMENT AFF., http://disarmament.un.org/treaties/t/moon (last visited Mar. 21, 2018) (showing that Armenia, Australia, Austria, Belgium, Chile, Kazakhstan, Kuwait, Lebanon, Mexico, Morocco, Netherlands, Pakistan, Peru, the Philippines, Saudi Arabia, Turkey, Uruguay, and Venezuela are the only parties to have ascended to or ratified the treaty). Notably, China, India, Japan, the European Union, Russia, the United States and the United Kingdom are not parties to the treaty. *See id.*

[113] *The World Heritage Convention*, UNESCO, http://whc.unesco.org/en/convention/ (last visited Mar. 21, 2018).

the Abu Simbel and Philae temples following construction of the Aswan High Dam in Egypt.[114] The success of that project snowballed into other successful efforts to preserve the Venice lagoon, the ruins at Moenjodaro, Pakistan, and the Borobodur Temple in Indonesia, eventually leading to the adoption of the WHC.[115] As of March 2018, the WHC has 193 States Parties.[116]

Substantively, the WHC obliges States Parties to identify, protect, conserve, present, and transmit to future generations cultural and natural heritage sites within their territories.[117] "Cultural heritage" is defined by the Convention to include monuments and groups of buildings of "outstanding universal value from the point of view of history, art or science," as well as sites of universal value "from the historical, aesthetic, ethnological or anthropological point of view."[118] Sites of "natural heritage" are separately defined to include natural features, geological and physiographical formations, and sites of universal value to science, conservation, or natural beauty.[119] Article 11 requires each State Party to submit a list of all sites within their territorial jurisdiction that meet these criteria.[120] The Intergovernmental Committee for the Protection of the Cultural and Natural Heritage of Outstanding Universal Value (the "World Heritage Committee" or "Committee") may then determine which sites submitted by each State Party are to be listed on the World Heritage List.[121] Additionally, the World Heritage Committee may

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[114] *Id.* (noting that 50 nations raised nearly half of the $80 million cost of disassembling and moving the temples). Although not culminating in a treaty until the 1970s, international cooperation for the preservation of cultural heritage dates back to the League of Nations' International Museum Office and the 1931 Athens Charter for the Restoration of Historic Monuments. *See* CHRISTINA CAMERON & MECHTILD RÖSSLER, MANY VOICES, ONE VISION: THE EARLY YEARS OF THE WORLD HERITAGE CONVENTION ch. 1 (2013) (ebook).
[115] *The World Heritage Convention*, *supra* note 114.
[116] *See States Parties: Ratification Status*, UNESCO, http://whc.unesco.org/en/statesparties/ (last visited Mar. 21, 2018).
[117] World Heritage Convention, *supra* note 13, at arts. 3-4.
[118] *Id.* at art. 1.
[119] *Id.* at art. 2.
[120] *Id.* at art. 11(1). The World Heritage Committee comprises twenty-one States Parties elected by the General Assembly of UNESCO, with advisory roles for various intergovernmental and non-governmental organizations. *See id.* at arts. 8-10.
[121] *Id.* at 11(2).

name sites "the conservation of which major operations are necessary and for which assistance has been requested under [the] Convention" to the "List of World Heritage in Danger."[122] The Committee may also determine more specific criteria for inclusion on either the World Heritage List or List of World Heritage in Danger.[123]

Once a site is added to either the World Heritage List or the List of World Heritage in Danger, Article 6 obliges all States Parties to protect the site and to not "take any deliberate measures which might damage directly or indirectly" sites of cultural or natural heritage within another State Party.[124] Article 7 further provides a general obligation of all States Parties to cooperate and assist in efforts to conserve and identify cultural and natural heritage.[125] Finally, the last three articles establish the World Heritage Fund, comprised of governmental and private contributions, which the Committee can use to assist States Parties in "the protection, conservation, presentation or rehabilitation of" sites on either of the heritage lists.[126]

2. 2001 UNESCO Convention on the Protection of Underwater Cultural Heritage

In 2001, the international community recognized that the World Heritage Convention and the United Nations Convention on the Law of the Sea both failed to adequately protect cultural heritage at sea, especially heritage located beyond the jurisdiction of any nation, and developed the Convention on the Protection of Underwater Cultural Heritage ("Underwater Heritage Convention" or "UHC") in response.[127] The UHC has 58 parties as of this writing.[128]

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[122] World Heritage Convention, *supra* note 13, at art. 11(4).
[123] *Id.* at art. 11(5).
[124] *Id.* at art. 6.
[125] *Id.* at art. 7.
[126] *Id.* at arts. 13-16. Each State Party is obligated to pay into the Fund in an amount not to exceed one percent of their contribution to the general UNESCO budget. *Id.* at art. 16.
[127] *See* Vadi, *supra* note 26, at 361-62.
[128] *See Convention on the Protection of Underwater Cultural Heritage*, UNESCO, http://www.unesco.org/eri/la/convention.asp?KO=13520&language=E&order=alpha (last visited Mar. 21, 2018).

The Underwater Heritage Convention defines "underwater cultural heritage" as "all traces of human existence having a cultural, historical or archaeological character which have been partially or totally under water, periodically or continuously, for at least 100 years such as ... buildings, structures, artefacts and human remains ... vessels, aircraft ... and objects of prehistoric character."[129] This definition excludes natural heritage, something the World Heritage Convention recognizes,[130] and also draws the arbitrary age threshold of 100 years.[131] The Convention prefers in situ preservation to extraction, and requires salvage operations to be "authorized by the competent authorities."[132]

Importantly, the UHC obligates a State Party and any party under its jurisdiction to avoid direct or indirect damage to protected sites.[133] It further encourages international cooperation, including bilateral and multilateral treaties, to preserve and protect underwater heritage sites.[134] Like other conventions dealing with actions at sea, the UHC alters the obligations and rights of States Parties depending on the location of the heritage site.[135] Importantly for this Article, the UHC includes obligations to protect underwater heritage beyond the jurisdiction of any state, in a region the Convention calls the "Area."[136] Specifically, the Convention requires vessels flying the flag of a State Party to report the discovery of any site in the Area that would qualify as underwater cultural heritage.[137] Any State Party may then declare "its interest in being consulted

[129] Underwater Heritage Convention, *supra* note 13, at art. 1(1)(a).
[130] World Heritage Convention, *supra* note 13, at art. 2.
[131] *See* Vadi, *supra* note 26, at 363 ("The 100-year cut-off point 'has no logic from a scientific viewpoint but [wa]s inserted purely for administrative convenience.'" (quoting Patrick J. O'Keefe, *Protection and International Collaboration: The Legal Framework of the UNESCO Convention 2001*, *in* FINISHING THE INTERRUPTED VOYAGE 90, 91 (Lyndel Prott ed., 2006))).
[132] Underwater Heritage Convention, *supra* note 13, at arts. 2(5), 2(7), 4, 33.
[133] *Id.* at art. 5.
[134] *Id.* at art. 6.
[135] *See id.* at arts. 8-12.
[136] *Id.* at arts. 11-12.
[137] *Id.* at art. 11(1).

on how to ensure the effective protection of that underwater cultural heritage."[138] The UHC calls for the appointment of a "Coordinating State" for each site charged with organizing the consultation of all interested parties and implementing any agreed upon protective measures.[139] The Coordinating State may also grant or deny authorization for future activities at the site.[140] The UHC requires Coordinating States to act "for the benefit of humanity as a whole, on behalf of all States Parties" and with "[p]articular regard . . . to the preferential rights of States of cultural, historical or archaeological origin."[141] States who violate the Convention face sanctions sufficient to deter future violations, which are enforced by the States Parties.[142] Like the WHC, the UHC also calls for States Parties to cooperate in "the protection and management of underwater cultural heritage."[143]

B. Expansion of World and Underwater Heritage into Space: Barriers to Liftoff

As written, the World Heritage and Underwater Heritage Conventions cannot be expanded to include cultural and natural heritage in space for distinct reasons. First, the Underwater Heritage Convention is written to address only those sites "partially or totally underwater."[144] Thus, even though the UHC contemplates preservation of sites beyond the jurisdiction of any state, those sites must be below the Earth's oceans, not in space. The WHC is limited for a different, though related, reason: it requires a site to be within the territory of a State Party.[145] Galactic heritage

[138] Underwater Heritage Convention, *supra* note 13, at art. 11(4).
[139] *Id.* at art. 12(2), 12(4).
[140] *Id.* at art. 12(4)(b).
[141] *Id.* at art. 12(5).
[142] *See id.* at art. 17.
[143] *Id.* at art. 19(1).
[144] Underwater Heritage Convention, *supra* note 13, at art. 1(1)(a).
[145] *See supra* notes 118-124 and accompanying text; *see also* Vadi, *supra* note 26, at 95 ("[W]orld heritage sites, unlike the 'common heritage of mankind,' remain subject to the territorial sovereignty of the territorial state, and property rights are left untouched by the World Heritage Convention."); Ellis, *supra* note 15, at 551 (noting that the Underwater Heritage Treaty demonstrates the intention that the World Heritage programme not extend to areas outside the territory of a State Party). The World Heritage Committee has not shown any interest in outer-space preservation, either. *See* Cecelia Balli, *We Made History on the Moon. But How Do We Preserve It?*, HOUS. CHRON. (Aug. 1, 2017), https://www.houstonchronicle.com/local/gray-matters/article/Moon-Preservation-11402877.php.

sites would therefore also be beyond the scope of the WHC, because, under the Outer Space Treaty, no state may declare sovereignty or jurisdiction over a celestial body.[146] Moreover, the WHC obliges States Parties to take charge of maintaining the sites within their territories, which the OST's no-sovereignty rule renders impracticable.[147]

Realistically, neither the World Heritage nor Underwater Heritage Conventions can be easily extended beyond Earth's orbit to include galactic sites worthy of protection and preservation. That said, the Conventions do provide an ideal framework for a similar treaty, the Galactic Heritage Convention, proposed in the next part.

V. A NEW APPROACH: THE GALACTIC HERITAGE CONVENTION

Although limited in scope, the World Heritage and Underwater Heritage Conventions demonstrate the international community's ability to develop a preservation regime for important cultural and natural sites. These Conventions provide an easily translatable framework for similar preservation of important sites in our galaxy. This Part will discuss how aspects of the WHC and UHC can be combined to create a new Galactic Heritage Convention ("GHC") that will protect sites of cultural importance (for example, the Apollo landing sites), natural importance (for example, Olympus Mons on Mars), and scientific importance (for example, the regions of Mars most likely to host evidence of life). After establishing this framework, Subpart V.B will then discuss the benefits of using the heritage approach to preserve celestial bodies.

A. The Framework: Protecting Cultural and Natural Heritage in Space

Ideally, the Galactic Heritage Convention would include aspects from both the World Heritage Convention and its underwater counterpart. Specifically, the GHC would adopt the

[146] *See* Ellis, *supra* note 15, at 551; Balli, *supra* note 146 (describing the difficulties of designating the Apollo landing sites as National Historic Landmarks under U.S. law, noting that "[the OST] prohibits any country from appropriating outer space").
[147] Ellis, *supra* note 15, at 551.

WHC's inclusion of natural as well as cultural sites so that it may be used to preserve sites of natural and biological importance as well as those considered important to human history. The GHC would then mirror the Underwater Heritage Convention in its approach to recognizing sites, developing measures for their protection, and enforcement of those measures.

The GHC would include provisions for the protection of three main types of sites: (1) cultural heritage sites; (2) natural heritage sites; and (3) scientific sites. As with the WHC, the GHC would allow its governing committee to promulgate more in-depth criteria for inclusion on the List of Galactic Heritage Sites (the "List").[148] Cultural heritage would be defined to include sites of universal value due to their significance to the history of human space exploration. Most notably, the definition would be used to protect the sites of the Apollo 11 and Apollo 17 landings and the sites of any future manned landings on Mars.[149] Unmanned landing sites, such as the Soviet Union's Luna missions, might also be protected from disturbances.

The natural heritage category, unlike cultural heritage, would be used to protect areas of a celestial body that are part of that body's identity and natural beauty regardless of their subjective importance to humanity. Like the WHC's natural heritage category, the GHC would protect areas for their aesthetic value as well.[150] This category could be used to protect certain Maria on the Moon or the highest peaks and most breathtaking valleys on Mars.[151]

Finally, although the WHC includes scientific importance as part of its definition of natural heritage,[152] the GHC would establish scientifically valuable sites as a separate category to

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[148] *See supra* note 124 and accompanying text.
[149] For a history of missions to Mars as of this writing, see *Augmented Reality: Explore InSight, NASA's Latest Mission to Mars*, N.Y. TIMES (Apr. 30, 2018), https://www.nytimes.com/interactive/2018/05/01/science/mars-nasa-insight-ar-3d-ul.html.
[150] *See* World Heritage Convention, *supra* note 13, at art. 2 (protecting sites because of their "universal value from the aesthetic ... point of view").
[151] *See* INT'L ACAD. ASTRONAUTICS, PROTECTING THE ENVIRONMENT OF CELESTIAL BODIES 45-48 (describing sites on the Moon and Mars that might be worthy of protection for their scientific, historic, natural, or future importance).
[152] *See id.*

recognize that the Moon and Mars host manmade devices and naturally insignificant regions that are nonetheless hugely important for future and ongoing scientific research. Crucially, this category would protect the seismological and laser equipment at certain Apollo and Lunar sites on the Moon as well as regions of Mars thought to host evidence of life.

To identify sites within the three categories and to develop measures for their protection, the Galactic Heritage Convention would adopt an approach somewhere between the World Heritage and Underwater Heritage Conventions. Like the WHC, the GHC would create a governing committee that would be in charge of determining which sites make it onto the List of Galactic Heritage Sites or List of Galactic Heritage in Danger.[153] States Parties would elect the Galactic Heritage Committee in a similar manner to the current World Heritage Committee. Because no State Party would have sovereignty over any site in space, except maybe the spacecraft themselves,[154] the GHC would diverge from the WHC in the manner of recommending and protecting sites. Similar to the UHC, the Galactic Heritage Convention would allow any State Party, or flagship of a State Party, to recommend a site for protection to the Galactic Heritage Committee. In addition, the GHC might also permit a special body of scientists to recommend scientifically important areas on celestial bodies. The Galactic Heritage Committee would then decide within a specified timeframe whether the recommended site makes it onto the List. Depending on whether the site is listed for its cultural, natural, or scientific importance, the development and enforcement of protective measures would then differ.

For sites listed for their cultural importance, the Galactic Heritage Committee would notify States Parties of the intention of the Committee to add the site to the List. As under the UHC, States Parties with an interest in the preservation of the galactic cultural site may notify the

[153] *See supra* notes 121-24 and accompanying text.
[154] *See* Ellis, *supra* note 15, at 546

Committee of their desire to be consulted and the Committee shall appoint a Coordinating State and subcommittee of other interested states charged with developing protective measures for the site in question. As a default rule, the GHC would require the Committee to appoint the State Party of mission origin as the Coordinating State, unless it is in the interest of all parties to appoint another state.[155] For example, the United States would be given primary rights to develop protective measures for the Apollo landing sites that make it on the List. The Coordinating State and its subcommittee will develop protective measures within a specified timeframe and publish them. These measures might include restrictions on how close other craft can get to the site as well as limits on the landing trajectories of craft that might fly over the sites.[156] Like the UHC, primary responsibility for enforcing protective measures would fall on the Coordinating State, with all States Parties and their nationals obliged under the Convention to avoid actions directed at a protected site. The Coordinating State would also have the right to authorize or deny any requests to interfere with the cultural site or sites in its charge, though it must act in the interest of all humanity when exercising this discretion.[157] Finally, the GHC would mirror the UHC's encouragement of bilateral and multilateral agreements between nations, especially agreements between those nations most likely to interact with protected areas.[158]

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[155] Preferring the interests of the state of mission origin corresponds with the unique characteristics of a cultural heritage site, the manmade aspects of which are already owned by the state of origin while the surface beneath is considered "res publica." *See* Vadi, *supra* note 26, at 95-96 (discussing the difference between cultural heritage and common heritage).

[156] For regulations NASA has already proposed, see generally NASA PRESERVATION REPORT, *supra* note 20.

[157] The obligation to act in the interest of all humanity is necessary to prevent discriminatory use of the Coordinating State's discretion, such as permitting its own nationals to exploit a site. In essence, the Coordinating State would act as an agent of the Galactic Heritage Committee. This is the same obligation found in the UHC. *See supra* note 142 and accompanying text. It is also in keeping with the OST's requirement that "outer space shall be free for exploration and use by all States without discrimination … on the basis of equality." Outer Space Treaty, *supra* note 12, at art. I. A similar permit system has already been established by Annex V to the Madrid Protocol, which permits the creation of Specially Protected and Specially Managed Areas in Antarctica. *See* Madrid Protocol, *supra* note 43.

[158] *Cf.* Ellis, *supra* note 15, at 556 (noting the importance of agreements between those nations capable of reaching the *R.M.S. Titanic* to the *Titanic's* ultimate protection).

For sites of natural or scientific importance, the protective measures would take into account the interests of humanity and the celestial bodies themselves, with no one state getting preference. Instead, the Galactic Heritage Committee would delineate the protective requirements for a site that all States Parties would then have to follow. As a guide, regulators might look to the Antarctic Treaty System and its environmental protection measures.[159] To add predictability, the treaty might also limit the scope of the measures the Committee could adopt.[160] Additionally, the Convention could require that a recognized body of scientists and representatives from space agencies and private companies be given a role in determining the necessary and proper measures to be adopted. This would give spacefaring nations and companies an extra avenue of input and buy-in, increasing the likelihood of compliance.[161] In any case, the protective measures would again be enforced by sanctions, reporting requirements, and normative pressure from the GHC's hopeful legitimacy.

B. Why This Time is Different: Benefits of the Heritage Law Framework

Admittedly, a Galactic Heritage Convention, or any treaty on environmental protection in space for that matter, is no small feat. Getting nations—most importantly, spacefaring nations—to agree to protect entire swaths of lifeless and semi-lifeless bodies will be challenging when those bodies also present immense opportunities for resource extraction.[162] But if any approach to space environmentalism has the best chance, the heritage law approach appears to be it for several reasons.

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[159] *See* INT'L ACAD. ASTRONAUTICS, *supra* note 152, at 69-73 (describing the Antarctic Treaty System as a foundation for outer-space preservation).
[160] For examples of rules that might be promulgated in galactic heritage sites, see Cockell & Horneck, *supra* note 14, at 294 (suggesting that regulators might restrict waste, modes of access, extent of access, and more within parks).
[161] *See* INT'L ACAD. ASTRONAUTICS, *supra* note 152, at 9 (noting that "it would be unwise to allow a single interest-group, or user-group, to judge which parts of the space environment should be protected and which should not").
[162] *See* Ellis, *supra* note 15, at 551-52 (dismissing the creation of a Galactic Heritage Treaty because of the effort).

First, at least as far as protecting cultural sites, there are longstanding arguments that cultural wealth is hugely important to a nation. Adam Smith wrote on the importance of investing in culture as an economic driver, and cultural economists have since argued that cultural heritage and economics are not as distinct as one might imagine.[163] Indeed, the United States has already shown an interest in preserving its cultural heritage in space by attempting to unilaterally preserve the Apollo landing sites.[164] And the WHC has proven that nations desire to have their cultural resources "'recognized by UNESCO as important for humanity and transported through the prestige of the UN system.'" [165] It is therefore fair to say that there are inherent incentives for the preservation of galactic cultural sites that will encourage states, especially spacefaring nations, to join the GHC out of self-interest. If the GHC is crafted in such a way as to support, rather than abrogate, States Parties' attempts to preserve their own heritage—as the WHC has done—then its success is even more likely.[166]

Second, the heritage approach considers the preservation of sites as an *erga omnes* obligation of all nations "in the interest of humanity as a whole."[167] This for-the-benefit-of-all perspective

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[163] Vadi, *supra* note 26, at 97-98.
[164] *See generally* NASA PRESERVATION REPORT, *supra* note 20; Ellis, *supra* note 15. California and New Mexico have also added artifacts from the Apollo landings to their historic registers. Kenneth Chang, *To Preserve History on the Moon, Visitors Are Asked to Tread Lightly*, N.Y. TIMES (Jan. 9, 2012), https://www.nytimes.com/2012/01/10/science/space/a-push-for-historic-preservation-on-the-moon.html. Russia has similar interests in its lunar history as well. *See* Brad Scriber, *New Moon Race Endangers Historic Space Artifacts*, NAT. GEO. (Aug. 2017), https://www.nationalgeographic.com/magazine/2017/08/space-preserving-moon-from-private-industry/.
[165] CAMERON & RÖSSLER, *supra* note 115, at ch. 6 (quoting Interview by Christina Cameron and Mechtild Rössler with Bernd von Droste, U. Montréal, in Paris, Fr. (Feb. 1, 2008)). The GHC likely would have the same prestige-gaining incentive for states with cultural heritage in space, though it must maintain some level of selectivity to do so. *Cf. id.*
[166] *See* Vadi, *supra* note 26, at 121-22.
[167] *Id.* at 103; *see also* CAMERON & RÖSSLER, *supra* note 115, at ch. 6 (describing the World Heritage Committee's efforts to preserve the Old City of Dubrovnik in Croatia during the Balkan Wars in the absence of a viable state party and noting that "'[t]he great strength of the World Heritage is in establishing the idea that a site that has been placed on the List somehow creates a sort of *ergo omnis* obligation by states'" (quoting Interview by Christina Cameron and Mechtild Rössler with Francesco Francioni, U. Montréal, in Rome, It. (May 5, 2010))); Corrine Brenner, Note, *Cultural Property Law: Reflecting on the Bamiyan Buddhas' Destruction*, 29 SUFFOLK TRANSNAT'L L. REV. 237, 261-68 (discussing whether destruction of a heritage site would violate erga omnes or jus cogens obligations).

fits within the existing framework of international space law—one that considers space as belonging to all mankind and no particular nation or generation.[168] Thus, by approaching environmentalism in space from the heritage perspective, international negotiators are already within the same paradigm as existing space law, making more dramatic changes to the space law treaty system unnecessary.

Third, the heritage approach allows for the consideration of moral arguments for preservation.[169] This allows the international community to define the value of a site based on more than its importance as property (of which there is no concept in space), and to consider arguments for the preservation of areas on lifeless bodies (such as the Moon) and on potentially life-harboring bodies (such as Mars) at the same time. In other words, the heritage approach to space environmentalism allows for flexibility and for a more expansive definition of what can and should be protected.[170]

That said, the heritage system is not without need for improvement. Notably, the WHC does not provide any means for dispute resolution.[171] Indeed, part of its wide acceptance has been its "soft law" approach to preservation.[172] Any galactic heritage treaty must therefore grapple with how best to address the enforcement problem. This Article suggests an approach similar to the Underwater Heritage Convention, whereby Coordinating States (for cultural sites) and the States Parties more generally (for natural and scientific sites) take it upon themselves to impose sanctions against wrongdoers. In addition, the GHC, like the UHC, would encourage bilateral

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[168] *See* Outer Space Treaty, *supra* note 12, at art. I; *see also* Vadi, *supra* note 26, at 104 (noting that "'[h]eritage creates a perception of something handed down; something to be cared for and cherished'" (quoting Lyndel V. Prott & Patrick J. O'Keefe, *'Cultural Heritage' or 'Cultural Property'?*, 1 INT'L J. CULTURAL PROP. 307, 311 (1992)).
[169] Vadi, *supra* note 26, at 105.
[170] *See* CAMERON & RÖSSLER, *supra* note 115, at ch. 6 ("Although the text of the [World Heritage] Convention remains constant, its application has changed with the evolving understanding of heritage conservation theory and practice.").
[171] Vadi, *supra* note 26, at 129-30.
[172] *Id.* at 129.

and multilateral agreements between states, particularly spacefaring nations, to protect sites, though no nation would claim sovereignty. The GHC could also require nations to provide regular reports on their efforts to prevent disturbances to Galactic Heritage Sites, monitoring those efforts to reinforce the GHC's mandates.[173] In the end, enforcement of the GHC would rely on strong normative pressures that have thus far proven effective under the World Heritage Convention.

Indeed, a heritage framework likely will prove more effective than alternatives at the difficult task of enforcing preservation measures in space. The World Heritage Convention has shown that the risk of defection can be mitigated by the "blame and shame" of causing a site to be moved from the World Heritage List to the List of World Heritage in Danger.[174] The World Heritage Committee has also demonstrated its capacity to shape the behavior of sovereign nations through normative pressure.[175] Likewise, the List of Galactic Heritage in Danger can be used to create the same reputational pressures that will mitigate the risk of defections, especially when heritage is viewed as an interest of all humanity. As some scholars have argued, moreover, the progeny of international heritage law has established a general international custom that obliges all states to protect heritage sites.[176] Thus, what one could initially view as a weakness of

[173] The decision of the 1997 General Assembly of States Parties to mandate periodic reporting of conservation efforts under the WHC helped "build a systematic approach to understanding and improving the state of conservation of internationally significant sites." *See* CAMERON & RÖSSLER, *supra* note 115, at ch. 6; *see also* CLAIRE CAVE & ELENE NEGUSSIE, WORLD HERITAGE CONSERVATION: THE WORLD HERITAGE CONVENTION, LINKING CULTURE AND NATURE FOR SUSTAINABLE DEVELOPMENT 254 (2017) ("[A] major success regarding the implementation of the World Heritage Convention has been the systematic monitoring of sites.").
[174] *See* Vadi, *supra* note 26, at 111 (noting that "a number of states have taken action to prevent delisting [of a World Heritage Site] because of the consequential perceived loss of reputation").
[175] *See id.* at 131-32 (citing the example of the City of Cologne eventually rescaling planned skyscraper projects after pressure from the World Heritage Committee); *see also* CAMERON & RÖSSLER, *supra* note 115, at ch. 6 ("Through key policy and site-specific decisions, the World Heritage System affected the way that heritage values were perceived and conservation strategies were formulated.... Its influence on global practice in cultural and natural heritage conservation is undeniable.").
[176] *See supra* note 168 and accompanying text; *see also* Vadi, *supra* note 26, at 120-21 (noting also that protection of cultural heritage has been linked to fundamental human rights). For an argument that another custom of international

mirroring the WHC (its soft law approach) may actually prove to be a strength. That is, by adopting the approach of a widely accepted treaty, the GHC can capitalize on custom and wide acceptance as a means of normative enforcement.[177]

In addition to enforcement concerns, the cost of protecting galactic sites is another potential barrier to the GHC's effective implementation. It is undeniable that a lack of financial support has hampered preservation of World Heritage Sites. Although establishing a World Heritage Fund to help developing nations protect their heritage sites, the WHC has done little in the way of substantive support.[178] Arguably, preservation of galactic sites could be even more expensive given travel costs and other imponderables. In reality, however, the Galactic Heritage Sites would be easier to protect, because: (1) until settlement of space is widespread, protecting sites will be relatively inexpensive, as states could simply plan in advance to leave certain areas alone; and (2) those nations and companies with the ability to disturb galactic sites are also most likely to have the resources to afford compliance costs.[179] Therefore, the GHC would be a low-cost convention, requiring little expense to preserve sites and pushing any costs onto those nations and parties most capable of absorbing them. In fact, there is potential that galactic heritage

law, the precautionary principle, provides the impetus for states to avoid harms to galactic environments, see generally Larsen, *supra* note 43.

[177] Wide acceptance has similarly been key to the Outer Space Treaty's continued legitimacy. *See supra* note 107 and accompanying text.

[178] *See* CAMERON & RÖSSLER, *supra* note 115, at ch. 6 (opining that '[t]he level of resourcing to support World Heritage sites, particularly in less developed countries, is way behind what is expected." (quoting Interview by Christina Cameron and Mechtild Rössler with Natarajan Ishwaran, U. Montréal, in Paris, Fr. (March 2, 2009))).

[179] For example, NASA's requested budget for Fiscal Year 2019 will be an estimated $19.9 billion, including $10.5 billion for space exploration. NAT'L AERONAUTICS & SPACE ADMIN., FY 2019 BUDGET ESTIMATES (2018). Although spending a much smaller amount (an estimated $2 billion a year in 2015), China's space program "has grown roughly 10% a year for the past decade." Kelly Dickerson, *China's Space Program is Growing Extremely Fast*, BUS. INSIDER (June 16, 2015), http://www.businessinsider.com/how-big-is-chinas-space-program-2015-6. And, in 2017, private spaceflight company, SpaceX, was "valued at around $21 billion, making it one of the most valuable privately held companies in the world." Katie Benner & Kenneth Chang, *SpaceX is Now One of the World's Most Valuable Privately Held Companies*, N.Y. TIMES (July 27, 2017), https://www.nytimes.com/2017/07/27/technology/spacex-is-now-one-of-the-worlds-most-valuable-privately-held-companies.html.

designations could boost revenues for private companies by creating space tourism destinations, offsetting compliance costs and encouraging preservation.[180]

Undoubtedly, using the WHC and UHC as a framework for galactic preservation presents an opportunity to begin the important task of regulating human exploitation of celestial bodies. The heritage paradigm allows nations to take ownership of their own cultural history while also obliging states to preserve sites of natural and scientific importance for the benefit of all humankind. The GHC could take a softer approach, like the WHC, but that does not mean it would be ineffective. Normative pressures coupled with the potential for sanctions can control potential defectors, and the exact enforcement mechanisms can be determined at the negotiating table. Its low cost would also incentivize States Parties to observe it. Regardless of its enforcement, the Galactic Heritage Convention proposed in this Article would allow for flexibility in protecting the beauty and value of our heavenly neighbors before humans have the chance to pollute their relatively untampered landscapes.

CONCLUSION

Humans are returning to space. In one way or another, manmade craft and their crews will soon populate the surface of the Moon and even Mars. This exploration will be largely private and will be driven by the promise of lucrative resources. The resources of our orbital neighbors will surely improve life here on Earth, but their unbridled extraction threatens to ruin what we may not yet understand. The intangible and universal value of scientific discovery, natural beauty, and untouched lifeforms hangs in the balance. A treaty is therefore necessary to

[180] *Cf.* CAVE & NEGUSSIE, *supra* note 174, at 254-55 (describing the positive and negative impact of tourism on World Heritage Sites and noting the economic incentives of a World Heritage designation). Tourism might also be a vital part of creating normative pressure to comply with the GHC. *See* Cockell & Horneck, *supra* note 14, at 294 (observing that "preservation of the Grand Canyon National Park … is made possible by encouraging people to visit and appreciate its splendor and special status").

harmonize the economic and technological importance of galactic resources with the cultural, natural, and scientific legacy of space.

The Galactic Heritage Convention that this Article proposes takes the structure of heritage law on Earth and applies it to cosmic worlds. It recognizes the importance of our own heritage in space and the heritage of celestial bodies in their own right. The GHC would lay predictable and defined ground rules, a benefit to commercial and governmental explorers alike. It would work within the existing no-sovereignty regime of space law by placing the responsibility for preservation in humanity as a whole and no nation in particular, while at the same time giving States Parties input into the preservation of important missions in their spacefaring history. Ultimately, the GHC would preserve fragile environments and artifacts for uses that benefit humanity and our solar system, taking preservation to infinity and beyond.