

The Development of a Lunar Land Ethic

Jessica Heim

Abstract. ‘Space ethics’ is a term which encompasses a wide variety of ethical quandaries. Issues such as how we should treat extraterrestrial life if we encounter it (even in the form of bacteria), whether it is permissible to genetically alter humans, so that they are more suited to space travel, and what degree of resource extraction is acceptable in space (is it acceptable to mine an asteroid into oblivion?). All can be considered aspects of space ethics. In this paper, I will focus primarily on a particular subset of space ethics – that of how we ought or ought not to treat terrestrial environments outside the Earth, specifically that of the Moon. As the response people have regarding such questions are rooted in their conception of the nature of the relationship between humans and their environment, I will examine some of the predominant ideas in the space community on this subject, as well as address critiques of the status quo. I will also explore alternative perspectives which may lead to more favorable outcomes for both the future of humanity in space, as well as to more sound treatment of the terrestrial environments we explore, and will offer thoughts on the development of a lunar land ethic.

Just over fifty years ago, Apollo astronauts traveled to the moon for the first time. Though the central focus of these missions was to land successfully on the lunar surface, learn more about the Moon, and return safely to Earth, one of most lasting and influential impacts of these voyages was not about the Moon at all. Rather it was the image of our Earth, the beautiful ‘blue marble’¹ floating in space, which captivated the human race. As Apollo astronaut Jim Lovell described it, ‘here we came all this

¹ See BBC *Sky at Night* Magazine, ‘Pictures of Earth from space’, 31 August, 2021,

< <https://www.skyatnightmagazine.com/space-missions/pictures-earth-from-space/> > [accessed 8 October, 2022].

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way to the Moon and yet the most significant thing we are seeing is our own home planet, the Earth'.² Never before had we seen images of our entire planet from afar, and the sight of it, described by Lovell as 'a grand oasis in the big vastness of space', was compelling.³ Describing the view of the Earth at such a distance, Apollo astronaut Rusty Schweickart noted that it 'is so small and so fragile and such a precious little spot in that universe... and you realize on that small spot, that little blue and white thing, is everything that means anything to you'.⁴ Though this shift in perspective brought about by seeing the Earth from a distance, termed the 'Overview Effect' by Frank White, was certainly felt most deeply by the astronauts themselves, the photographs of this view affected the larger human consciousness as well. In the following decade, the nascent environmental movement began to take off, with many key pieces of legislation being passed, for example the Clean Air and Clean Water Acts in the United States. The idea that we all share this fragile planet and need to work together to take care of it became more widespread, and the first Earth Day was celebrated in 1970.⁵

It was in this era that the discipline of environmental ethics began to come into its own, with the first classes in this field being offered in the early 1970's and a journal, *Environmental Ethics*, beginning publication by the end of the decade.⁶ The field is now well established, and there are many books and papers examining what a proper relationship between

² Alan Ritsko, *Nova: To the Moon* (Lone Wolf Studios, 1999), cited in Holly Henry and Amanda Taylor, 'Re-thinking Apollo: Envisioning Environmentalism in Space', in David Bell and Martin Parke, eds, *Space Travel & Culture* (Malden, MA: Blackwell Publishing, 2009), pp.190–203, p.193.

³ World Peace Through Technology, 'The Overview Effect: Cosmic Consciousness and the Big Picture,' < <https://wptt.org/2013/12/21/the-overview-effect-cosmic-consciousness-and-the-big-picture/> > [accessed 28 June 2019].

⁴ Russell L. Schweickart, *No Frames, No Boundaries* (film commentary), Creative Initiative/Beyond War, Palo Alto, CA. From *Earth's Answer: Explorations of Planetary Culture at the Lindesfarne Conferences* (West Stockbridge, MA: Lindesfarne/Harper & Row, 1977), cited in Frank White, *The Overview Effect: Space Exploration and Human Evolution*, 3rd edn (Reston, VA: American Institute of Aeronautics and Astronautics, Inc., 2014), p.37.

⁵ 'The History of Earth Day', <https://www.earthday.org/history/> [accessed 13 February 2022].

⁶ Holmes Rolston III, *A New Environmental Ethics: The Next Millennium for Life on Earth*, (New York, NY: Routledge, 2012), p.20.

humans and the rest of Earth's natural world might look like.⁷ However, the field of space ethics, 'what we should and shouldn't do in space', is much less well-developed.⁸ This may be due, in part, to the fact that since the Apollo missions of the 1960's and 1970's, humans have not ventured beyond low-Earth orbit. However, with renewed interest in human space exploration in recent years in both the public and private sectors, the study and implementation of space ethics need no longer be of interest to academics alone. Rather, increased human presence in space necessitates that discussion of such topics comes to the forefront. As greater numbers of people with varying interests engage in off-Earth activities ranging from scientific study to resource extraction to human settlements, their actions will have a lasting impact upon the celestial bodies involved. Thus, the time is right for a deeper and more widespread examination of how we view ourselves not only in relation to the Earth but in relation to the larger space environment as well. It is therefore necessary to consider the wider area of space ethics and the narrower field of how we ought or ought not to treat terrestrial environments outside the Earth, specifically that of the Moon.

Human Relationship with the Space Environment

A central question to ask when considering the development of a lunar land use ethic is, 'What is the story we tell of our relationship to the space

⁷ See Nicholas Campion, 'Adventures in Space: Harmony, Sustainability and Environmental Ethics', in Nicholas Campion and Chris Impey, eds, *Imagining Other Worlds* (Lampeter: Sophia Centre Press, 2018), pp.69–85. For recent discussions see James S.J. Schwartz and Tony Milligan, "'Space ethics" according to space ethicists', *The Space Review*, <https://www.thespacereview.com/article/4117/1> [accessed 13 February, 2022]; Zachary J. Goldberg, 'The Ethics of Space Exploration', Trilateral Research, <https://www.trilateralresearch.com/the-ethics-of-space-exploration/> [accessed 13 Feb 2022]. For recent discussions on the Moon, see Daniel Capper, 'What Should We Do with Our Moon?: Ethics and Policy for Establishing International Multiuse Lunar Land Reserves', *Space Policy* 59 (February 2022), <https://www.sciencedirect.com/science/article/abs/pii/S0265964621000540> [accessed 13 Feb 2022]; and Evie Kendal, 'Five ethical questions for how we choose to use the Moon', *The Conversation*, 2 June 2019, <https://theconversation.com/five-ethical-questions-for-how-we-choose-to-use-the-moon-116801> [accessed 13 Feb 2022].

⁸ Mark Williamson, 'Space Ethics and Protection of the Space Environment', *Space Policy* 19 (2003): pp.47–52, p.48.

environment?⁹ A prevalent theme in the history of space exploration is the idea of space as a frontier, a wild place full of danger, which humans must overcome. Gifford Pinchot, the United States' first director of the Forest Service and proponent of the 'wise use' of the nation's forests, expressed such sentiment at the start of the twentieth century, stating, 'The first duty of the human race is to control the earth it lives upon... Out of this attack on what nature has given us we have won a new kind of prosperity'.¹⁰ This idea of the Earth as something entirely separate from humans, something to be conquered, became part and parcel of the rhetoric of the Space Age and, despite a more widespread ecological awareness, is still deeply embedded in the framework of space exploration. In talking about their focus on reinvigorating efforts to return to the Moon, former US President Donald Trump and Vice President Mike Pence repeatedly evoked the image of a space pioneer of sorts, emissary of 'American leadership and American values' who explores space in a manner akin to those early explorers who were 'discovering the new world'.¹¹ Frequent reference to the 'frontier' was made in Trump's rhetoric, harkening back to an earlier age in America's history when there was still, for the European colonists, a 'frontier' to settle, never mind the existing indigenous population.

Similarly, there are many who view bodies such as the Moon and asteroids primarily as rich sources of raw materials which will be of great use in facilitating more extensive human exploration and exploitation of the space environment. For instance, Trump's Commerce Secretary, Wilbur Ross, spoke of 'turning the Moon into a kind of gas station for outer space', noting how water on the Moon could be broken down and used for fuel.¹² Though this particular example is rather strongly worded and perhaps slightly jarring to those who have not thought of the Moon in this manner, there are many advocates of the extensive utilization of space

⁹ See Campion, 'Adventures in Space', pp.77–8.

¹⁰ Gifford Pinchot, 'The Fight for Conservation.' in Donald Worster, ed., *American Environmentalism: The Formative Period, 1860-1915* (New York: Wiley, 1973), cited in Holmes Rolston III, *A New Environmental Ethics: The Next Millennium for Life on Earth*, (New York: Routledge, 2012), p.23.

¹¹ NASA Video, *Presidential Space Policy Directs NASA to Return Humans to Moon*, 11 December, 2019, <<https://www.youtube.com/watch?v=GNZY6BHTg2o&feature=youtu.be>> [accessed 3 March 2019].

¹² CNBC, 'Wilbur Ross on Space Race: We Want to Turn the Moon Into a Gas Station,' 22 February, 2018, <<https://www.cnbc.com/2018/02/22/wilbur-ross-on-space-race-we-want-to-turn-the-moon-into-a-gas-station.html>> [accessed 28 June 2019].

resources who argue that such development will help preserve the Earth. For example, in the 1970's, Princeton physics professor Gerard O'Neill argued that the 'dirty' industry should move into space; that way, it will be a much nicer place down here on Earth.¹³ This thinking is echoed more recently by Jeff Bezos, who likewise advocates for large scale mining in space, referring to this as the 'Great Inversion', described by Christian Davenport as 'mining for energy resources in space, while leaving Earth alone'.¹⁴ In this view, the best way to protect Earth is simply to take our polluting processes elsewhere.

Space: a Place With Unlimited Resources?

Frequently associated with the concept of space resource extraction is the idea that space resources are infinite, and therefore we no longer need to feel constrained by limits. Both Elon Musk and Jeff Bezos appear to subscribe to this idea, with Musk declaring that a million people could be living on Mars in a hundred years and Bezos believing that the solar system has the resources to support a trillion humans.¹⁵ Space enthusiast David Harland neatly expresses this widespread sentiment, stating, 'The prospects for mankind as a spacefaring species are encouraging. The solar system is our backyard. It has all the resources that we'll ever need... The resources of the Moon will enable us to venture into deep space'.¹⁶ In this way of thinking, we don't need to be as concerned about limited resources and worry about what our future may be like should we fail to develop sufficient ways to live sustainably within the Earth's ability to provide – we can simply utilize those resources offered by the asteroids and other terrestrial bodies. As Jeff Bezos proclaimed, 'I want my great-great

¹³ The Roundtable, 'Interview with Gerard O'Neill and Isaac Asimov', Originally broadcast in 1975 (24 May 2018) < <https://www.youtube.com/watch?v=DM88sUBTTRM&feature=youtu.be> > [accessed 15 May 2019].

¹⁴ Christian Davenport, *The Space Barons: Elon Musk, Jeff Bezos, and the Quest to Colonize the Cosmos* (New York: Public Affairs Hachette Book Group, 2018), p.259.

¹⁵ National Geographic, 'Elon Musk: A Million Humans Could Live on Mars By the 2060s,' < <https://news.nationalgeographic.com/2016/09/elon-musk-spacex-exploring-mars-planets-space-science/> > [accessed 15 May 2019]; 'Jeff Bezos Just Gave a Private Talk in New York', *Business Insider*, 23 February 2019, < <https://www.businessinsider.com/jeff-bezos-blue-origin-wings-club-presentation-transcript-2019-2> > [accessed 14 May 2019].

¹⁶ David M. Harland, *Moon: From 4.5 Billion Years Ago to the Present*, Haynes Owner's Workshop Manual (Newbury Park, CA: Haynes Publishing, 2016), p.171.

grandchildren to be using more energy per capita than I do'.¹⁷ Thus, if resources are unlimited, then conservation need not be as central to ensuring a good future for our descendants.

Relationship Between Humans and the Land

While ideas that humans are fundamentally separate from their environment and can do with it what they see fit – that the Moon and other celestial bodies are primarily of value due to their potential as sources of raw materials, that space resources are in infinite abundance, and that moving our environmentally ‘unfriendly’ activities off-Earth is a solution to our environmental woes are widespread – there have been many critiques of such ways of thinking. Back in 1948, forester and environmental thinker Aldo Leopold wrote at length about the problematic consequences brought about by the predominant mindset of viewing the land as simply a resource to be used. ‘We abuse land because we regard it as a commodity belonging to us. When we see land as a community to which we belong, we may begin to use it with love and respect.’¹⁸ As part of improved land management strategies, Leopold advocated for the development of a ‘land ethic,’ in which one views oneself as a ‘member of a community of interdependent parts’ which includes ‘the land...’¹⁹ Such an ethic, Leopold argues, ‘changes the role of *Homo sapiens* from conqueror of the land-community to plain member and citizen of it, noting that ‘the conqueror role is eventually self-defeating’ anyway.²⁰ Changing how one views oneself in relation to the environment will lead to both improved health of the environment and to enhanced human well-being, Leopold believes. Similar thinking regarding the importance for humans to more fully realize their connectedness to the world around them has been expressed by many others. His Holiness the Dalai Lama has spoken frequently about compassion, world peace, and the environment. ‘Just as we should cultivate gentle and peaceful relations with our fellow human beings’, he says, ‘we should also extend that same attitude toward the natural environment’, noting that eventually we will suffer if we fail to do

¹⁷ Christian Davenport, *The Space Barons: Elon Musk, Jeff Bezos, and the Quest to Colonize the Cosmos*, (New York: Public Affairs Hachette Book Group, 2018), p.260.

¹⁸ Aldo Leopold, *A Sand County Almanac and Sketches Here and There* (New York: Oxford University Press, 1949), p.viii.

¹⁹ Aldo Leopold, *A Sand County Almanac*, pp. 203–04.

²⁰ Aldo Leopold, *A Sand County Almanac*, p.204.

this.²¹ Though neither Leopold nor the Dalai Lama were referring to the environment outside of Earth, extending such Earth based ethics to our nearest celestial neighbors, such as the Moon, seems like a natural consequence of a broadening sphere of moral consideration.

Space Resource Utilization

Regarding space resource extraction (lunar and asteroid mining), aside from the question of whether easily accessible resources in the solar system are in fact, truly unlimited, there is the issue of whether the approach of exporting pollution off-Earth really solves our environmental problems – after all, the environment can be considered to be the physical surroundings in which one finds oneself – ‘environmental’ issues need not exclusively refer to those occurring on the Earth. Even if resource extraction on the Moon and asteroids becomes technologically and economically feasible, by engaging in such large-scale exploitation, are we really being as environmentally conscious as we think we are? Or, as Tony Milligan wonders, ‘are we going to do exactly what some skeptics have suggested all along by carrying our flawed practices into a larger arena?’²² Though finding new ways to protect the Earth is certainly laudable, if, for example, we turn much of the lunar surface into a strip mine (a potential scenario should Helium-3 extraction become viable), and destroy much of the evidence of its geological history in the process, it seems there may be problematic elements in our ‘environmental’ ethic.

Then there are potential issues brought about by the opening up of new sources of resources. For example, if we at some point are able to obtain large quantities of metals or other resources in space, how conservative would people be in utilizing such materials if they believed that these were available in limitless supply? Granted, economic and technological challenges may put limits on what is feasible to access, and perhaps resources thus obtained would be used exclusively for a limited set of projects, but the question still remains of how increasing supply in this way may affect attitudes and consumption patterns. In response to O’Neill’s ideas about creating space colonies and using resources from space, essayist Wendell Berry voiced strong opposition, arguing that such a mindset is ‘absolute obedience to the law of the frontier: humans are destructive in proportion to their supposition of abundance; if they are

²¹ His Holiness The Dalai Lama, *Worlds in Harmony: Compassionate Action for a Better World*, 2nd edn (Berkeley, CA: Parallax Press, 2004), p.54.

²² Tony Milligan, *Nobody Owns the Moon: The Ethics of Space Exploration* (Jefferson, NC: McFarland & Company, Inc., Publishers, 2015), p.100.

faced with an infinite abundance, then they will become infinitely destructive'.²³ Berry asserted that utilizing space resources sidesteps the whole issue of trying to live sustainably and simply allows us to continue our wasteful ways.

Stewardship of the Space Environment

Though it seems that if humans are to continue to explore the Moon, Mars and beyond, some resource utilization on these locales may be necessary or preferable to using materials sourced exclusively from Earth, it is questionable whether a mindset in which the Moon or asteroids are seen simply as a source of materials for use is ethically optimal.²⁴ As Milligan ponders, to understand the Moon 'merely as a resource seems, in some way, to fall short of what it is to acknowledge our human potential. We can be so much more than the beings who seize and appropriate all that surrounds us'.²⁵ Perhaps the answer lies less in a dichotomy of *whether* we should utilize resources from space, but in *what context* and in *what manner* we might do so without bringing about destruction on a scale similar to or greater than what we have done with Earth based mining. Though the process of mining the Moon will likely not result in ecological harm or disruption of indigenous communities, as is frequently the case on Earth, it is indisputable that large scale resource utilization will cause extensive and permanent alterations to the landscape, as well as potentially rendering the area being thus used no longer as useful a source of useful scientific information about the geologic history of that region. How best to balance preservation of landscape and scientific data with potential resource use?

One possible way of viewing optimal treatment of the both the Earth and the Moon is the idea of stewardship. According to Robert Seddon, 'Stewardship... implies not a duty to leave things just as they are, but a duty to preserve information and avoid thoughtless, wasteful destruction'.²⁶ Such thinking may be an improvement over the 'man as conqueror'

²³ 'Comments on O'Neill's Space Colonies - Wendell Berry', in Stewart Brand, ed., *Space Colonies* (San Francisco, CA: A CoEvolution Book, Published by the Whole Earth Catalog, Waller Press, 1977), pp.36-7, p.36.

²⁴ See Richard York, 'Towards a Martian Land Ethic', *Human Ecology Review* 12 no, 1 (2005), pp.72-73.

²⁵ Tony Milligan, *Nobody Owns the Moon*, p.99.

²⁶ Robert Seddon, 'Exploring the Heavens and the Heritage of Mankind', Jai Galliot, ed., *Commercial Space Exploration*, (Burlington, VT: Ashgate Publishing Company, 2015), pp.149-60, p.138.

perspective, yet it still is insufficiently detailed to assist in the determination of whether it is acceptable to mine or otherwise alter a given locale. Some space thinkers have attempted to articulate a more extensive methodology to assist in determining what might or might not constitute ethically defensible actions. For example, Milligan argues that ‘the protection of objects of scientific curiosity should be a priority’, and that exploitation of space resources for use in scientific research outposts and space settlements would be more justifiable than for use in space tourism, as ‘We know of no ethical duty that space tourism uniquely helps satisfy’.²⁷ Milligan also argues against ‘trivial or frivolous use’ of such resources.²⁸ Holmes Rolston III, a key figure in the development of environmental ethics, also offers suggestions for elements to consider when determining locations off-Earth that are specifically deserving of preservation. He believes locations which show evidence of creative geologic or other physical processes, are examples of ‘exotic extremes’, or which ‘radically transform human perspective’, are among those that should be protected.²⁹ While such frameworks are certainly not the end of the story, they are useful starting points for discussion of ethical elements of human actions on the Moon.

Berry also lends insight into another aspect to consider when attempting to gain some degree of consensus on the parameters of lunar land use: ‘people *exploit* what they have merely concluded to be of value, but they *defend* what they love’.³⁰ In other words, based on this line of reasoning, the only way people are going to care about the development of a lunar land ethic is if they have a personal emotional connection to the Moon and see it not just as a location containing a specific set of chemical elements, but also as a ‘place’, that is, somewhere which has ‘distinctive meanings

²⁷ James S.J, Schwartz and Tony Milligan, ‘Some Ethical Constraints on Near-Earth Resource Exploitation’, in Cenani Al-Ekabi, Blandina Baranes, Peter Hulsroj, and Arne Lahcen, eds, *European Space Policy Institute Yearbook on Space Policy 2015* (Austria: Springer, 2017), pp.237–39, pp.238 and 234.

²⁸ James S.J, Schwartz and Tony Milligan, ‘Some Ethical Constraints on Near-Earth Resource Exploitation’, in *European Space Policy Institute Yearbook on Space Policy* (2015): p.234.

²⁹ Holmes Rolston III, ‘The Preservation of Natural Value in the Solar System’, Eugene C. Hargrove, ed., in *Beyond Spaceship Earth: Environmental Ethics and the Solar System* (San Francisco, CA: Sierra Club Books, 1986), pp.140–82, pp.173–78.

³⁰ Wendell Berry, *Life is a Miracle: An Essay Against Modern Superstition*, (Berkeley, CA: Counterpoint, 2000), p.41.

and values for persons' and is more grounded in human experience.³¹ Though the Moon has certainly held a place of importance in cultures throughout the world, perhaps being able to actually physically visit the Moon will engender a greater degree of connection to it, thereby leading to more extensive discourse on the development of a lunar land ethic and to the creation of a more truly sustainable society in space.

³¹ Christopher Tilley, *A Phenomenology of Landscape* (Oxford: Berg Publishers, 1994), p.15.