Chapter 14
The Emergence of an Environmental Ethos on Luna

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Abstract

Questions of how humanity should undertake and regulate activities on the Moon have been considered for over half a century. In this chapter we outline the various philosophical approaches out of which an environmental ethos may emerges on Luna (the Earth's Moon). We draw on existing thinking within environmental ethics, particularly in regards to wildernesses, and consider the diversity of religious and philosophical frameworks and nascent relevant legal structures. Commercial and competitive considerations militate against stakeholders readily adopting shared norms. Nevertheless, there remains a need for some sort of a Treaty or other form of binding agreement that can be signed, ratified and enacted by all spacefaring nations, rather as the Antarctic Treaty has been by all nations with direct involvement there. This need is becoming more urgent.

Keywords

Environmental ethics . Luna . The Moon . Wilderness . Outer Space

14.1 Introduction

Almost immediately after Apollo 11 landed on the Moon on 24 July 1969, questions of how to regulate activities on the Moon, and potentially other celestial bodies, became a subject of focused study and concern. It still took a further 15 years before the Moon Agreement, also known as the Moon Treaty, was ratified, after the minimum required five members states had signed. However, this Treaty, for reason we discuss below, has proved ineffectual, despite providing a valuable statement of intention.

The regulation of lunar activities can be examined from a number of perspectives – legal, political, scientific and ethical. Our principal focus in this chapter is on ethical considerations. Our argument is that there is much to be learnt from the well-founded discipline of environmental ethics, with the Moon being considered as an example of an extreme environment. We therefore look at wildernesses to see what lessons might be learnt. We conclude by examining what would be desirable with respect to how humans use the resources of the Moon, and considering how agreement might be reached.

14.2 Approaches to Environmental Ethics

Ethics is the branch of philosophy concerned with how we should decide what is morally wrong and what is morally right. Humans have been guided by ethical considerations since before our species, *Homo sapiens*, evolved. If we look at other animal species, we can discern rules that guide their behaviour. Indeed, in our closest evolutionary relatives, the great apes, we can see evidence of many of the same ethical issues that occupy us. Jane Goodall's

pioneering work on chimpanzees, for example, showed how individuals formed alliances to their mutual benefit, behaved as though they had certain moral obligations and routinely attempted to deceive other chimpanzees (van Lawick-Goodall 1971).

Traditionally, Western academic accounts of human ethics have examined the deontological approaches of Immanuel Kant and others (including the role of religion), consequentialist thinking (particularly Jeremy Bentham's utilitarianism and John Stuart Mill's refinement of this) and then the more recent turn to virtue ethics (deriving from Aristotle). A different approach is to examine more recent works in anthropology and the social sciences to look at what 'ordinary people' (rather than academic ethicists) think about what is morally right or wrong, and at what people actually do.

One major recent study analysed ethnographic accounts of ethics from 60 different societies, around the world (Curry et al. 2019). The authors found seven moral rules: help your family, help your group, return favours, be brave, defer to superiors, divide resources fairly and respect others' property. Examples of most of these rules were found in most societies and there were no examples of societies in which any of these behaviours were considered morally bad. Significantly, these rules were observed with equal frequency across continents: they were not the exclusive preserve of 'the West' or any other region.

However, one notable feature of these rules is that they apply only to humans. Similarly, while religions have some ethical precepts applying to non-humans, the focus in the Abrahamic faiths is overwhelmingly on relations between people, and between people and God. Indeed, in Judaism, Christianity and Sufism, humans are specifically seen as created in the image and likeness of God – *Imago Dei*, placing them above the rest of the created order. However, there have been moves within Abrahamic theology to come to a deeper understanding of how humans should relate to the whole of the creation. In part, such moves have been driven by greater awareness of ecological considerations (e.g., Page 1996).

Other religions have more consistently given ethical consideration to non-humans. One of Buddhism's central precepts is compassion for all of life and many Buddhists are vegetarian. Hinduism (though it is difficult to generalise as, more than most religions, it is an amalgam of many traditions and philosophies) teaches that all living creatures have a soul, and meat eating is typically either restricted or avoided. Jains not only are vegetarians but avoid eating underground vegetables such as potatoes and onions to prevent harm to soil organisms. The Bahá'í faith emphasises that animals should be treated with kindness, and recognises the need for stewardship of the natural environment.

Secular philosophies have also paid attention to non-humans. Bentham is rightly remembered for his "The question is not, Can they reason?, nor Can they talk? but, Can they suffer? Why should the law refuse its protection to any sensitive being?" (Bentham 1789/1970, p. 283n) and utilitarians such as Peter Singer (1975) have developed this train of thought, arguing that much of human attitudes and behaviour towards non-human animals is speciesist. Our focus in this chapter is on still broader issues, namely environmental ethics.

It has long been appreciated that indigenous communities can have and operate with a rich conceptualisation of environmental ethics. There is a danger of romanticisation here – we should remember that in many parts of the world indigenous people have been responsible for environmental degradation, indeed, the extinction of many species, particularly large mammals and flightless birds through overexploitation (e.g., Smith et al. 2018). Nevertheless,

though a range of mechanisms (religious traditions, mythical narratives, long-lasting informal agreements), many indigenous people do make more sustainable use of their environmental resources than do many modern people (e.g., Kelbessa 2005). In the West, too, the eighteenth and nineteenth centuries saw a growth in appreciation of wild places and land more generally (cf. Leopold 1949).

In the Western tradition, a key issue in environmental ethics has been the distinction between 'instrumental value' and 'intrinsic value'. In essence, the notion of intrinsic value is simply an extension of Kant's categorical imperative – that humans (in Kant's case) and environments (in environmental ethics) should be valued and treated not merely for what they can do for us (the 'ecosystem services' approach) but, at least in part, for what they are in themselves. This approach to valuing the environment developed in a number of countries (Brennan & Lo 2020). In the USA, Leopold's arguments that land as a whole is worthy of our moral concern was echoed by Stone (1972), who argued that natural objects such as trees should have the same standing in law as corporations, Holmes Rolston III (1975), who argued that humans have a moral duty to preserve species, and Paul Taylor (1986) who argued that whole ecosystems are worthy of moral consideration. But it is the Norwegian Arne Næss who is perhaps most associated with this movement, with his call to 'deep ecology', which again espoused the importance of the intrinsic value of nature and rejected the notion of humans as individuals, separate from the rest of the world (Brennan & Lo 2020). Næss was born in 1912 and in 1939 took up the post of Professor of Philosophy at the University of Oslo. He was an accomplished mountaineer and took part in Green Party politics and in nonviolent environmental action, for instance, chaining himself in 1970 to the rocks at the Mardal waterfall to protest against a projected dam (Krabbe 2010).

As part of these considerations there is also the issue of the exercise of our human capacities, including our rights, perhaps even obligation to life itself, to carve out our place in the cosmos, and that in doing so we fulfil our potential as a species, 'an ethics of fulfilment'. This may include adapting environments, recognising that stewardship in its most complete sense is not simply about keeping things in balance, but is a dynamic process of which we are a part (Norman 2020).

14.3 Wilderness on Earth

What we might term 'space ethics' is at an early phase in its development (Szocik et al. 2020) and issues to do with the environment have only begun to be examined. We can draw usefully by looking at ethical attitudes and issues that have arisen in respect of wilderness on Earth.

Wilderness consists of natural environments on Earth that have been relatively undisturbed by human action. Traditionally, wilderness was assumed to be terrestrial but more attention is now being paid to marine wilderness. The rapidly increasing and global reach of human activity means that interest in wilderness has unsurprisingly grown over the last century or so. If we just focus for a moment on the country in which the two of us live, the United Kingdom, there has been a rapid and recent growth in what is now called 'rewilding'. Rewilding is a form of ecological restoration in which humans let nature take its course to a greater extent than is traditional in conservation, where habitat 'management' take a lot of time and effort. So, for example, The Great Fen Project (https://www.greatfen.org.uk) lies between Huntingdon and Peterborough and entails moving land from high-intensity arable

use to low-intensity beef and lamb production as a result of the use of cattle and sheep for habitat management. While the main arguments in favour of the project are to do with the enhancement of wildlife diversity, there are expected to be human benefits too through less soil erosion, less flooding and new sources of income such as willow and reed harvesting. Rewilding often goes hand in hand with the reintroduction of species that became endangered or were driven to extinction by human activity and the UK has seen the reintroduction of a number of animals, including sea eagles, red kites, bitterns, pool frogs, natterjack toads, sand lizards, smooth snakes, wild boar, pine martens, the chequered skipper butterfly, the ladybird spider and the Eurasian beaver (Rewilding Britain 2021).

On a larger scale, the John Muir Wilderness in California covers some 2,350 km^2 (Figure 14.1). It was established in 1964 as a result of the Wilderness Act and named after the Scottish-American naturalist John Muir (1838-1914), whose early environmental activism helped to preserve the Yosemite Valley and Sequoia National Park. Today, the most comprehensive listing of wilderness and other protected areas is available at https://www.protectedplanet.net/en and updated regularly.

Perhaps the area on Earth that has the most useful parallels with Luna in terms of the issues raised by the possibility of environmental protection is the Antarctica, the only continent on Earth with no indigenous humans. In 1959, the Antarctic Treaty came into force, signed by the twelve countries active in the Antarctic at that time (Scientific Committee on Antarctic Research 2020). The original Treaty has subsequently been augmented by various Recommendations, a Protocol and two Conventions. The primary purpose of the current Antarctic Treaty System is to promote scientific research, to hold all territorial claims in abeyance and to ensure that Antarctica continues to be used exclusively for peaceful purposes. As of 2019, there are 53 states party to the treaty, of which 29 (including the original twelve signatories) have voting rights. It is also worth mentioning that the Antarctic Treaty came into existence at a time of increasing international tensions; it was the first arms control agreement during the so-called Cold War between the Soviet Union and the USA and their respective allies.

14.4 Environmental Ethics in Space

Humans seem initially to have treated the issue of waste in space just as we tended to treat the issue of waste in the oceans – simply assuming that it (space / the oceans) was so vast that we would have almost no effect on it. Yet, so-called ‘space debris’ began to accumulate from the time of the launch of Sputnik 1 on 4 October 1957, which orbited for a few months before falling back into the Earth’s atmosphere. The European Space Agency’s Space Debris Office estimates, using statistical models, that there are 34,000 artificial objects orbiting the Earth that have a diameter great than 10 cm, 900,000 objects in the 1-10 cm size range and 128 million objects in the 1-10 mm size range (European Space Agency 2021). Only about 20,000 of these (including the 2500+ operational satellites) are large enough to be tracked; the rest pose hazards that cannot be avoided by altering flight paths.

Sources of space debris include dead spacecraft, lost equipment, garbage bags intentionally jettisoned from space stations (!), booster rockets and the results of anti-satellite weapons testing. Damage caused by collisions with space debris varies from scratches (which can compromise solar panels, telescopes and cameras) to wholesale destruction. The first major collision between two satellites occurred on 10 February 2009 when the operational 560 kg

commercial communications satellite Iridium 33 collided with the derelict 950 kg Russian military communications satellite Kosmos 2251. The relative speed of impact was about 42,000 kilometres per hour and both satellites instantly broke up, creating thousands more pieces of space debris. In 1978, the NASA scientist Donald Kessler proposed what has come to be known as the Kessler syndrome, in which the abundance of objects (including space debris) reaches the point that collisions become ever more frequent due to a cascade effect resulting from the proliferation of new pieces of debris from collisions. In a worst-case scenario, this could prevent space activities, including the use of satellites, for generations.

In an early examination of the implications of space exploration for environmental ethics, Hartmann (1984) suggested that new discoveries raised the possibility of a long-term shift of mining, refining and manufacturing from the Earth's surface to locations outside Earth's ecosphere, potentially allowing Earth to begin to return toward its natural state. However, he also acknowledged ambivalence amongst environmentalists about such a possibility, which many distrusting such a scenario. Intriguingly he also wrote: "Due to impending resource depletion on Earth, we may have only until the mid-twenty-first century to pursue the promising potential of space exploration to alleviate environmental problems of Earth. Subsequently, there may be too little industrial base to support vigorous exploration and exploitation of resources in space" (Hartmann 1984, p. 227).

More recently, Martin Elvis and Tony Milligan (2019) ask how much of the Solar System we should leave as wilderness. They point out that humans are poor at estimating how long it takes seriously to deplete environmental resources – a point that seems to be corroborated by the depletion of marine fish stocks and terrestrial reserves of such very different resources as peat, groundwater and rare earth metals. This human limitation is exacerbated by the effects of a typical pattern in which demand for a finite resource grows exponentially. Accordingly, they suggest a rule of thumb in which "as a matter of fixed policy, development should be limited to one eighth, with the remainder set aside" (Elvis & Milligan 2019, p. 574). This 'one-eight principle' can be criticised as being somewhat arbitrary. However, the lesson of history is that if principles can be written into international Treaties at an early stage, they can be long-lasting and effective.

In the language of environmental ethics that we introduced earlier, Elvis and Milligan's approach provides instrumental reasons for environmental protection in space. Other authors have either argued on intrinsic grounds or combined arguments that draw on instrumental value and intrinsic value. Perhaps the most sustained treatment is provided by Jim Schwartz (2020), who develops and extends arguments developed by his collaborator Tony Milligan (2014). Schwartz' arguments are situated within both an instrumental and an intrinsic valuation of space exploration, with his principal focus being on the generation of scientific knowledge and understanding. One of the rather refreshing aspects of Schwartz (2020) is the way in which he debunks a number of the standard arguments for space exploration. He argues, for example, that there is little evidence that spending money on space flight leads to more STEM (Science, Technology, Engineering and Mathematics) graduates, that space colonies might result in undesirable autocratic or totalitarian governments, and that space settlements are not needed urgently as a way of preserving the human species because there are cheaper ways of doing that (e.g., improving asteroid detection to avoid collisions, averting ecological collapse on Earth).

Schwartz examines the environmental arguments for protecting the Earth from contamination by life from space ('back contamination' – cf. *The Andromeda Strain*) and for protecting

other planetary bodies from contamination with life from Earth ('forward contamination'). Most of his focus is on forward contamination and he is sympathetic both to the possibility that non-terrestrial life has intrinsic value and to the argument that even in the absence of non-terrestrial life, there are reasons for protecting space environments. Building on the arguments of Holmes Rolston III, Schwartz concludes that:

> … we should not proceed in discussion about the scope of and rationale for planetary protection under the presumption that we already know what is interesting, valuable, or worth protecting in the space environment … what we discover and what we learn through the exploration of space will affect what we find interesting and what we value … what we need for the moment is a growing rather than an attenuating appreciation of the space environment.
>
> (Schwartz 2020, pp. 143-4)

14.5 The Particular Case of Luna

At present, the basic legal framework of international space law (including the exploitation of Luna) is provided by the 1967 Outer Space Treaty. There are 110 countries that are party to the Treaty, including China, India, Russia, the USA and almost all the countries in Australasia, Europe and South America. Its main points are that it prohibits the placing of nuclear weapons in space, limits the use of the Moon and all other celestial bodies to peaceful purposes only, establishes that space shall be free for exploration and use by all nations, and holds that no nation may claim sovereignty of outer space or any celestial body (United Nations for Disarmament Affairs 1967).

However, the 1967 Outer Space Treaty is silent on the issue of commercial activities, such as mining. Ten years of negotiation led to the Moon Treaty of 1979 (United Nations 1980), which, *inter alia*, treats the Moon and its natural resources, as the 'common heritage of mankind' and says that an international regime would be needed to govern exploitation of the Moon's resources. However, this proved too ambitious. Only 18 states are party to the Treaty, which means they are prepared to support the process involved in further development of the treaty. Crucially, it does not mean they have ratified the treaty, and thus consented to be bound by it. While India is a signatory, it has not ratified it. China, Russia and the USA have not even gone that far, and have given clear indications, including via recent Executive Orders of the US Administration, that they have no intention of travelling down this route. In the case of India, there is a call for them to exit from the Moon Treaty altogether (Chennai 2020). Aware of the importance of the principles to be established, the United Nations Committee on the Peaceful Uses of Outer Space (COPUOS) held a high-level meeting in 2018 that tried to produce a consensus on a framework of laws for the sustainable development of outer space, but this too failed (O'Brien 2019).

In the absence of international agreement as to how the Moon's resources might be exploited (or not), it is unsurprising that there are increasing signs of a 'wild West' free-for-all. In 2020, the then President of the USA signed an Executive Order to support mining on the Moon and elsewhere (Wall 2020). This included the statement that:

> Americans should have the right to engage in commercial exploration, recovery, and use of resources in outer space, consistent with applicable law. Outer space is a

> legally and physically unique domain of human activity, and the United States does not view it as a global commons.

At the time of writing (in the early days of the Biden administration), the USA plans to have a 'manned' (one of the two astronauts will be a woman) trip to the Moon in 2024. There are also plans to extract valuable deposits of water-ice from the lunar South Pole. These could be used to make rocket fuel on the Moon, serving as the foundation for a lunar economy (Rincon 2020). What are called 'the Artemis Accords' – a set of guidelines for the crewed exploration of the Moon – have been signed only by eight countries (Australia, Canada, Italy, Japan, Luxembourg, the United Arab Emirates, the UK and the US), with Russia stating that it is 'too US-centric' for it to sign (Newman 2020).

China has an expanding set of Moon activities. The Chinese Lunar Exploration Program is an on-going series of robotic Moon missions that had its first launch, the Chang'E-1 lunar orbiter, in 2007. In 2019, Chang'E-4 provided the first robotic visit to the far side of the Moon (Li et al. 2019). It is difficult to be sure what China's long-term lunar aims are. In November 2017, it signed an agreement with Russian to cooperate on lunar and deep space exploration and Goswami (2018) has argued that China's long-term aims are to meet its burgeoning economic and energy needs.

In reality, it may be that with existing technologies, mining on the Moon or any other extra-terrestrial body for the benefit of those of us remaining on Earth is simply economically unfeasible (Crawford 2015) – rather as deep-sea mining was touted for decades before it finally began to take off (probably causing considerable environmental damage in the process – cf. the Deep Sea Mining Campaign http://www.deepseaminingoutofourdepth.org).

However, it is very possible that mining on the Moon might take place for the benefit of astronauts and, eventually, residents there. Moon rocks and dust are typically about 45% oxygen by mass and in 2020, the UK company Metalysis was awarded a European Space Agency contract to develop the technology (electrochemistry) to turn Moon dust and rocks into oxygen, leaving behind aluminium, iron, silicon and other constituents for lunar construction workers to build with. The oxygen itself might be used for breathing or in rocket propulsion systems (Sample 2020).

Furthermore, the need for an environmental ethics of Moon exploration is stressed by Elvis et al. (2021) who point out that there are only a handful of sites of particular interest on the Moon to those whose focus is relatively high concentrations of resources of special value. *Sinus Medii* is one of two places ideal for siting a lunar elevator (Figure 14.2). The same point obtains if, for example, you are interested in erecting an astronomical telescope on the Moon. Elvis et al. conclude that "diverse actors pursuing incompatible ends at these sites could soon crowd and interfere with each other, leaving almost all actors worse off. Without proactive measures to prevent these outcomes, lunar actors are likely to experience significant losses of opportunity" (p. 1). At least eight spacecraft from nations including China, India, Japan, Russia and the USA are set to go to the Moon by the end of 2024 (Witze 2021).

Of course, there are lessons from history on Earth so, whatever the ethics of environmental exploitation, one hopes that pragmatism prevails and governance arrangements are put in place. In addition, it is entirely possible that a new kind of lunar culture will emerge over time, especially if there are a number of different groups present on the Moon at any one

time. The various international space stations have shown how international competition can occur even at times of heightened terrestrial tensions between nations. Such cooperation is particularly likely if astronauts who know one another are in danger or require assistance – international cooperation is notable in extreme environments, such as on Antarctica. One could hope that such cooperation might lead the way for more formalised arrangement to come into being. As an aside, some readers may be reassured that there are plans for a decent 4G wireless network on the Moon (upgradable to 5G), with Nokia having been awarded a US$14m contract to this end in 2020 (France-Presse 2020). Presumably, some of us will eventually have @luna email addresses – but whether they will be @luna.ac or @luna.com remains to be seen.

14.6 Conclusions

It isn't likely that a single set of coherent principles to govern activities on the Moon, with the accompanying development of an environmental ethos, will be established simply by means of the organs of the United Nations or some other existing international body. All indications are that lunar governance and environmental ethos will be a messy affair, led by prudential considerations and come into being, as on our own home planet Earth, piecemeal. We hope the multiple lunar missions planned over the next decade will result in situations that lead to the establishment of an environmental ethos that is not based purely on short-sighted considerations, but will be based on deep ethical reflection drawing on the full diversity of traditions within moral philosophy. Furthermore, if our presence in space is to be sustained, and supportive of life on Earth, then maximum cooperation will be necessary. As situations emerge it is likely there will increasingly be a push for more developed structures. Some sort of development of the Artemis Accords will hopefully result in a Treaty that can be signed, ratified and enacted by all spacefaring nations, rather as the Antarctic Treaty has been by all nations with direct involvement there.

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Figure 14.1 Caption: Little Lakes Valley from above Mack Lake in the John Muir Wilderness in California (Jane S. Richardson (talk · contribs), CC BY-SA 3.0 https://creativecommons.org/licenses/by-sa/3.0, via Wikimedia Commons). Taken from https://commons.wikimedia.org/wiki/File:Little_Lakes_Valley_from_above_Mack_Lake.jpg.

Figure 14.2 Caption: *Sinus Medii* is one of two places ideal for siting a lunar elevator, a proposed transportation system between the Moon's surface and a docking port in space (James Stuby based on NASA image, Public domain, via Wikimedia Commons). Taken from https://commons.wikimedia.org/wiki/File:Sinus_Medii_2093_med.jpg.