Articles

Astro-Green Criminology: A New Perspective against Space Capitalism

Outer Space Mining may make the Same Mistakes in Space as we have on Earth

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I. Introduction

As outer space expeditions have been actualized in modern history, humankind started to view outer space as another hope and chance for human conquest and achievements. Bearing in mind that outer space presented new challenges and opportunities to humans, it was important for them to decide how to utilize this seemingly infinite opportunities. In other words, humankind could potentially gear towards the abuse and reckless conquest of this new frontier if they chose to do so since no one was and is familiar with this new territory. Nevertheless, humankind recognized the need for a legal framework to utilize outer space effectively and cautiously as it feared possibilities of world wars, space wars, and chronic conflicts among nations.

Since outer space mining became an emerging plan for many countries, it is critical to determine what the main concerns are and to legislate necessary laws for peaceful outer space. Outer space mining became a more controversial topic because of its vulnerability to breach of many treaties of the United Nations as it promotes ownership and sales of outer space materials which is a main subject of violation for many UN treaties.

In this paper, we discuss some problems in outer space mining: space capitalism and sustainable development, national and international regulations, space environment and its protection, and philosophical foundation of outer space protection.

II. New Gold Rush 'Space Mining': Space Capitalism

1. Space capitalism: New space economy

Committee on the Peaceful Uses of Outer Space (hereafter COPUOS) explains the dawn of asteroid mining that history of outer space mining so-called asteroid mining began with heightened interests in outer space and launch of satellites in the late 20th century. As many became concerned with depletion of natural resources on Earth, they began to pay more attention to available resources in outer space. For example, a metallic asteroid can potentially provide with billions of iron and

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millions of cobalt, nickel and platinum. In fact scientists have been in search of new renewable energy resources and have determined that helium-3 is viable natural resources. It is important to note that this particular resource is only available on the Moon as the Earth only contains extremely minimal amount of it (Committee on the Peaceful Uses of Outer Space [COPUOS] 2017a; McKay *et al*. 220–229).

Then COPUOS examines the legality of space mining. Many scientists believe that space mining will become a reality within a few decades. Outer space has become a more promising idea for numerous countries as they anticipate more resources to be found. Not only nations but private mining companies are also closely paying attention to outer space mining at this time. United States and Luxembourg governments attempt to fund outer space mining projects soon, and they put their efforts into approving legislations which would legalize outer space mining through allowing companies to own, sell, and transport outer space materials. However, it is inevitable for them to face the breaches of the UN treaties such as the Outer Space Treaty and the Moon Agreement since these treaties ban the ownership of resources and planets outer space for the sake of peacekeeping in outer space (Committee on the Peaceful Uses of Outer Space [COPUOS] 2017a).

According to Pelton, space mining enterprises are moving from dreams to experimental tests and technology development to the formation of actual businesses which are now seeking to implement these new resource-capturing capabilities in space. There are real companies with real employees, raising real capital to support actual ventures which want to bring new assets to resource-starved world. These vital New Space commercial activities will be keys to replacing fossil fuel energy and assisting with natural resource shortages which will become increasingly common by the end of twenty-first century. Without the ability to access space resources our planet and the global economy could wither away under the weight of too many people and too little resources (Pelton 91). One of the prominent firms Deep Space Industries is aiming to send small satellites to research the prospect of minerals and ice for future mining. Another firm Planetary Resources aims to develop telescopes to analyze asteroids for mining (Committee on the Peaceful Uses of Outer Space [COPUOS] 2017a).

The new space economy is the pathway to the future as we enter a new era for humankind. But, Pelton warns, if this transition is not done correctly, the longer-term sustainability of the planet and of human civilization will remain at risk. These new space enterprises must do more than simply replenish diminishing natural resources and fossil fuels. They must be broadly conceived as part of an overall strategy to transform human society (Pelton 91).

2. Technological progress and space mining development

Next let's start with a following question: Where do we stand in terms of truly developing a space mining industry? Currently there are four companies which are pursuing space mining and they are all US-based. These startup companies are Planetary Resources, Inc., Deep Space Industries, Shackleton Energy and Moon Express (Pelton 99).

Pelton explains a diversity of space mining that today's space mining companies represent a diversity of viewpoints on several key points. Some envision mining on the Moon, and others are more focused on the mining of asteroids. The potential targets for these space mining operations also vary widely. Some focus on volatiles, and especially water, which could be broken down to hydrogen and oxygen to create space-based 'filling stations' for rocket launchers. Others talk about obtaining rare substance such as helium-3 isotopes, and yet others talk about finding asteroids

which are nearly pure platinum. Most agree on the need for careful prospecting to find reasonable asteroid targets before actually thinking of space mining operations (Pelton 101; Hellgren)

However, Pelton refers to technological progress and developments of space mining. there is clearly skepticism as to how soon space mining could really happen. Skeptics challenge the very idea: What possible resource could be cost effectively reclaimed from space which would have sufficient value to pay for the huge investment costs? What space resources make sense, given the competitive advantage of mining carried out in land mines and even the oceans? (Pelton 99) In the past half century there has been enormous progress in space transport, space habitats, and artificially intelligent robots which are capable of achieving progressively more demanding tasks. The technology to create reliable and increasingly low-cost space transportation systems, small, low cost robotic prospecting spacecraft with sophisticated sensors and robotic devices to carry out remote mining, and dozens of other technical capabilities to allow space mining, are either currently being developed or are on the way (Pelton 106; Chen *et al*.; Hein *et al*.).

In short, history reveals that outer space mining is a promising future industry and technology. But at the same time, it can be the root cause of further global conflicts and controversies.

III. Space Mining and Its Regulation

1. Legal framework for sustainable space mining activities

As the development of the space mining industry progresses, Leterre explains, the need for a legal framework regulating space resource utilization increases. The ambiguity left by the Outer Space Treaty regarding the permissibility of such activities has already led two countries, the United States and Luxembourg, to adopt their own national legal framework in order to offer investors the legal certainty which they require to further develop their activity, and which current international law might not fully secure. The choice of the United States and Luxembourg to favor a national framework, rather than wait for the establishment of an international regime, was criticized by the international community, most notably during the session of the Legal Subcommittee of the UN Committee on the Peaceful Uses of Outer Space (Committee on the Peaceful Uses of Outer Space [COPUOS] 2017a; Leterre 3–4; Johnson 90–91).

Reflecting on the future legal framework of outer space is not an exercise, valuable as it is, in theory. It corresponds to crucial interests of mankind, Leterre warns, as resources found in outer space can be regarded as a substitute for resources extracted from Earth at a time when such resources are becoming scarcer. That private entities can be the ones carrying out the mission to use outer space is probably less important than protecting mankind from the negative outcomes this exploitation can lead to. This is why it is important not to repeat what has been done on Earth: exploit first, be concerned about consequences only second. It is the role of legal reflection to provide the elements of consideration which will help find a solution to such dilemmas (Leterre 78; Doshi).

2. Principle of ‘Common Heritage of Mankind’

De Cnudde introduces the principle of ‘Common Heritage of Mankind’ as an international regime. It is important to stress out why an international regime is necessary for the exploitation of space. There are a lot of risks regarding space exploitation which is not a contained activity, much can go wrong during the mining of resources on the Moon. Also, in the future, space exploitation will be the result of the corporation between states and private companies. This asks to be regulated in order to achieve the most optimal effects in a

commercial sphere. On another level, the aspect of environment is important because a big risk of endangering the unique environment of space comes with exploitation. The current space debris is partly already a consequence of the commercial use of telecommunications in space. An international regulation is also needed here to guarantee the preservation of the unique ecology of space. Next to this, not all states have the capacity to start commercial operations in space. As states with the capacity and resources are rather rare, in order to avoid the creation of more inequality between states, an international treaty seems appropriate to provide some security. The role of the controversial 'Common Heritage of Mankind' principle plays a very substantial role in this context. A last argument for facilitating an international regime for space exploitation is to create a well-arranged market where commercial activities are organized as fair as possible for each party involved (de Cnudde 2–3; Bonnal; Takemura).

From the developed states' point of view, de Cnudde adds, one could argue that the current status of exploitation suffices and that the further regulation should be handled on a national level. However, this would lead to some issues. The environmental protection would not be strong enough and consequences for violating the ecology would be nearly absent. Eventually, as the interests for mankind would only be a shallow promise, only the developed states would truly enjoy the benefits of outer space. In order to create a fair and safe environment, thus, there is a need for an international regulation (de Cnudde 93).

3. International and national regulation

Jakhu *et al*. mention that the difficulty of consistency between national and international regulations. Difficult and demanding space mining activities may be undertaken under the current status of the international and national regulatory environment. Current international space law, represented mainly by the 1967 Outer Space Treaty and the 1979 Moon Agreement, will take us only so far. There is the need for a clear global space governance system to provide the basis for orderly exploitation of space natural resources. National regulatory initiatives such as the U. S. Space Act of 2015 are necessary for national legal and administrative purposes, but could also potentially render the concerned states in violation of their international obligations. Thus, careful implementation of such national laws is important in order to maintain full compliance with relevant international treaties (Jakhu *et al*. 147; Hobe *et al*.)

Jakhu *et al*. explain that there are no specific resolutions or measures which exclusively discuss the subject of mining in outer space as it is yet to be fully explored. However, in the past few years, the United Nations passed numerous resolutions regarding outer space activities. As of now, the UN has had reports on a variety of issues such as space debris mitigation, near-earth object (NEO) management, global satellite systems, nuclear power use in outer space, review of the outer space treaties, and capacity-building in space law (Committee on the Peaceful Uses of Outer Space [COPUOS] 2017a; Committee on the Peaceful Uses of Outer Space [COPUOS] 2017b; De Man).

In short, noticing a rapid growth in space expeditions and industries, with new developments in space activities, such as mining outer space, it is necessary to discuss stronger enforcement of space laws and the idea of rule of law, and to regulate outer space better in the near future.

IV. Space Environment and Its Protection

1. Protection of space environment

COPUOS mentions the importance of environmental considerations concerning space mining. Since large scale mining was first undertaken on

Earth, it has become evident that there are significant environmental externalities generated by the process. The rise of the environmental movement in the past few decades has seen a heightened level of scrutiny towards these practices. Mining companies have been forced by both regulation and public opinion to alter their production methods. A significant part of this adjustment has been in the making of the mining process more energetically efficient. As NEAs (near Earth asteroids) and other celestial bodies are explored and eventually mined for resources, a similar debate will likely emerge for endeavors undertaken in this new frontier. It remains to be determined if environmental damage caused by mining ought to be taken into consideration in space. The nature of the body on which the mining is being done will likely affect this debate, as those bodies intended for long term inhabitation will be subject to harsher scrutiny. If environmental considerations should come into play, its extent is a potential area of contention, as is which environmental law ought to regulate mining practices (Committee on the Peaceful Uses of Outer Space [COPUOS] 2017a).

Then Almár explains 'astroenvironmentalism' that the problem of cautiously preserving solar system environment is called astroenvironmentalism, which could provide a conscience to the plans of planetary exploration and exploitation. There is a fundamental conflict between the interest of future exploiters of planetary resources on the one side and astronomers as planetary environmentalists on the other. Namely, in case planetary explorers do not fully address the environmental consequences of their activity and do not protect the pristine surface and subsurface of celestial bodies, all essential in situ evidence on the origin and evolution of planets, asteroids and satellites will be denied future generations of astronomers. A balance must be found between the impact of any mission and the scientific results or other benefits which may be obtained thereby. Furthermore, certain activities may be sufficiently detrimental to the environment to require restrictions and prohibitions thereof, regardless of any benefits which otherwise may be realized (Almár 1577–1578; Hlimi 445–449; MacWhorter).

2. Classification of activity and possible action

Space activities are, according to Almár, classified into following four categories:

– *Research* – In situ research is always producing a certain amount of pollution. Only product and not pollution should be delivered to the celestial bodies and the Earth's environment in general. There is a lot of space debris already on the surface of the Moon, Venus and Mars (Almár 1578).

– *Industrial activity*, – Mining in particular may destroy smaller celestial bodies. It can be clearly demonstrated how the surface of an entire celestial body can be modified and destroyed by a medium range surface mining activity. The small Martian moon Phobos is considered an ideal base for such an activity. Phobos, with its special system of surface grooves, however, is probably unique in the solar system. If mankind decides to mine the Moon or colonize Mars, the environmental impact will increase by at least an order of magnitude. As terrestrial experience has shown, when exploration becomes exploitation the environment tends to suffer (Almár 1578).

– *Colonization and terraforming* – The result will be a large-scale transformation of the environment — it means reforming the environment of a planet to accommodate human life. Several difficult questions are posed: Does Mars as a planet have any intrinsic value in and of itself? Is there less intrinsic worth in a planet which is devoid of life than in one with an active biosphere? Should we access and use the resources which are available there or should we leave them as they are? Environmental issues can reasonably leave the problem of terraformation for future generations to worry about, if and when it assumes a degree of

reality (Almár 1578).

– *Free-for-all* – The result of every kind of activity in these foreign environments will depend heavily on the strategy and legal regime of the endeavor. The worst possible scenario is free-for-all, i.e. whoever gets there first should have the right to do whatever they want. This could lead to destruction of entire celestial bodies preventing the possibility of its further investigation in the future. Enormous damage and danger could be caused by a free-for-all in space (Almár 1579).

Then Almár insists that the time has come, however, for environmental concerns to be applied to developments in space. The 1979 Moon Treaty has as central premise the notion that no single nation or private entity has the right to appropriate commonly-owned resources. The 'Common Heritage of Mankind' principle is the basis of this notion. Two recent examples illustrate, however, that these principles are not really respected: the private Artemis Society plans to organize lunar excursions to interested people. Business interest to the Moon will arise without authorization and without being conscious of rights and obligations. SpaceDev plans for launch private space probes to investigate and eventually mine the resources of asteroids. Again there is no authorization and the private ownership of asteroid would be a dangerous example in the future (Almár 1579; Krolikowski *et al*.).

3. Framework or mechanism of preservation

Consideration is given to the designation of areas of special scientific interest, or 'international scientific preserves' by several other authors as well. Constructing an adequate environmental legal regime for outer space prohibiting private ownership of wilderness areas is a fundamental wilderness principle. The realization of such a system needs, however, an effective legal framework, otherwise in the 21st century large-scale industrial activity on different celestial bodies could reach detrimental effects before anybody could react. Clearly an international environmental-protection treaty is needed for the 'outer-space wilderness.' The standards implementing those principles have to be tailored to meet the needs of the specific environments which they are designed to protect. Some degree of flexibility is needed in order to make regular space exploration and even exploitation possible (Almár 1580).

In short, the time has come, however, for environmental concerns to be applied to developments in space. In constructing an adequate environmental legal regime for outer space prohibiting private ownership of wilderness areas is a fundamental wilderness principle.

V. Philosophical Foundation of Outer Space Environmental Protection

1. History of environmentalism: anthropocentric-, ecocentric-, and astrocentriic environmentalism

First, Hueber *et al*. explains 'anthropocentric' environmentalism. Human beings would self-identify as enemies of 'the environment.' After all, everyone wants clean air to breathe and clean water to drink, and does not want anyone to invade his/her person or property with harmful substances. People who go this far with their environmentalism probably comprise the majority of humanity. They can be said to be adherents of 'anthropocentric' environmentalism. Anthropocentric environmentalists can be found across the political spectrum. For example, voices ranging from the right to the extreme Marxist left have called for unprecedented global government intervention to combat perceived environmental threats to human well-being. Others, however, have advocated *laissez-faire* capitalism as the appropriate means to protect the environment to maximize human well-being on Earth. For the anthropocentric en-

vironmentalist, non-human creatures and objects are valuable to the extent that humans value them (Huebert *et al*. 283).

Second, Huebert *et al*. explains 'ecocentric' environmentalism. In the second half of the twentieth century, another type of environmentalism came to the fore: 'ecocentric' environmentalism. Ecocentric environmentalism holds that the environment itself is intrinsically valuable, and that human beings themselves have value only to the extent that they play a role in, and support, this environmental whole. According to radical ecocentrism, only 'ecological wholes' (such as species, ecosystems, the land or the biotic community) have a value in themselves and the value of the ecological parts is determined by how far they contribute to the survival and well-being of the ecological whole. The ecocentric view is not limited to concern for animals or even plants, but extends to the entire Earth, dirt and rocks included. Everything on Earth, except for humans, is seen as possessing 'intrinsic value' that is destroyed or threatened by any human tampering at all (Huel. 284).

Third, we can see two kinds of 'astrocentric' environmentalism. One aspect is that in the next few decades we see a significant movement into outer space and other celestial bodies: 'astroenvironmentalism.' With an environmental approach, protection of the outer space environment and its subsystems is the priority, not ensuring that outer space can be used for human space activities. Outer space, a source of wonder and inspiration for centuries, deserves to be preserved 'in its original pristine state, for its own sake' and for future generations to enjoy (Huebert *et al*. 286). The other is that astroenvironmentalism is a concept which applies the values of environmentalism and preservationism to developments in space exploration, commercialization, and militarization. Recent developments in space exploration suggest this perspective which is not widely acknowledged enough by those who envision taking steps to enter space. Since mankind made such a mess of this planet and is now paying the environmental price for the damage, this topic is of extreme importance because we must avoid making the same mistakes in space as we have on earth. At issue are the environmental consequences of the steps we are about to take in entering space. Astroenvironmentalism is another re-formulation of the associated environmental concerns involving a space wilderness to protect, rather than a 'frontier' to exploit (Miller 2001; Miller 2005).

2. From 'frontier exploitation' to 'wilderness protection'

Billings gives an important query: Do humans have rights to exploit extraterrestrial resources and alter extraterrestrial environments? (Billings)

First appears the perspective of 'frontier exploitation'. Billings explains that in the 21st century, politicians and other advocates have been promoting 'the Moon-Mars thing' as exploration for the sake of exploring and also as a means of opening up the solar system to private property claims, resource exploitation, and commercial development. One space advocate compares the solar system to a giant grocery store which has everything. In this vision, those with the means to get to the store first get the all the goods; those who get there late may get nothing, it is like a system in the spirit of imperialism. The rhetoric of this space advocacy reflects an assumption that the values of materialism, consumerism, and hyper-consumption are values worth extending into the solar system. The conception of outer space advanced by these advocates embodies the idea of a solar system and beyond of wide-open spaces and limitless resources — a space frontier. This frontier rhetoric, with its images of pioneering, homesteading, claim-staking, and conquest, has been persistent in American history, and the frontier metaphor has been, and still is, a domi-

nant metaphor in rhetoric about space exploration (Billings; Weeks 171–179; Coradini).

Currently, on the other hand, we can see the movement to 'wilderness protection', scientific, legal and ethical considerations of protection and preservation in space intersect in planetary protection policy. According to Billings, NASA and the international Committee on Space Research (COSPAR) have long-standing national and international planetary protection policies in place directing solar system exploration missions to take steps to prevent the transport of terrestrial biological contamination to extraterrestrial environments and the transport of extraterrestrial biological contamination to Earth through solar system sample returns. The rationale for these policies is to maintain pristine conditions in extraterrestrial environments for the purpose of scientific exploration. The wilderness metaphor has been suggested as an alternative to the idea of space as a frontier in the concept of 'astroenvironmentalism', the idea of applying the values of environmental protection and preservation to space exploration. Treating the solar system like a wilderness to protect rather than a frontier to exploit could keep environmental hazards, human-made debris, nuclear weapons, and nuclear power out of space, and prohibit private and sovereign property claims. It is the most important, as Miller points out, 'to avoid making the same mistakes in space as we have on Earth' (Billings; National Academies of Sciences, Engineering, and Medicine; Huebert *et al*. 287–288).

3. Space sustainability as systemic 'space justice'

According to the systemic view, Aganaba explains, sustainability is the self-evident term for the dynamic equilibrium between man and nature and for the co-evolution of both within the Gaia mega-system. On a practical level this can be understood as a requirement of harmonization of all public policies and social practices and their convergence towards ensuring the co-evolution of manmade systems and ecosystems. It is this harmonization and convergence that makes it a modern conception of justice, justice towards nature and future generations (Aganaba: 35).

Under the principle of systemicity, Aganaba continues, sustainability exists when three kinds of capital, namely natural capital, social capital, and cultural capital, are not diminished by the decisions and acts of states and citizens, but increase with the passage of time. The aim is that the increase in the capital is by virtue of public policy adopted through a regulation of the process of co-evolution to prevent further degradation of the ecosystems and society. This provision of degradation of the space environment is a shared goal which should seek to unite and restore cohesion. The reconceptualization of space sustainability from this perspective therefore includes a greater value being given to natural capital which includes outer space as well as the cultural capital of actors utilizing the domain alongside increasing social capital such as safety, stability and security (Aganaba: 36–37; Islam).

In short, astroenvironmentalism is a concept which applies the values of environmentalism and preservationism to developments in space exploration, commercialization, and militarization. The declaration of celestial bodies as pristine wildernesses which need to be protected rather than frontiers to conquer is listed among space environmentalism's goals. Outer space, a source of wonder and inspiration for centuries, deserves to be preserved in its original pristine state, for its own sake and for future generations to enjoy.

VI. Conclusions

'Space capitalists' advocate effectiveness of space exploration and exploitation pursued by private entrepreneurs. They think that market-driven,

private initiatives should take the lead through enhanced competition and significant resources of outer space. There are vast gold mines in the sky which are sufficient to replenish many of our rarest natural resources; water which can be broken down to hydrogen and oxygen to fuel spaceship; rare metals such as platinum and other valuable ores which are being depleted on Earth; and we need to look at space as a new frontier which opens almost unlimited opportunity.

Contemporary visions of the human future in space range from careful exploration and enjoyment of a pristine wilderness to extension of familiar terrestrial patterns of conquest, colonization and exploitation. Facing an opportunity to envision a new 21st century era of spacefaring, the aerospace community has chosen to go back to the future, leaning on outdated rhetoric of frontier conquest and manifest destiny to justify mining the Moon and others and creating human colonies in space. But the frontier/conquest/exploitation rationale for space exploration may not be widely relevant outside the space community today. The question of 'why we should be going into space' deserves deep thought.

At this moment, against the recent tendency of space exploration, space capitalism, we need create a new discipline named 'astro-green criminology'. Humans have created environmental and ecological ruin on the planet, and now space debris is starting to pollute space around Earth. From this new perspective, if we need the space exploration and space exploitation, they must be done in an environmentally and ecologically safe and sound manner which does not pollute outer space, create adverse effects such as climate change, or endanger life. We have no right to pollute and contaminate other planets (the Moon, the Mars, asteroids and so on) through human space activities such as mining and colonization.

[Notes]

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