

Space Mining and the Protection of Extra-Terrestrial Environment in the Light of Article IX of the Outer Space Treaty

Federico Bergamasco*

Abstract

Large-scale human activities in space, and in particular space mining, might pose a threat to the preservation of the environment of space, the Moon and other celestial bodies. The only provision in the Outer Space Treaty that directly deals with environmental protection is paragraph two of Article IX. Such provision, despite its imprecise terminology and restricted scope of application, still constitutes the main framework principle for any legal international regulation *de iure condendo*. Before entering into complex negotiations for sectorial legal instruments, however, it is necessary to clarify a common approach to the interpretation of Article IX in the light of fundamental ethical question. Is the extraterrestrial environment worthy of protection *per se* or is it exclusively instrumental to human interests? The paper argues that only an anthropocentric approach to Article IX would ensure consistency with the rest of the Outer Space Treaty and its adequacy to provide the basis for any future legal effort.

Introduction

The last decade suggests that we are on the cusp of a true commercialization of space.¹ A new generation of large-scale human activities is about to start, conferring an unprecedented meaning to the freedom of use of outer space established by Article I of Outer space Treaty. Among them stands with particular prominence the so-called “space mining”. It aims at finding and exploiting the abiotic resources present on the Moon and other celestial bodies, such as rare minerals and water, and create new space economy both

* PhD Researcher, Université du Luxembourg, Faculty of Law, Economics and Finance, federico.bergamasco@uni.lu.

1 Williamson, Space Ethics and the Protection of the Space Environment, Space Policy 19, 2003, p. 51.

at short and long term.² The legal discussion about space mining, mainly focused on the appropriation of natural resources, crosses also the different and wider debate on the protection of outer space environment from the harmful effects of human activities. Article IX of the Outer Space Treaty, although remaining central in this sense, is considered vague and inadequate. Before rushing into advocating the adoption of new legal instruments, however, it is necessary to deal with a fundamental preliminary question: is space, including the Moon and other celestial bodies, worthy of protection and upon which moral ground? There are two main ethical approaches to the protection of the space environment: the “anthropocentric” one, which focuses primarily on human interests, and the “econcentric” one, which considers the environment morally worthy *per se*. Both of them are possible interpretative keys to Article IX of the Outer Space Treaty. Their application, however, would lead to very different consequences.

1. An Ethical Premise

1.1 Anthropocentrism

The question whether space and celestial bodies constitute an environment that deserves protection, and upon which moral ground, should be decided consciously, and should not remain in the ambiguous domain of intuition or convention. Considering space as an entity with intrinsic ethical value, indeed, would lay the foundation for a future regulatory model that is very different from an ethics that treats it just as a domain for the further expansion of human interests.³ While these questions have remained confined to the theoretical debate so far, and have basically involved the scientific community, the aforementioned boost in the exploitation of space is about to attribute them an unprecedented concrete relevance.

There are two main approaches that face each other in the consideration of such complex issue: the “anthropocentric” one and the “econcentric” one. They find their origin in the ethics of the terrestrial environment, and their categories have subsequently been extended to outer space. Several versions of them exist, but the present dissertation will focus the basic features of the two main schools of thoughts and put them in relation to Article IX OST.

According to the anthropocentric environmentalism, only human beings have inherent worth, and all other entities – whether living creatures or remote objects – are valuable only to the extent that they are instrumental to human

2 Project de Loi sur l'Exploration et l'Utilisation des ressources de l'Espace, Rapport de la Commission de l'Economie, N. 7093, 06.07.2017, p. 3.

3 Reiman, *Is Space an Environment?*, Space Policy 25, 2009, p. 81.

well-being and to the betterment of humankind.⁴ When applied to space such approach leads to interesting consequences.

At first, it would be questionable whether the space environment deserves the same level of consideration and protection of the terrestrial environment. Earth is a closed system, and any harm that we provoke to its environment directly affects the human existence. Space on the other hand is essentially endless and void, and our actions have a limited capacity to influence space phenomena in a substantive way. How could, for instance, building polluting mines on Ceres affect human welfare at all?⁵

On the contrary, the anthropocentric approach would allow shifting the ecological pressure of industries and other polluting activities off Earth and moving it to the remote depths of space. Earth will remain the centre of humankind for a very long time; therefore, it would make sense to concentrate our environmental efforts here instead to prioritize the rights of potential microorganisms and the inherent value of lifeless environments, especially when our own long-term survival is at stake.⁶

Focusing on human interests, furthermore, does not mean that we would be allowed to exploit the outer space environment short-sightedly. A wide range of interests would be encompassed, aside of the commercial one: scientific exploration, the protection of historical and cultural heritage, and even the aesthetical value of celestial bodies. The protection of the environment would not be neglected, but would be instrumental for the long-term well-being of humankind.

1.2 Ecocentrism

The ecocentric environmentalism, on the contrary, starts from the assumption that the environment itself has an inherent moral value and is worthy of protection for its own sake, independently from any human interest.⁷ This would include not only indigenous life forms and ecology, but also the intrinsic worth of geology and morphology.⁸ The application of it to outer space takes also the name of “astroenvironmentalism”.⁹

4 In favour of a strong anthropocentric environmentalism see Huebert, Block, Space Environmentalism, Property Rights, and the Law, 37 U. Mem. L. rev. 281, 2007.

5 Reiman, *supra* note 3, p. 82.

6 *Ibid.*, p. 83.

7 ROLSTON, The Preservation of Natural Value in the Solar System, in Hargrove Eugene C, Editor, Beyond the Spaceship Earth, San Francisco: Sierra Club Books, 1986, p. 140-82. See also Williamson, Protection of the Space Environment: the First Small Steps, *Advances in Space Research* 34, 2004, p. 2340.

8 Williamson, Space: the Fragile Frontier, Virginia: American Institute of Aeronautics and Astronautics, 2006.

9 Miller, Astroenvironmentalism: the Case for Space Exploration as an Environmental Issue, 15 *Electronic Green J.* 2001.

The primary consequence of such approach would be the necessity of the preservation of the extraterrestrial environment in its original pristine state.¹⁰ The use of it for human activities would have a subsidiary importance and would be legitimate only as far as compatible with this condition.

It is rather intuitive that, by following this premise, most of commercial space activities would be banned or would become prohibitively expensive. Even space exploration, no longer a priority, would likely face major constraints. Would it be rightful, for instance, to crash a probe on a planet in order to obtain scientific data, if that would leave a permanent scar on the surface of the celestial body?

There are, of course, several versions of astroenvironmentalism, some of them aware of the necessity to balance the protection of space and celestial bodies with the development of human activities. Most of them, however, lack an objective criterion to distinguish a legitimate alteration of the extraterrestrial environment from an impermissible one, and tend to unwillingly resort to anthropocentric criteria.¹¹

A moderate version of astroenvironmentalism, which has the privilege to guarantee a firmer ethical standard, is the so-called “biocentric” approach. It prescribes that all biological entities deserve moral consideration, and human beings are treated as equal as any other being deemed to be alive.¹² This life-centred environmental ethics would imply that human exploration and use of space is legitimate as long as it does not harm any life form that exists, or may exist, in the extraterrestrial environment.

According to the current scientific knowledge, Earth is the only body of the Solar System capable of hosting life, and, although we do not have conclusive proof, space can be defined as mostly lifeless.¹³ That would make the ethical constraints to the use of the Solar System exclusively theoretical. It is also true, however, that we do not have the conclusive proof that each celestial body is devoid of life. The application of the precautionary approach, as suggested by some commentators, would once again lead to contradictory outcomes.¹⁴ A theoretical but meaningful example is the idea of terraforming inhospitable planets. It is unlikely that, once a futuristic decision of terraforming another planet is made, it would be possible to completely exclude the existence of life not yet discovered. Would the importation of

10 Huebert, Block, *supra* note 4, p. 287.

11 See for instance Williamson, Space Ethics and the Protection of the Space Environment, *supra* note 1, p. 50.

12 Baker, *The Application of Emerging Principles of International Environmental Law to Human Activities in Outer Space*, McGill University, Montreal, 1996.

13 Reiman, *supra* note 3, p. 83.

14 See for instance Cinelli, *The Current International Legal Setting for the Protection of Outer Space Environment: the Precautionary Principle Avant La Lettre*, *Reciel* 22 (2), 2013.

terrestrial life be legitimate if it implies the risk of wiping out local biological entities, even if dormant? And when is the likelihood of discovering local life low enough to justify terraforming?¹⁵ Even if such conclusive proof was obtained, and the existence of microbial life confirmed, would it be reasonable to ban the terraforming, given that it would imply the spread of a larger and more complex biosphere in a mostly dead habitat?

The pros and cons of each position are extremely complex and it is not feasible to cover all of them. It is however necessary to bear these ethical premises in mind before proceeding to the analysis of the international legal framework currently relevant for the protection of the extraterrestrial environment.

2. Article IX of the Outer Space Treaty

2.1 Purpose

The Outer Space Treaty was drafted in a period when few States had space program capabilities, and the interest of the space community was mainly dedicated to space science and exploration.¹⁶ Attention for environmental matters was still rather low, and as a consequence in the Outer Space Treaty there is one single provision that abstractly discusses outer space environmental protection.¹⁷

Such provision is limited to a single paragraph of an Article. The purpose of Article IX OST is indeed two-pronged: while the second paragraph of Article IX OST addresses directly the protection of the environment, and specifically the forward and backward contamination, the rest of the Article focuses on the interest of States Parties by establishing different general principles: the principle of cooperation and mutual assistance; the principle of due regard for the interests of other States Parties; the duty to undertake consultations with other States Parties in case of expected harmful interference.

In the light of the focus of the present analysis, it is appropriate to integrally report here the text of the Article:

“In the exploration and use of outer space, including the Moon and other celestial bodies, States Parties to the Treaty shall be guided by the principle of cooperation and mutual assistance and shall conduct all their activities in outer space, including the Moon and other celestial bodies, with due regard to the corresponding interests of all other States Parties to the Treaty.

15 Reiman, *supra* note 3, p. 83.

16 Hofmann, Planetary Protection from a Legal Perspective: Due Diligence and National Legislation, in *Protecting the Environment of Celestial Bodies*, IAA Cosmic Study: Protecting the Environment of Celestial Bodies, 2010, p. 63.

17 Gupta, Critique of the International Law on the Protection of the Outer Space Environment, *Astropolitics*, 14:1, 2016, p. 24.

States Parties to the Treaty shall pursue studies of outer space, including the Moon and other celestial bodies, and conduct exploration of them so as to avoid their harmful contamination and also adverse changes in the environment of the Earth resulting from the introduction of extraterrestrial matter and, where necessary, shall adopt appropriate measures for this purpose.

If a State Party to the Treaty has reason to believe that an activity or experiment planned by it or its nationals in outer space, including the Moon and other celestial bodies, would cause potentially harmful interference with activities of other States Parties in the peaceful exploration and use of outer space, including the Moon and other celestial bodies, it shall undertake appropriate international consultations before proceeding with any such activity or experiment.

A State Party to the Treaty which has reason to believe that an activity or experiment planned by another State Party in outer space, including the Moon and other celestial bodies, would cause potentially harmful interference with activities in the peaceful exploration and use of outer space, including the Moon and other celestial bodies, may request consultation concerning the activity or experiment.”

In general terms, Article IX is “a provision, which is designed to protect outer space and celestial bodies from contamination and pollution and to protect the legitimate programs of States from undue interference”.¹⁸ The part dedicated to environmental protection of the extra-terrestrial environment appears however to have a marginal relevance in the larger context of the Article, which is primarily concerned with the protection of States Parties’ interests, and is additionally overshadowed by the provision dealing with the protection of the Earth.¹⁹

Despite its limited relevance, such provision constitutes the only principle of the Outer Space Treaty dedicated to the issue, and any legal analysis – as well any debate on further regulatory instruments – shall take it into full account. It is affected, however, by several shortcomings that are due to be analysed.

2.2 Scope of Application

The Outer Space Treaty opening Article classifies the extra-terrestrial environment into three categories: outer space, the Moon, and other Celestial Bodies, and groups them under the same legal regime.²⁰ The second paragraph of Article IX makes no exception, and is coherent with such categorization. While outer space and the Moon give rise to limited doubts as to their identification, the great variety of natural objects present in the solar

18 Dembling, Arons, *The Evolution of Outer Space Treaty*, *The Journal of Air Law and Commerce*, 1967, note 47.

19 See *infra*, 2.3.

20 *Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, Including the Moon and Other Celestial Bodies*, 18 UST 2410, 610 UNTS 205, 6 ILM 386 (1967), Art. I and Art. II. Hereinafter, OST.

system makes the term “celestial body” potentially debatable.²¹ Currently, according to the International Astronomical Union, known natural objects that can be found in the solar system include the Sun, the planets, the Moon, the moons of other Planets, NEOs, asteroids, comets, dwarf planets, trans-Neptunian objects, and Kuiper Belt objects.²² In absence of any autonomous definition in the *corpus juris spatialis*, the purpose and spirit of the Treaty would be better served by an expansive interpretation of celestial body to include all natural bodies within the Solar System, excluding only the Earth.²³ The protection granted by Article IX, therefore, would extend accordingly.

The scope of application of the Article appears more restrictive, instead, with regard to the kind of activities concerned. A literal interpretation of the second paragraph limits the duty of States Parties to avoid harmful contamination only in the pursuance of “studies of outer space” and “space exploration”. In the protection of the space environment, thus, there is an apparent departure from the general scope of application of the Outer Space Treaty – covering both the exploration and the use of outer space – and a limitation of such protection to the first kind of activities. Since the entry into force of the Treaty in 1967, technological developments have multiplied space activities that do not fall under the category of “studies” and “exploration”. Not only direct exploitation activities such as space mining would be left outside, but also traditional uses of outer space such as the operation of satellites for telecommunications, Earth observation, and satellite navigation.²⁴

Last but not least, the applicability of the Article is limited to the States Parties to the Treaty. This is of course coherent with the law of the treaties general rules.²⁵ While the first part of the Article concerning the principle of “cooperation and mutual assistance” was first included in the 1963 UNGA

21 It has to be recalled, however, that the legal delimitation between airspace and outer space is still subject of debate. See De Oliveira Bittencourt Neto, *Defining the Limits of Outer Space for Regulatory Purposes*, Springer, 2015.

22 Lyall, Larsen, *Space Law: a Treatise*, 2009, p. 176.

23 Tennen, *Towards a New Regime for Exploitation of Outer Space Mineral Resources*, 88 *Neb. L. rev.* 794 2009-2010, p. 797. It would be debatable, however, whether a celestial body – such as a small asteroid – artificially removed from its orbit and under human control would still be deemed as a celestial body or whether it would fall within the category of “space object”.

24 This would imply the lack of relevance of Article IX with regard to a growing issue such as orbital space debris, or an aberrant interpretation such as its applicability only to the debris created by scientific satellites.

25 See Vienna Convention on the Law of the Treaties, 63 *AJIL* 875 (1969), Art. 26. Hereinafter, Vienna Convention.

Resolution,²⁶ and therefore can be deemed to have turned into international customary law,²⁷ the second paragraph constitutes an incorporation original to the OST. Since all space faring nations have ratified the OST,²⁸ however, such limit is likely to have limited practical impact.

2.2 Terminology

According to the wide opinion of the commentators, the main shortcoming of Article IX is the lack of precision in its terminology. Such issue, quite common to all the space treaties,²⁹ proves to be particularly undermining in the potential role of Article IX for the adoption and enforcement of environmental protection measures.

The core element of the second paragraph is the concept of “harmful contamination”, and the related duty upon States Parties to avoid it. It is not sufficiently precise, however, to identify which type of degradation of the outer space environment is prohibited, and to what extent.³⁰

The presence of the term “harmful” suggests at first that contamination is not per se prohibited, and thus that exploration activities are lawful even if to a limited degree contamination is caused.³¹ It is not defined, however, what “harmful” means, i.e. the distinction between legal and non-legal contamination remains obscure. The term “contamination” itself lacks a definition. This seemingly leaves it open to cover both the biological and non-biological kind, thus encompassing not only the classical notion of “forward contamination” but also the release of chemical and radioactive contaminants.³² It is however debatable whether it would also cover environmental modifications of different kind, such as the alteration of the topography and geology of a celestial body, or even its full consumption,

26 Declaration of Legal Principles Governing the Activities of States in the Exploration and Use of Outer Space, GA res. 1962, UN GAOR Supp. (No. 15) at 15, UN Doc. A/5515 (1963).

27 Ree, Freeland, *The Crystallisation of General Assembly Space Declarations into Customary International Law*, Proceedings of the Colloquium on the Law of Outer Space, 46, 2004.

28 As at 1 January 2017 the Outer Space Treaty has 105 States Parties. UNOOSA, Status of International Agreements relating to activities in outer space as at 1 January 2017, A/AC.105/C.2/2017/CRP.7.

29 Qizhi, *Environmental Impact of Space Activities and Measures for International Protection*, 16:1 Journal of Space Law, 1988, p. 125.

30 For a general overview of the various types of extraterrestrial environment contamination see KRAMER, *Extraterrestrial Environmental Impact Assessment – A Foreseeable Prerequisite for Wise Decisions Regarding Outer Space Exploration, Research and Development*, Space Policy 30, 2014, p. 217.

31 Lyall, *Planetary Protection from a Legal Perspective – General Issues*, in *Protecting the Environment of Celestial Bodies*, IAA Cosmic Study, 2010, p. 57.

32 *Ibid.*, p. 58.

which would be typical consequences of upcoming large-scale human activities like space mining.

It is also debatable why for the protection of the terrestrial environment the terminology is different. While the term “adverse change” has a much broader scope than “harmful contamination” and is easier to be proven, the specification that it shall derive from the “introduction of extraterrestrial matter in the environment of the Earth” makes it more circumstantiated and easier to enforce. The Article, therefore, seems to stress more the environmental protection of the Earth rather than of space and celestial bodies.³³

The generic terms “appropriate measures” and “where necessary” do not add any meaningful content to the obligation, confirming the high level of abstractness of the provision.

The remaining and prevalent part of Article IX, focused on the protection States Parties interests, suffers a similar level of ambiguity, by leaving terms like “guided” and “corresponding interest” without further specification.

In conclusion, despite Article IX stipulates that States “shall” avoid harmful contamination, and the intent of the drafters was allegedly to establish a legally binding obligation, the ambiguity of the terms leaves too much room for States’ discretion. As a consequence, its provisions result too vague to be actually enforceable.³⁴

3. Other Provisions in the *corpus juris spatialis*

3.1 The Moon Agreement

Article IX OST is not the only provision in the *corpus juris spatialis* that directly addresses the issue of environmental protection. The aim of the Moon Agreement,³⁵ signed in 1979, is to establish a comprehensive legal framework for the exploration and use of the Moon and other celestial bodies, developing further the general principles established by the Outer Space Treaty. Art 7.1 MA, in particular, elaborates on the subject of environmental protection, partially succeeding to fill some of the *lacunae* left by the OST. It widens the scope of Article IX by explicitly extending it also to the exploitation phase of space activities, and by stating the duty upon States Parties to “prevent the disruption of the existing balance of its environment”. Such disruption can take place by the introduction of “adverse changes”, by its “harmful contamination through the introduction of extra-environmental

33 Gupta, *supra* note 17, p. 27.

34 Apking, The Rush to Develop Space: the Role of Space Faring 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, 2005, p. 447.

35 Agreement Governing the Activities of States on the Moon and Other Celestial Bodies, 18 ILM 1434 (1979). Hereinafter, MA.

matter”, or “otherwise”. Despite the concept of “harmful contamination” remains undefined, it is beyond doubt that these specifications give a more circumstantiated meaning to the provision. States Parties, furthermore, have the obligation to inform the U.N. Secretary General about the measures undertaken to prevent the disruption of the existing balance of the space environment.

The Moon Agreement, however, while can be used as an interpretative tool for the OST, has a very limited practical application. As to 2017, only 17 States have ratified it,³⁶ among which none of the major space-faring nations. Its relevance remains therefore mostly theoretical.

3.2 Principles of International Law

Article III OST prescribes that States Parties shall carry on the exploration and use of outer space “in accordance with international law, including the Charter of the United Nations”.³⁷ This provision implies the relevance of principles of general international law to the domain of space activities, including the specific field of environmental protection.³⁸

Outer space and celestial bodies, according to the Outer Space Treaty, shall be considered as the “province of all mankind”,³⁹ and are “not subject to appropriation by claim of sovereignty, by means of use or occupation, or by any other means”.⁴⁰ As a consequence, they enjoy the status of *res communis omnium*, together with other areas beyond States’ territorial jurisdiction such as the high seas, the atmosphere and the Polar Regions.⁴¹

The principles of international environmental law that may be applicable to space, thus, pertain to the specific area of the protection of the global commons, whose legal maturity is still highly controversial.

While it is generally recognized that States are under a general obligation to protect and preserve the global environment,⁴² to assert that States are prohibited from causing damages in the common areas is far from the reality of the situation.⁴³ The development of *erga omnes* obligations that aim at

36 UNOOSA, Status of International Agreements relating to activities in outer space as at 1 January 2017, A/AC.105/C.2/2017/CRP.7.

37 OST, Article III.

38 Lyall, IAA Study, *supra* note 31, p. 56.

39 OST, Art. I.

40 OST, Art. II.

41 Xue, Hanquin. *Transboundary Damage in International Law*, Cambridge University Press, 2003, p. 191.

42 This is also enunciated in Principle 2 of the 1992 Rio Declaration on Environment and Development. See Declaration on Environment and Development, in report of the UN Conference on Environment and Development (A/CONF. 151/26/Rev.1 (Vol. 1), 14 June 1992, Annex (Rio Declaration), Principle 2.

43 Xue, Hanquin, *supra* note 42, p. 246. This also raises the controversial issue of which State would have the legal standing to invoke the international responsibility of the violating State, thus involving problems of secondary rules. See Draft Articles on

protecting the global commons *per se*, and not the States' interests in common areas, does not seem to have reached a sufficient level of maturity. International jurisprudence has identified several principles that concern the responsibility of States for transboundary pollution. However, they are necessarily bound to the harm to foreign nationals and foreign territory, and no mention was ever made to customary obligations relating to global environment.⁴⁴

Principles of international law such as the principle of prevention, the precautionary approach and the polluter-pays principle are established by several Treaties specific to certain areas, and are consequently applicable and enforceable only among the concerned States Parties. Outside the positive rules of conventional instruments, on the other hand, they are considered to be still in their emerging phase. Notwithstanding some encouraging signs in this direction in the recent years,⁴⁵ it is hard to claim that they are part of binding customary international law.⁴⁶ The principle of prevention and the precautionary principle, for instance, have been called as suitable for the application to outer space environment.⁴⁷ It would also be necessary, however, to carefully assess the feasibility of their application to the extra-terrestrial environment of outer space and celestial bodies, characterised by its extreme remoteness and absence of a biosphere.

In conclusion, resorting to general principles of international environmental law – at least at the present time – does not seem to be a viable solution to identify punctual obligations upon States for the protection of the extra-

Responsibility of States for Internationally Wrongful Acts, with Commentaries, in Report of the International Law Commission, 53rd sess. UN Doc. A/56/10, Article 48.1(b), p. 126.

44 See for instance Trail Smelter Arbitration (U.S. v. Can.), 1938/1941, R.I.A.A. 1905. For the ILC approach on the issue, see also Draft Principles on the Allocation of Loss in the Case of Transboundary Harm Arising Out of Hazardous Activities, with Commentaries, in Report of the International Law Commission, 56th sess. UN Doc. A/56/10.

45 See Itlos Advisory Opinion of 1 February 2011, Responsibilities and Obligations of States Sponsoring Persons and Entities with Respect to Activities in the Area, p. 41, par. 135. According to the Chamber, “the incorporation of the precautionary principle into a growing number of international treaties and other instruments, (...) has initiated a trend towards making this approach part of customary international law”.

46 Baker, *supra* note 12, p. 79.

47 On the proposal to apply the precautionary principle to the protection of outer space from space debris see for instance Cinelli, Pogorzelska, The Current International Legal Setting for the Protection of the Outer Space Environment: the Precautionary Principle Avant La Lettre, *Reciel* 22 (2), 2013. With regard to the applicability of the principle of prevention see instead Viikari, The Environmental Element in Space Law: Assessing the Present and Charting the Future, *Martinus Nijhoff*, 2008, p. 173.

terrestrial environment. The *lex specialis* constituted by the Outer Space Treaties, therefore, remains the primary direction where to look at.

4. An Anthropocentric Approach to Article IX OST

The analysis returns then to the starting point: Article IX OST and its role as legal foundation for any further instrument *de iure condendo*.

A literal interpretation of its second paragraph bears all the limits of the era when it was conceived and would force to a very restrictive applicability, narrowing it to exploration activities. At the same time, it would suggest a will to protect space environment *per se*, thus adopting an ecocentric approach.⁴⁸

An extensive interpretation, on the contrary more recommendable, would however be feasible only once accepted the anthropocentric nature of all Article IX – including the provision on the protection of extraterrestrial environment.

An intransigent ecocentric interpretation of the second paragraph of Article IX may at a first instance look more appealing, as it would presumably entail the adoption and enforcement of stricter environmental standards. It would nevertheless have the aberrant consequence to isolate it from the rest of the Treaty, leaving it in splendid isolation but mostly deprived of its practical relevance.

An anthropocentric reading of paragraph two would allow an interpretation more consistent with the spirit and the purpose of the Treaty – as prescribed by the Vienna Convention on the Law of the Treaties⁴⁹ – and would permit the use of the remaining provisions to partially remedy the ambiguities and the shortcomings of Article IX.

Such approach would at first connect it with the rest of the Article. It would result less problematic to claim that it applies also to space exploitation, fully covered by the rest of the Article, and the term “harmful” would finally acquire a more specific meaning: contamination is harmful when it prevents or disturbs other States’ present or future space activities. Specularly, degradation of the environment would represent a possible form of harmful interference in the meaning of the third and fourth paragraph of Article IX.⁵⁰

An extensive interpretation of the due regard principle established by the first paragraph, moreover, would be fully legitimated, thus reinforcing the obligation to respect the interests of other States Parties by not endangering the environment of outer space and celestial bodies.⁵¹

48 Cinelli, *supra* note 47, p. 192.

49 Vienna Convention, Art. 31.1.

50 Tennen, *supra* note 23, p. 817.

51 Hofmann, IAA Study, *supra* note 16, p. 63.

Even more importantly, an anthropocentric approach would bring Article IX in line with the Outer Space Treaty as a whole. The purpose of the Outer Space Treaty, as well as of the rest of the *corpus juris spatialis*, is not the preservation of the space environment in its pristine state, but rather the exploration and use of outer space for peaceful purposes.⁵² Thus, it is primarily and solely concerned with human space activities and their orderly development. A fundamental link can be established to Article I, where with the concept of “province of all mankind” would include a common interest to preserve the space environment.⁵³ Its degradation, indeed, in this perspective would jeopardise its fruition by the present as well as future generations.⁵⁴

Last but not least, a balance must be ensured with the freedom of exploration and use of outer space, which is a fundamental right of the States according to Article I.⁵⁵ An approach aimed at directly and primarily protecting the environment, instead, may result too restrictive, especially if aimed at preserve it in the pristine conditions, and would constitute a potential obstacle in the negotiation of any further legal framework implementing Article IX.

The anthropocentric nature of Article IX has been pointed as a shortsighted approach.⁵⁶ On the contrary, it constitutes the only interpretation consistent with the rest of the Outer Space Treaty, and the most pragmatic basis for the future discussion on an international agreement aimed at, or inclusive of, the protection of outer space and celestial bodies’ environment.

5. Conclusion

Article IX of the Outer Space Treaty suffers many problems, and is not able to guarantee alone the environmental sustainability for future space activities. It still provides, however, the main basis for the introduction of environmental values in the *corpus juris spatialis*. Its amendment, called as necessary by several commentators,⁵⁷ could only be contextual to a general revision of the Outer Space Treaty, and would risk to get negatively influenced by the wider negotiating difficulties. The possibility to open the OST to a general revision pertains policy considerations, and is outside the scope of the present analysis.

52 Cinelli, *supra* note 47, p. 193.

53 Hofmann, IAA Study, *supra* note 16, p. 64.

54 Gupta, *supra* note 17, p. 190.

55 Williamson, Space Ethics, *supra* note 1, p. 50.

56 In favour of the need to shift from an anthropocentric to an ecocentric approach see Baker, *supra* note 12.

57 See for instance Gupta, *supra* note 17.

Instead of opening the Pandora box of a Treaty revision, it would be more advisable to remedy the shortcomings of Article IX by adopting an appropriate implementing legal instrument. Several proposals for a Convention conjugating the exploitation of natural resources with the preservation of the environment have been advanced: particularly interesting are the ones that refer to the Wellington Convention on the Regulation of Antarctic Mineral Resource Activities or the UNCLOS Convention Part XI as a model.⁵⁸

Such path, however, requires a pragmatic approach. Before engaging in the draft on fine-detailed rules on sectorial issues, such as space mining, it is advisable to seek international consensus on a basic ethical policy identifying the goods to be protected and an agreed moral ground.⁵⁹

An anthropocentric vision of Article IX does not constitute a watered-down compromise, but the most suitable approach to ensure compliance with the rest of the Outer Space Treaty and guarantee balance between the rights of space explorers and exploiters and the sustainability of space activities. Preservation of the environment, thus, would be instrumental to the protection of long-term human interests. The regulatory models pointed above are encouraging steps ahead, and deserve a dissertation built on the reflection on the moral value and legal significance of Article IX OST.

A final word shall be dedicated to the domestic regulation of outer space environment. Two countries, namely the United States and Luxembourg, have so far adopted national legislations on space mining.⁶⁰ While they aim at ensuring business certainty by guaranteeing property rights on the extracted resources, they do not treat the environmental preservation of celestial bodies, leaving it into a legal void of Article IX OST.⁶¹ In the light of the above analysis, also a scattered national-based approach to the issue may result detrimental for the achievement of a long-term common policy. Seen from the positive perspective, this regulatory vacuum should instead be considered as a moving force towards a proper international discussion on the matter.

58 See for instance Kerrest, *Exploitation of the Resources of the High Sea and Antarctica: Lessons for the Moon?* In *Proceedings of the Forty-seventh Colloquium on the Law of Outer Space*, 2004.

59 Williamson, *Space Ethics*, *supra* note 1, p. 51.

60 US Commercial Space Launch Competitiveness Act, Title IV: Space Resource Exploration and Utilization, 51 USC 10101, 2015; Loi du 20 Juillet 2017 sur l'Exploration et l'Utilisation des Ressources de l'Espace, *Journal Officiel du Grand-Duché de Luxembourg*, N° 674 du 28 juillet 2017.

61 The applicability of the US National Environmental Policy Act to the extraterrestrial environment is however still subject to debate. See Kramer, *Extraterrestrial Environmental Impact Assessment – A Foreseeable prerequisite for wise decisions regarding outer space exploration, research and development*, *Space Policy* 30, 2014, p. 218.