

Legal Issues Surrounding Human Settlements on the Moon and Other Celestial Bodies

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Abstract

With the shortage of space and resources on earth to support increasing human population, plans are devised for human habitation on the moon and other celestial bodies. While the State agencies of the developed States are involved in implementing such plans from a long period of time, the private space players are not far behind in involving themselves in such endeavours. Rapid scientific and technological innovations are indicating the fact that the idea of human settlement on the moon and other celestial bodies is not a far-fetched dream. However, the possible legal impediments under the international space treaties as well as under conflicting municipal laws seem to be the major concerns in the practical implementation of such a fascinating idea. To start with, it is significant to bear in mind that the international space law has developed on the basis of the principle of common rights as against individual rights. In furtherance of this spirit of common rights, one of the fundamental principles of international space law is the principle of national nonappropriation enshrined under Article II of the Outer Space Treaty 1967. The idea of celestial settlement is seen as a threat to this fundamental principle as human settlements might lead to the claim of State sovereignty and consequently national appropriation in contravention of Article II. An incidental question that arises out of such settlements is also the possibility of private property claims and rights for resource exploitation by the settlers, which again brings forward debates under Article II of the Outer Space Treaty and Article 11 of the Moon Agreement 1979. Protection of celestial environment is another area of concern arising out of celestial settlements. While the celestial environment is known to be fragile, the current treaty norms under Article IX of the Outer Space Treaty and Article 7 of the Moon Agreement are grossly inadequate to regulate environmental pollution. Added to this, the liability norms under the space treaties are human-centric, and hence, they don't fix any liability for damage caused to celestial environment. Another limb of concern in celestial

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settlements stems from the need for regulating the activities of settlers. While there would be concerns about the applicable law governing the human activities, exercise of jurisdiction and law enforcement would become much more complicated in the absence of judiciary and executive machinery on the celestial bodies. Hence, the celestial settlements need to be organised and well-planned to avoid the situation of costs outweighing the benefits in economic, social and legal sense.

1. Introduction

Rapid increase in the human population on the Earth has brought serious concerns in terms of available space and access to natural resources. While many of the earthly resources are finite and non-renewable, even the renewable resources are not being reproduced at the speed with which the human population is increasing. Hence, there exists a gap between the demand and supply, which is widening day by day. The developing and less developed countries are facing huge problem of poverty and hunger. It is astounding to note that approximately 9 million people die every year due to hunger.¹ One third of the world population doesn't have access to basic facilities for leading a decent life.² An estimated 150 million people are homeless and about 1.6 billion people lack adequate housing.³ Even in the developed countries like the United States of America, the number of homeless persons is alarming and unfortunately not decreasing despite concerted efforts.⁴

The above concerns of mankind have resulted in lateral thinking in terms of searching alternatives for human survival. One of the suggested alternatives in this regard has been the human habitation on the moon and other celestial bodies.⁵ The pioneer space agencies like NASA and ESA have been working

1 See <https://www.theworldcounts.com/challenges/people-and-poverty/hunger-and-obesity/how-many-people-die-from-hunger-each-year>, (accessed 16.08.20).

2 See World Health Organization, 1 in 3 people globally do not have access to safe drinking water – UNICEF, WHO, <https://www.who.int/news-room/detail/18-06-2019-1-in-3-people-globally-do-not-have-access-to-safe-drinking-water-unicef-who>, (accessed 16.08.20); see also Time, 1 in 3 People Worldwide Don't Have Proper Toilets, Report Says, <https://time.com/3942630/toilets-who-unicef-report/>, (accessed 16.08.20).

3 See Yale Global Online, As Cities Grow, So Do the Number of Homeless, <https://yaleglobal.yale.edu/content/cities-grow-so-do-numbers-homeless>, (accessed 16.08.20).

4 See Statista, Estimated number of homeless people in the United States from 2007 to 2019, <https://www.statista.com/statistics/555795/estimated-number-of-homeless-people-in-the-us/>, (accessed 16.08.20).

5 Alan Wasser, Douglas Jobs, Space Settlements, Property Rights and International Law: Could a Lunar Settlement Claim the Lunar Real Estate it Needs to Survive?, *J. Air L. & Com.* 73 (2008) 37-78 at 38.

in this direction since quite some time.⁶ The private space agencies have also joined the race for extra-terrestrial human habitation, and more significantly, they are progressing with great speed towards achieving their goal.⁷ One of the crucial factors for such habitation is the creation of human-friendly atmosphere on the moon or other celestial bodies. Several plans are devised for having access to water, oxygen and other basic amenities for human existence.⁸ Availability of fuel for transport and construction materials on the celestial bodies for self-sufficiency is tested by the space-faring nations.⁹ Technological developments are also taking place for the safe transportation of people to implement the plans of celestial habitation.¹⁰

With the scientific developments in the direction of human habitation on the moon and other celestial bodies, several legal challenges have come to the forefront. One of the major reasons for the emergence of new legal challenges in the field of space activities has been the shift from scientific activities to commercial activities in outer space. Most of the fundamental principles of space law are initially developed for regulating State-oriented scientific activities, which are not suitable for application to commerce-oriented activities of both States and private enterprises. Hence, there is an absolute need to ponder upon these legal principles and challenges posed by them before implementing the fascinating idea of human habitation on celestial bodies.

2. Principle of Non-Appropriation

Since the beginning of the space activities, the world community was clear of the fact that the principle of sovereignty, which is applicable to the airspace, should not be made applicable to the outer space. This is reflected in the approach of both the USSR and the United States in not seeking permission

6 See NASA, Moon to Mars Overview, <https://www.nasa.gov/topics/moon-to-mars/overview>, (accessed 16.08.20); see also Konrad Szocik, Tomasz Wojtowicz, Leszek Baran, War or Peace? The Possible Scenarios of Colonising Mars, *Space Policy* 42 (2017) 31-36 at 34 & 35.

7 See Stuart Fox, 6 Private Companies That Could Launch Humans into Space, <https://www.space.com/8541-6-private-companies-launch-humans-space.html>, (accessed 25.08.20).

8 Using the ice in the polar craters to meet the requirement of water, and also obtaining air by dividing water into hydrogen and oxygen is one of the plans for the creation of a human friendly atmosphere on the moon. See NASA's Plans to Build a Human Settlement on the Moon, <https://science.slashdot.org/story/19/02/17/0033239/nasas-plans-to-build-a-human-settlement-on-the-moon>, (accessed 16.08.20).

9 Louis de Gouyon Matignon, In Situ Resource Utilization, <https://www.spacelegalissues.com/in-situ-resource-utilization/>, (accessed 16.08.20).

10 Hanneke Weitering, How Space X's Starship Will Help Establish a Mars Base, <https://www.space.com/spacex-starship-mars-transportation-plans.html>, (accessed 16.08.20).

from other States to orbit their satellites over the territories of those States. Other States also did not object to the activities of the USSR and the United States, which indicated their common *opinio juris* of not claiming sovereignty over the outer space.¹¹ The USSR and the United States continued their position of not claiming sovereignty even after entering into the outer space or landing on celestial bodies.¹² This position of the States to accept the principle of common rights in outer space got culminated into province of all mankind and national nonappropriation principles under Articles I and II of the Outer Space Treaty¹³ respectively. These provisions are again reproduced under Articles 4(1) and 11(2) of the Moon Agreement¹⁴.

Article II of the Outer Space Treaty prohibits the national appropriation of the outer space and celestial bodies by claim of sovereignty, use or occupation or by any other means. Human habitation on the moon or other celestial bodies would question the edifice of the national nonappropriation principle. While there is a debate about the prohibition on individual appropriation under Article II of the Outer Space Treaty¹⁵, the large-scale human habitation on the moon and other celestial bodies would inevitably lead to national appropriation.¹⁶ Historically, the claims of State sovereignty and assertion of rights over the resources have stemmed out of human habitation, even though, it is not the sole criterion for determining sovereignty.¹⁷ When we look from the perspective of relationship between the State and territory, any claim of property right through occupation transforms into claim of exclusive rights and assertion of sovereignty.¹⁸

11 S. Bhatt, *Legal Controls of Outer Space – Law, Freedom and Responsibility*, S. Chand & Co. (Pvt.) Ltd., New Delhi, 1973, at 95.

12 The Soviet Union has also deposited a document to the UN General Assembly stipulating the absence of State sovereignty in outer space as well as advocating for freedom of exploration for all States. See UN Doc. A/AC.105/C.2/SR.7 (21 August 1962) at 4 & 5.

13 Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, Including the Moon and Other Celestial Bodies, 27 January 1967, 610 UNTS 205, 18 UST 2410, TIAS No 6347, 6 ILM 386 (entry into force 10 October 1967).

14 Agreement governing the Activities of States on the Moon and Other Celestial Bodies, 5 December 1979, 1363 UNTS 3 (entry into force 11 July 1984).

15 Wayne N. White, Jr., *Real Property Rights in Outer Space*, Proceedings of the Fortieth Colloquium on the Law of Outer Space, 1997, 6 – 10 October, 370-384 at 378.

16 See Eugene Brooks, *Legal Aspects of the Lunar Landings*, Int'l L. 4(3) (1970) 415-432 at 425.

17 The Case Concerning the Legal Status of Eastern Greenland (Denmark v. Norway), 1933 PCIJ, Ser. A/B, No. 53 and Clipperton Island Arbitration (Mexico v. France), 2R. INT'L ARB. AWARDS 1105 (1931).

18 Harry H. Almond, Jr., *The Legal Status of Property on the Moon and Other Celestial Bodies*, Proceedings of the Thirty-ninth Colloquium on the Law of Outer Space, 1996, 7 – 11 October, 20-30 at 20.

Hence, it is evident that allowing celestial habitation would mean making way for national appropriation of celestial bodies.

If we go by the spirit of Article II of the Outer Space Treaty read with the principle of province of all mankind under Article I of the Outer Space Treaty, even the individual appropriation should be prohibited under Article II of the Outer Space Treaty. When the States are prohibited to nationally appropriate the outer space and celestial bodies, even the private individuals are barred from appropriating them. Historically, this view has been accepted and endorsed by almost all international space law experts across the globe.¹⁹ International Law Association has also proclaimed that the draftsmen of nonappropriation principle have never intended to allow this principle to be circumvented by individuals by asserting their claims over the celestial bodies.²⁰ Even a reference to Article VI of the Outer Space Treaty indicates the fact that the responsibility for private activities in outer space is attributed to concerned State/s²¹, and thus, any private claim over the outer space or celestial bodies would contravene the principle of national nonappropriation. System of allocation of property rights in both common law and civil law systems also supports the above-mentioned position. In the common law system, State owns all property and the individuals enjoy the grant from the States.²² Hence, if the State doesn't own something, it cannot transfer rights in it to individuals. This means a person from common law jurisdiction cannot assert any right over the moon and other celestial bodies as his/her State doesn't possess any such right over them. Though in civil law system,

19 See Paul G. Dembling, Daniel M. Arons, *The Evolution of the Outer Space Treaty*, J. Air L. & Com. 33 (1967) 419-456 at 421; Bin Cheng, *The 1967 Space Treaty*, J. du droit Int'l, 95 (1968) 532-645 at 574; D. Goedhuis, *Legal Aspects of the Utilization of Outer Space*, Neth. Int'l L. Rev. 17 (1970) 25-50 at 36; Manfred Lachs, *The Law of Outer Space*, Netherlands, Springer, 1972, at 44; Carl Q. Christol, *Article 2 of the 1967 Principles Treaty Revisited*, Annals Air & Space L. IX (1984) 217-265 at 218; Ram S. Jakhu, *Legal Issues Relating to the Global Public Interest in Outer Space*, J. Space L. 32 (2006) 31-110 at 44; Zachos A. Paliouras, *The Non-Appropriation Principle: The Grundnorm of International Space Law*, LJIL 27 (2014) 27-54 at 50 & 51.

20 International Law Association, *Report of the Fifty-Fourth Conference*, The Hague, 1970, at 429.

21 Outer Space Treaty, Art. VI states that "States Parties to the Treaty shall bear international responsibility for national activities in outer space, including the Moon and other celestial bodies, whether such activities are carried on by governmental agencies or by non-governmental entities, and for assuring that national activities are carried out in conformity with the provisions set forth in the present Treaty. ..."

22 See Thomas Gangale, Marilyn Dudley-Rowley, *To Build Bifrost: Developing Countries Property Rights and Infrastructure*, American Institute of Aeronautics and Astronautics, 2005, 1-11 at 1, https://www.academia.edu/32985152/To_Build_Bifrost_Developing_Space_Property_Rights_and_Infrastructure, (accessed 17.08.20).

property can exist independently of State ownership²³, the individual claiming rights over the property can claim only over something that doesn't belong to anyone. Hence, only *res nullius* can be subject to property claims.²⁴ However, the moon and other celestial bodies are not *res nullius*; rather they belong to everyone by virtue of the principle of province of all mankind.

The advocates of private property rights in outer space and celestial bodies have often failed to comprehend the above norms of property rights, more particularly in civil law systems, and also misconstrued the notion of sovereignty with jurisdiction. Bacca, for example, was of the view that;

The same property rights system that is most beneficial on Earth will be most beneficial on the celestial bodies.... Although the provision of Article II against national appropriation contradicts these property concepts, it is inconsistent with the notions of jurisdiction and ownership found elsewhere in the treaty. This provision should therefore be modified and replaced with a concept of reasonable use or investment. Such a provision should provide for initial allocation of unclaimed property only upon productive use or investment.²⁵

The above proposition, predominantly based on the civil law system of allocation of property, is rooted in the wrong assumption that the moon and other celestial bodies are *res nullius*. We should also understand that the notions of jurisdiction and ownership in the space treaties are solely connected with the space objects and their personnel.²⁶ They have nothing to do with the property rights on the moon and other celestial bodies. Added to this, allocation of property on productive use or investment would result in an unjust enrichment by select few who may afford such endeavours. People in the developing world are essentially precluded from receiving any benefit in the bounties of nature. Even among those who can afford, an unhealthy competition would develop to grab the celestial property, which would ultimately breed criminality and destroy peaceful coexistence.²⁷

23 White, Jr., *supra* note 15.

24 Johana Catena, Legal Matters Relating to the "Settlement" of "Outposts" on the Moon, Proceedings of the Forty-Seventh Colloquium on the Law of Outer Space, 2004, 4 – 8 October, 414-424 at 418.

25 Kurt Anderson Baca, Property Rights in Outer Space, J. Air L. & Com. 58 (4) (1993) 1041-1085 at 1084.

26 Reference can be made to Art. VIII of the Outer Space Treaty and Art. 12 of the Moon Agreement.

27 Modesto Seara Vazquez, Cosmic International Law, Wayne State University, Detroit, 1965, 231-235; Jason Krause, The Outer Space Treaty Turns 50. Can it Survive a New Space Race, ABA J., https://www.abajournal.com/magazine/article/outer_space_treaty#:~:text=Can%20it%20survive%20a%20new%20space%20race%3F,-By%20Jason%20Krause&text=In%201967%2C%20a%20time%20when,the%20pr vince%20of%20all%20mankind.%E2%80%9D, (accessed 25.08.20).

A reference to the Moon Agreement further substantiates the common understanding prevailing during the drafting of space treaties in 1960s and 70s on the absence of property rights in the moon and other celestial bodies. Article 9(2) and Article 11(3) of the Moon Agreement are the living examples of such prohibition. While Article 9(1) allows the use of celestial bodies to establish manned and unmanned stations, Article 9(2) prohibits any individual assertion of rights contrary to the principle of free access of every State to all areas of the celestial bodies in the following terms:

Stations shall be installed in such a manner that they do not impede the free access to all areas of the Moon of personnel, vehicles and equipment of other States Parties conducting activities on the Moon in accordance with the provisions of this Agreement or of article I of the Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies.²⁸

Added to this, an explicit prohibition on property rights can also be seen under Article 11(3) of the Moon Agreement, which states as follows:

Neither the surface nor the subsurface of the Moon, nor any part thereof or natural resources in place, shall become property of any State, international intergovernmental or non-governmental organization, national organization or non-governmental entity or of any natural person. The placement of personnel, space vehicles, equipment, facilities, stations and installations on or below the surface of the Moon, including structures connected with its surface or subsurface, shall not create a right of ownership over the surface or the subsurface of the Moon or any areas thereof. ...²⁹

Though the Moon Agreement has failed to receive wide-scale ratifications³⁰ and there is an argument against its internationally binding nature³¹, it is certainly useful in understanding the approach of the States and their negotiators during the drafting of the space treaties. Undoubtedly, the common rights principle has been the bedrock principle in the space treaty negotiations during 1960s and 70s. However, with the commercialization and twenty first century developments, some States and private entities are attempting to undo the foundations of space law to further their self-interests.

28 Moon Agreement, Art. 9(2).

29 Moon Agreement, Art. 11(3).

30 Only 18 States have ratified the Moon Agreement and 4 more have signed but not ratified it. See United Nations Office of Outer Space Affairs, Status of International Agreements Relating to Activities in Outer Space as at 1 January 2020, <https://www.unoosa.org/documents/pdf/spacelaw/treatystatus/TreatiesStatus-2020E.pdf>, (accessed 19.08.20).

31 Fabio Tronchetti, The Moon Agreement in the 21st Century: Addressing its Potential Role in the Era of Commercial Exploitation of the Natural Resources of the Moon and Other Celestial Bodies, *J. Space L.* 36 (2010) 489-524 at 500.

3. Rights over Celestial Resources

The human habitation on the moon and other celestial bodies would also bring questions about the rights over celestial resources. The UN space treaties have viewed the celestial resources as charity of nature, and hence, right of mankind as a whole in the celestial resources has been recognised in the form of principles like province of all mankind³² under the Outer Space Treaty and common heritage of mankind (CHM) under the Moon Agreement. In advocating for CHM, Article 11 of the Moon Agreement also recognises a need for establishing an international regime based on the requirements of benefit sharing and conservation for future generations.³³ Hence, giving individual rights over celestial resources to the inhabitants of celestial bodies would be against these fundamental principles of space law.³⁴ At the same time, human habitation on the moon and other celestial bodies without the conferment of rights over celestial resources also doesn't seem to be feasible in terms of sustenance of celestial inhabitants. Thus, there would be a tussle between the ideal of common rights and the reality of human habitation on celestial bodies.

Of late, the international community is evidencing unprecedented developments in some of the developed States to confer individual rights over celestial resources. These developments originated with the United States passing Commercial Space Launch Competitiveness Act 2015³⁵, which encourages commercial exploration and commercial recovery of space resources and asteroid resources by discouraging governmental barriers. The 2015 Act also allows the United States' citizens to enjoy all rights in

32 Voluntary sharing of benefits is an element of province of all mankind principle. See Carl Q. Christol, *Important Concepts for the International Law of Outer Space*, Proceedings of the Fortieth Colloquium on the Law of Outer Space, 1997, 6 – 10 October, 73-83 at 79.

33 Moon Agreement, Art. 11(5) supplemented by Art. 11(7). Since Art. 11(5) mentions the requirement of establishing an international regime “as such exploitation is about to become feasible”, majority of the scholars are of the view that the States need to develop such a regulatory regime before the beginning of large-scale exploitation. Ram S. Jakhu, Joseph N. Pelton, Yaw Otu Mankata Nyampong, *Space Mining and Its Regulation*, Springer, Switzerland, 2016, at 128 & 129; Virgiliu Pop, *Who Owns the Moon?*, Springer, Dordrecht, 2008, at 146; Edwin W. Paxson III, *Sharing the Benefits of Outer Space Exploration: Space Law and Economic Development*, Mich. J. Int'l L. 14(3) (1993) 487-517 at 500 & 501; Fabio Tronchetti, *The Exploitation of Natural Resources of the Moon and Other Celestial Bodies: A Proposal for a Legal Regime*, Brill, Leiden, 2009, at 45-47.

34 See Chad Crowell, *The Final Frontier: Preventing Space from Becoming the Wild West through the Establishment of Internationally Recognized Property Rights*, Geo. Mason J. Int'l Com. L. 11(1) (2020) 81-104 at 94 & 95.

35 See <https://www.congress.gov/bill/114th-congress/house-bill/2262/text>, (accessed 19.08.20).

connection with the resources recovered by them.³⁶ While Luxembourg has already followed the United States' approach by passing its law on asteroid mining in 2017³⁷, middle-east countries have also shown their interest in joining the race for grabbing celestial resources³⁸. These developments are furthered by the United States' Artemis Accords, which is designed for going back to the moon.³⁹ Though the detailed version of the Artemis Accords is yet to be made public, the released summary clearly indicates the unilateral approach of the United States to interpret the Outer Space Treaty in its own way to advance for lunar resource exploitation.⁴⁰

Undoubtedly, the above-mentioned approaches to grab celestial resources are self-centred and patently against the interests of international community. They are either based on the premise that the private claims would not result in State sovereignty or exclusive rights in contravention of Article II of the Outer Space Treaty; or on the logic that mining rights are independent of rights over the surface of celestial bodies and Article II of the Outer Space Treaty is confined to territorial rights.⁴¹ Such developments are not just against the fundamental principles of space law⁴² but also contrary to general understandings in public international law. International Law Association, for example, in its New Delhi Declaration of Principles of International Law Relating to Sustainable Development 2002 has explicitly recognised the link between benefit-sharing and sustainable development. In defining the objective of sustainable development, the New Delhi Declaration stipulates;

a comprehensive and integrated approach to economic, social and political processes, which aims at the sustainable use of natural resources of the Earth and the protection of the environment on which nature and human life as well as social and economic development depend and which seeks to realize the right of all human beings to an adequate living standard on the basis of their active, free and meaningful participation in development and in the fair

36 US Commercial Space Launch Competitiveness Act 2015, Chapter 513.

37 Law on the Use of Resources in Space, 2017, Luxembourg Chamber of Deputies, 22 August 2017, Number 674 of 2017; see also <https://spaceresources.public.lu/content/dam/spaceresources/news/Translation%20Of%20The%20Draft%20Law.pdf>, (accessed 19.08.20).

38 MidEast set to lead the race in space mining, <https://www.arabianbusiness.com/mideast-set-lead-race-in-space-mining-671601.html>, (accessed 16.08.20).

39 See NASA, The Artemis Accords, <https://www.nasa.gov/specials/artemis-accords/index.html>, (accessed 19.08.20).

40 Dennis O'Brien, The Artemis Accords: repeating the mistakes of the Age of Exploration, *The Space Rev.*, <https://www.thespacereview.com/article/3975/1>, (accessed 19.08.20).

41 P.J. Blount, Christian J. Robison, One Small Step: The Impact of the US Commercial Space Launch Competitiveness Act of 2015 on the Exploitation of Resources in Outer Space, *N.C.J.L. & Tech.* 18(2) (2016) 160-186 at 166-172.

42 See Crowell, *supra* note 34, at 91.

distribution of benefits resulting therefrom, with due regard to the needs and interests of future generations.⁴³

In addition to the New Delhi Declaration, Convention on Biological Diversity 1992⁴⁴, Bonn Guidelines 2002⁴⁵ and Nagoya Protocol 2010⁴⁶ advocate the need for fair and equitable benefit-sharing. Though these instruments are focused on the earth's resources, they reflect the common understanding of the international community on the need for sustainable use and benefit-sharing. It is also to be kept in mind that any effort towards monopolization of celestial resources carries the risk of bringing back the evils of colonization⁴⁷, which the international community has overcome with great struggle. Hence, the grant of individual rights over the celestial resources without the concept of benefit-sharing under different municipal laws is also undermining the current developments in international law. Unplanned human habitation on the celestial bodies would further aggravate the crisis and lead to more and more illegal assertions of individual rights over the common resources of the celestial bodies.

4. Protection of Celestial Environment

The next significant issue that comes to the limelight in celestial habitation is the protection of the celestial environment. The moon and other celestial bodies have their own unique environment. Due to the extremely less density of air, the celestial environment is more fragile⁴⁸, and unlike earth's environment, is not capable of curing itself from the effects of pollution.⁴⁹ Therefore, any damage caused to the celestial environment would trigger long-standing effect, which is detrimental for any activity on the celestial

43 ILA New Delhi Declaration of Principles of International Law Relating to Sustainable Development, 6 April 2002, ILA resolution 3/2002, annex as published as UN GA Doc. A/57/329, 31 August 2002.

44 Convention on Biological Diversity, 5 June 1992, 31 ILM 822; 1760 U.N.T.S. 69 (entry into force 29 December 1993).

45 Bonn Guidelines on Access to Genetic Resources and Fair and Equitable Sharing of the Benefits Arising out of their Utilization, 19 April 2002, UN Doc. UNEP/CBD/COP/6/24 (2002).

46 Nagoya Protocol on Access to Genetic Resources and the Fair and Equitable Sharing of Benefits Resulting from their Utilization, 29 October 2010, UN Doc. UNEP/CBD/COP/10/27 (2010), (entry into force 12 October 2014).

47 Ricky J. Lee, *Law and Regulation of Commercial Mining of Materials in Outer Space*, Springer, The Netherlands, 2012, at 8-12.

48 Matthew Rosendahl, *Galactic Preservation and Beyond: A Framework for Protecting Cultural, Natural, and Scientific Heritage in Space*, Wm. & Mary Envtl. L. & Pol'y Rev. 43(3) (2019) 839-870 at 849.

49 Christopher J. Newman, Mark Williamson, *Space Sustainability: Reframing the Debate*, Space Policy, 46 (2018) 30-37, <http://nrl.northumbria.ac.uk/id/eprint/33817/1/Space%20Sustainability%20paper%20FINAL.pdf>, (accessed 19.08.20).

bodies. As we evidence on the earth, human habitation and consequential activities have always brought misery to the environment. Even the mere human habitation on the celestial bodies would raise concerns over the disposal of household wastes in the absence of biodegradation.⁵⁰ Transmission of microbial life from the earth to the celestial bodies would contaminate the indigenous environment of celestial bodies.⁵¹ Extended activities like construction of buildings, developing means of transport, resource exploitation, industrial processing and production of commodities would further degrade the celestial environment with solid, liquid and gaseous wastes. With the large-scale commercial activities on the celestial bodies, the depletion of natural resources emerges as a concern of equal significance as evident on the earth. Use of rocket fuel, other chemicals or radio-active materials in the course of transportation also add on to the environmental problems.

The Outer Space Treaty deals with the protection of environment under Article IX⁵², which is one of its weakest limbs. Though it speaks about the prevention of harmful contamination of the outer space and celestial bodies, it fails to define the term ‘harmful contamination’. It is also more oriented towards the protection of the earth’s environment as it stipulates a broader obligation of preventing ‘adverse changes’ in the earth environment. Despite both the terms being not defined, a comparison of the two would result in the obvious conclusion that the term ‘harmful contamination’ is much narrower than ‘adverse changes’.⁵³

Comparatively, the Moon Agreement has a better provision in terms of protection of celestial environment. States Parties to the Moon Agreement are obligated under Article 7 to take measures for preventing the disruption of the existing balance of celestial environment, “whether by introducing

50 See April Greene 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*, *Colo. J. Int’l Env’tl. L. & Pol’y.* 16 (2005) 429-466 at 434 & 435.

51 William R. Kramer, *Extraterrestrial Environmental Impact Assessments – A Foreseeable Prerequisite for Wise Decisions regarding Outer Space Exploration, Research and Development*, *Space Policy*, 30(3) (2014) 215-222 at 217 & 218.

52 ... 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. ...

53 Nicolas N. Matte, *Environmental Implications and Responsibilities in the Use of Outer Space*, *Annals Air & Space L.* XIV (1989) 419-448 at 429; Mark Williamson, *A Pragmatic Approach to the “Harmful Contamination” Concept in Art. IX of the Outer Space Treaty*, 5th Eilene M Galloway Symposium on Critical Issues in Space Law, University of Mississippi, 2010, <http://www.spacelaw.olemiss.edu/events/pdfs/2010/galloway-williamson-paper-2010.pdf>.

adverse changes in that environment, by its harmful contamination through the introduction of extra-environmental matter or otherwise.” This obligation is supplemented by the requirement of informing the Secretary General of the United Nations about the measures being adopted by the States for protecting the celestial environment. Article 7 also obligates the States to notify the Secretary General of the United Nations in advance about the placement of radioactive materials on the celestial bodies to the maximum extent feasible. The areas of celestial bodies having special scientific interest can also be designated as international scientific preserves and special protective arrangements for them can be brought into force.

The cause of environmental protection is also furthered by Article 11 of the Moon Agreement. The concept of CHM advocated under Article 11 of the Moon Agreement incorporates sustainable development as an essential element.⁵⁴ Orderly and safe development as well as rational management of the celestial resources can be seen as main purposes of the international regime to be established under Article 11.⁵⁵ Unfortunately, these stronger provisions of the Moon Agreement also suffer from the problem of varied interpretations, especially by the developed States in their zeal to have less onerous obligations while carrying on activities on the celestial bodies. More significantly, the limited number of ratifications of the Moon Agreement makes it practically ineffective as a binding international norm.

In addition to the weaknesses of provisions relating to protection of celestial environment, the liability regime under the space treaties also fails to fix liability for environmental damage. Both the Outer Space Treaty⁵⁶ and the Liability Convention 1972⁵⁷ contain provisions dealing with the liability for damage caused to person or property. The Liability Convention, for example, defines the ‘damage’ as “loss of life, personal injury or other impairment of health; or loss of or damage to property of States or of persons, natural or juridical, or property of international intergovernmental organizations.”⁵⁸ Unfortunately, the liability for environmental damage finds no mention under either of the treaties. In the absence of fixation of liability, we cannot expect the States to seriously undertake their environmental obligations in the celestial bodies.

54 See generally Jorge Cabrera, Medaglia Fred-Perron, Current Status and Future Research Agenda on Benefit-Sharing in International Sustainable Development Law, *J. Korean L.* 17 (2018) 179-216.

55 Moon Agreement, Art. 11(7).

56 See Outer Space Treaty, Art. VII.

57 Convention on International Liability for Damage Caused by Space Objects, 29 March 1972, 961 UNTS 187; 24 UST 2389; 10 ILM 965 (1971) (entry into force 1 September 1972). See Art.s II and III.

58 *Ibid*, Art. I (a).

Though the Committee on Space Research (COSPAR) is continuously engaged in deliberations on protecting celestial bodies, it has limitations in achieving the desired objective of planetary protection. The COSPAR Planetary Protection Policy 2020⁵⁹ and its previous versions⁶⁰ are not comprehensive enough to deal with large-scale environmental damage that may occur due to human habitation on celestial bodies. While the Planetary Protection Policy focuses on prevention of chemical and biological contamination, the environmental concerns in celestial habitation are much beyond them. Despite COSPAR Panels are continuing their efforts and considering several issues of planetary protection⁶¹, one cannot be optimistic about their success as the COSPAR policies are just recommendatory in nature and not part of the binding international law. Implementation of COSPAR Policy is completely at the discretion of States and their agencies.⁶² Need for protecting the environment of outer space and celestial bodies is also reflected in the efforts of the United Nations Committee on Peaceful Uses of Outer Space (UNCOPUOS) in its 2008 Report Referring to Colonization⁶³ and 2017 Guidelines for the Long-Term Sustainability of Outer Space Activities⁶⁴.

It is pertinent to note here that most of the principles of international environmental law have developed in the last part of the twentieth century as well as in the twenty-first century. This period being a complete void in terms of binding international space law developments, the contemporary international environmental law principles do not find a place in space law. Hence, there is an urgent need for incorporating the recent developments in the international environmental law into the domain of space law to protect the celestial environment.

59 COSPAR Policy on Planetary Protection (approved by the COSPAR Bureau on 17 June 2020), https://cosparhq.cnes.fr/assets/uploads/2020/07/PPPolicyJune-2020_Final_Web.pdf, (accessed 21.08.20).

60 See COSPAR's Planetary Protection Policy, <https://cosparhq.cnes.fr/assets/uploads/2019/12/PPPolicyDecember-2017.pdf>, (accessed 25.08.20); see also COSPAR Planetary Protection Policy (20 October 2002; as amended on 24 March 2011), https://web.archive.org/web/20130306111646/https://science.nasa.gov/media/medialibrary/2012/05/04/COSPAR_Planetary_Protection_Policy_v3-24-11.pdf, (accessed 25.08.20).

61 Andre Galli, Andreas Losch, Beyond planetary protection: What is planetary sustainability and what are its implications for space research?, *Life Sci. Space Res.* 23 (2019) 3-9 at 5.

62 The COSPAR Panel on Planetary Protection Role, Structure and Activities, https://cosparhq.cnes.fr/assets/uploads/2019/07/PPP_SRT-Article_Role-Structure_Aug-2019.pdf, (accessed 25.08.20).

63 Report of the Committee on the Peaceful Uses of Outer Space, General Assembly Official Records, Sixty Third Session, 2008, UN Doc. A/63/20 at para 180.

64 Guidelines for the Long-Term Sustainability of Outer Space Activities, Committee on the Peaceful Uses of Outer Space Sixty First Session, 23 February 2018, UN Doc. A/AC.105/L.315.

Unfortunately, the current developments on sustainable development have also been earth-centric. In the zeal to promote the wellbeing of people on the earth, plans are devised for reaching out to the celestial bodies in an unsustainable manner. NASA, for example, in its vision on 'Planetary Sustainability' 2014 mentions one of the objectives as "A multi-planetary society, where the resources of the Solar System are available to the people of Earth."⁶⁵ Such an approach has the potentiality to transmit the earthly mistakes and failure in protecting the environment to celestial bodies.

5. Regulating the Activities of Celestial Inhabitants

The next concern from the legal point of view arises in terms of regulating the day to day activities and private affairs of celestial inhabitants. Governance of birth, death, marriage, divorce, succession, adoption, torts and crimes would be equally significant for preventing chaos on celestial bodies.⁶⁶ Due to the change in environment, social, psychological and behavioural changes are commonly predicted, and these changes might also have potentiality to increase crime rates. As rightly pointed out by Costello, unique issues may arise regarding regulation of sexual behaviour, management and control of family property, protection of dependent children and disabled adults, custody of children etc.⁶⁷ Mechanism for the protection of human rights of people on the celestial bodies is also one of the prominent aspects to be looked into.⁶⁸ In the absence of norms governing these aspects, the celestial habitation would be riddled with all problems that are evidenced in the human history. Though an argument may be made that the earthly laws can be made applicable on the basis of some connecting factors to govern these aspects, there are multiple problems in such an approach.

The very first problem in the application of our municipal laws to govern private affairs of celestial inhabitants would be the finding of suitable connecting factors for the extraterritorial application of our terrestrial laws. There may be arguments for application of laws on the basis of nationality or citizenship of the parties involved or on the basis of registration of the space

65 NASA, Our Vision for Planetary Sustainability, https://www.nasa.gov/sites/default/files/planetary_sustainability_pb brochure.pdf, (accessed 25.08.20).

66 See J. Stewart, Jr., Emerging Patterns of a Private International Space Law Regime – Evolutionary or Revolutionist, Proceedings of Twenty-Third Colloquium on the Law of Outer Space, 1980, 21-28 September, at 201-209.

67 See generally Jan C. Costello, Spacedwelling Families: The Projected Application of Family Law in Artificial Space Living Environment, *Seton Hall L. Rev.* 15(1) (1984) 11-51.

68 See Igor Levchenko, *et al.*, Mars Colonization: Beyond Getting There, *Global Challenges*, (2019) 1-11 at 4 & 5, <https://onlinelibrary.wiley.com/doi/full/10.1002/gch2.201800062>, (accessed 25.08.20).

objects. These approaches have limitations in cases wherein the parties belong to different States or space objects that have carried them are registered in different States. We should also keep in mind that there is a lot of divergence in the practices of common law and civil law countries regarding the application of their laws for the torts or crimes committed outside their territorial jurisdictions.⁶⁹ Even if the determination of applicable law is made on the basis of some connecting factors, the next concern would be regarding the interpretation of those laws as well as law enforcement. In the absence of any dispute settlement body and law enforcement authority, the laws would be of no practical significance. While bringing celestial inhabitants back to the earth for trial and law enforcement is not a feasible option, it is also not advisable to rely on a contingency of development of concerned authorities on the moon and other celestial bodies in the course of time.

Application of municipal laws on the basis of nationality, citizenship or registration as connecting factors would also not be a feasible option in case of subsequent generations of celestial inhabitants.⁷⁰ Say if a Russian settler marries a Japanese settler and they have children on the moon, none of the above-mentioned elements would succeed as a connecting factor to apply any municipal law for governing the activities of those children. This issue becomes more complicated as the time passes on and earthly link obliterates with successive generations of celestial inhabitants.

Defining the relationship between the inhabitants of earth and of celestial bodies is also significant.⁷¹ In the zeal to promote the commercial interests of earthly inhabitants, the human rights of the celestial inhabitants should not be violated by treating them as bonded labourers. One cannot rule out the possibility of commercial mining companies finding an opportunity in celestial habitation to send people for mining resources on the celestial bodies for catering to their greed. This has been witnessed by the world community in the era of colonization⁷² and we should not be repeating the same mistakes in the process of celestial habitation.⁷³ In light of this, there is

69 Hamilton DeSaussure, *An Integrated Legal System for Space*, J. Space L. 6(2) (1978) 179-192 at 182 & 183.

70 Levchenko, *supra* note 68, at 5.

71 George S. Robinson, *Frontier Law at L-5*, Annals Air & Space L. 4 (1979) 617-638 at 632.

72 See Elizabeth Colson, *Forced Migration and the Anthropological Response*, J. Refugee Stud. 16(1) (2003) 1-18 at 6; see also Hussein A. Bulhan, *Stages of Colonialism in Africa: From Occupation of Land to Occupation of Being*, J. Soc. & Pol. Psychol. 3(1) (2015) 239-256 at 246.

73 See Joshua Fitzmaurice, Stacey Henderson, *On the Legality of Mars Colonisation*, Adel. L. Rev. 40(3) (2019) 841-856 at 855.

a requirement of independence of celestial inhabitants from the inhabitants of the earth.⁷⁴

6. Conclusion

Human habitation on the moon and other celestial bodies is undoubtedly an interesting proposition. Especially with the overexploitation of resources on the earth, we cannot expect that the living of future generations would be adequately supported by the remaining resources. Hence, thinking in terms of alternative sources to support human existence has become a must. However, we should keep in mind that exploring the alternatives should be for furthering the rights and interests of whole mankind and not for serving the ulterior motives of select few. Unfortunately, the present plans of celestial habitations do not take into consideration the spirit of common rights envisaged under the UN space treaties. There is no safeguard against national appropriation or private appropriation of celestial bodies in the course of human habitation. Finding a suitable method of allocation of property rights over land and resources is also a farfetched dream in the current era of commercialization.

Human habitation on the moon and other celestial bodies carries high-level risk of causing damage to celestial environment. The existing regime under the Outer Space Treaty is very weak to prevent environmental degradation, and the failure of the Moon Agreement has furthered the environmental concerns. In addition, the absence of separate laws to govern the day to day activities of celestial inhabitants would ultimately make the celestial bodies as battlegrounds. Hence, it is not advisable to take an untimely step forward in the direction of human habitation on celestial bodies as it has the potentiality to pull us ten steps backward on several counts. Unless the above-discussed legal issues are adequately addressed, plans of celestial habitation should not be implemented to avoid the transportation of terrestrial mistakes to the moon and other celestial bodies.

74 See George S. Robinson, *Transcending to a Space Civilization: The Next Three Steps toward a Defining Constitution*, *J. Space L.* 32(1) (2006) 147-176 at 163 & 164.