

THE PROTECTION OF THE EARTH NATURAL ENVIRONMENT *THROUGH* SPACE ACTIVITIES: A GENERAL OVERVIEW OF SOME LEGAL ISSUES

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ABSTRACT

In the context of the protection of the Earth natural environment space activities can play an essential role in achieving sustainable development and protecting the terrestrial natural environment. In particular, remote sensing data can represent a fundamental tool for assessing and locating damages, monitoring progresses and effects of measures tackling environmental problems, verifying the application of environmental treaties and responding to man-made and natural disasters. This paper is aimed at analysing some interesting legal questions arising in relation to these aspects. As regards the use of space technology for the protection of the Earth natural environment, the first point will be to ascertain whether and to what extent the provisions of the *corpus iuris spatialis* can be regarded as a legal basis allowing and promoting it. Going a little further, other possible issues will be taken in consideration: is there a legal obligation to disclose relevant information where they could be useful in the protection of the terrestrial natural environment? Are there, in such a case, possible limitations? Could a State be held liable for not having revealed such information? In order to provide an answer, both space law and international law principles will be taken into account and particular attention will be paid to define which information could be the object of a duty to warn. Indeed, if this last element can be easily defined in relation to 'natural or man-made disasters', more problems can arise in relation to more 'abstract' phenomena (such as, for instance, climate change). Finally, on the basis of the assumption that the great beneficial impacts that space technology can have in relation to the protection of the Earth natural environment cannot be made useless, the protection of the Earth natural environment from space activities will be briefly mentioned in the attempt to delineate the general legal framework applicable and assess its effectiveness in the light of the foreseeable future increase in the use of outer space.

I. INTRODUCTION

Space activities play an essential role in achieving sustainable development and protecting the natural environment. In particular, remote sensing data can be used to assess and locate damage, monitor the progression and effect of corrective measures, verify the application of environmental treaties and assist in the response to man-made and natural disasters. In view of the increasing number of space-faring nations and the growing privatisation of outer space activities, it is important to consider whether the current legal framework can adequately respond to present and future needs in order to assure that new technological developments benefit 'all mankind'. Indeed, as Aldo Cocca noted in 1958, '*law today must anticipate the technical progress and foresee the legal implications*'.¹ This is particularly true in the field of space, where technology is advancing at incredible speed and law-makers have always had to balance the predictability of technological progression and the appropriate regulatory response.

The scope of this paper is restricted to space technology as it relates to the protection of the Earth

natural environment and will examine four aspects of the issue arising out of current international law principles:

- Whether and to what extent the provisions of the *corpus iuris spatialis*² can be regarded as a legal basis allowing and promoting this use of space technology;
- Whether there is a legal obligation to disclose relevant information acquired through the use of space applications where they could be useful for the protection of the terrestrial natural environment;
- Where the previous point is answered in the affirmative, whether there are possible limitations to this legal obligation; and
- Whether and to what extent a State could be held liable for the damages deriving for not having revealed such information.

Both international space law and general international law principles will be taken into account and particular attention will be paid to define what information could be the object of a duty to warn. Indeed, if this last

element can be easily defined in relation to 'natural or man-made disasters', problems can arise in relation to more 'abstract' environmental damages and phenomena (such as, for instance, 'climate change').

The concluding remarks will reiterate that protecting the Earth natural environment through the use of space technology fulfils one of the most important principles of the space treaties -- that the use of space has to be for the benefit of mankind -- but that this goal cannot be achieved unless the current legal regime clarifies some critical ambiguities in its provisions and provides an effective enforcement mechanism.

II. THE USE OF SPACE TECHNOLOGY FOR THE PROTECTION OF THE ENVIRONMENT IS SUPPORTED BY THE *CORPUS IURIS SPATIALIS*

Unsurprisingly, the five space treaties contain no specific provisions addressing the use of space technology for the benefit of the Earth environment. In the era during which they were negotiated, military considerations dwarfed all other uses for space technology; the exigency to adopt a legal regime capable of preventing outer space from becoming a new battlefield in the Cold War³ and avoiding a possible scramble for colonies or resources⁴ was foremost in the minds of the negotiators. Even the prospect of private commercial interests (recognized obliquely in Outer Space Treaty Article VI)⁵ seems to have a higher profile than the somewhat vague environmental provisions of Article IX. It was unforeseen, at that time, that space applications could produce data to serve environmental purposes. Nonetheless, the negotiators were prescient in counterbalancing the pressing concerns of the time by using general principles that could be further enhanced and elaborated to serve future developments.⁶

One of the most important provisions of the *corpus iuris spatialis* is Article I of the Outer Space Treaty according to which the 'use of outer space (...) shall be carried out for the benefit and in the interests of all countries (...) and shall be the province of all mankind'. And Article 4.1 of the Moon Agreement⁷ goes further, providing that 'due regard shall be paid to the interest of present and future generations as well as to the need to promote higher standards of living and conditions of economic and social progress and development'.⁸ Though the Moon Agreement may be technically binding on only the thirteen States that have ratified it,⁹ Article 4.1¹⁰ may be considered as expression of customary international law.¹¹ In addition, the necessity to pay due regard to present and future generations and promote higher standards of living is part of general international law,¹² making it a legally binding obligation even for States that are not Parties to the Moon Agreement.

International co-operation is another fundamental principle embodied and recognised in the treaties.¹³ The promotion of international co-operation in the use and exploration of outer space is clearly stated in Articles III, IX, X and XI of the Outer Space Treaty. The use of space technology for the protection of the Earth natural environment can be regarded as a practical implementation of this principle.

The recognition, in accordance to Article III of the Outer Space Treaty, that space activities shall be carried out according to, *inter alia*, general principles of international environmental law and human rights law¹⁴ also has special relevance to the Earth natural environment. The use of outer space for the protection of the natural environment is clearly in accordance with Article III of the Outer Space Treaty and the general principles of international environmental and human rights law.¹⁵ In fact, most international environmental treaties state that States shall co-operate by means of systematic observations, research and information exchange in order to better understand and monitor the Earth environment and the impact of human activities on it.¹⁶

In this respect, two elements must be emphasized. First, these provisions probably constitute general principles of international environmental law.¹⁷ Indeed, they found early recognition in the 1972 Stockholm Declaration on the Human Environment,¹⁸ according to which 'science and technology must be applied to the identification, avoidance and control of environmental risks and the solution of environmental problems'¹⁹ and thus may be regarded as binding on any State. Second, it is clear that the general reference to observation systems and technology can be easily applicable to the use of space applications.

The use of space technology for the protection of the Earth environment also finds support in other general principles of environmental and human rights law such as the right to sustainable development²⁰ and the use of scientific and technological progress in the interest of peace and for the benefit of all mankind,²¹ which could also augment the support of space technology as an important promoter of sustainable development²² and the use of technological progress in the interest of peace and for the benefit of all mankind.²³

Finally, it is important to emphasize that the use of space technology for the protection of the terrestrial environment finds clear support also in Article I, II and IX of the Remote Sensing Principles²⁴ and in the principle of international co-operation as enhanced by the Benefits Declaration.²⁵ In particular, Principle I of the Remote Sensing Principles recognises as one of the main purposes of remote sensing the protection of the Earth environment.²⁶ But do States have a legal

obligation to use their space technology for the benefit of the earthly environment? In particular, we will now focus on legal obligations to disclose relevant information useful for environmental protection. As a practical matter, remote sensing data are of special significance.²⁷

III. A LEGAL OBLIGATION TO INFORM?

Though the space treaties do not impose obligations among States to share data, there do exist international principles promoting the use of space technology to protect the terrestrial environment. The question is whether a duty to inform has developed in terms of customary law through *opinio iuris* and the continuous and congruent practice of States in that regard. Even without considering the controversial issue related to the moral versus legal nature of these principles,²⁸ it is evident that the broad meaning and value of these provisions may lead, in practice, to difficulties in application and enforcement. It is thus important to ascertain the existence of a general duty to inform whenever environmental protection is concerned. Indeed, many international environmental law instruments contain such an obligation, generally considered to be an expression of general international environmental law.²⁹

Initially, such a duty under international environmental law originally related to the obligation of the State (including private entities under its jurisdiction and control) causing trans-boundary pollution to inform/notify States potentially affected by its activities.³⁰ This specific condition may or may not apply to the case under examination, depending on whether the State in possession of relevant information obtained through its space applications is actually causing trans-boundary harm. But it is nevertheless apparent that international environmental law treaty provisions have evolved towards a more general duty to inform by any State aware of environmental damage, whether or not it is the cause of the harm.

For example, Article 198 of the United Nations Convention on the Law of the Sea³¹ provides that '*when a State becomes aware of cases in which the marine environment is in imminent danger of being damaged or has been damaged by pollution, it shall immediately notify other States it deems likely to be affected by such damage, as well as the competent international organizations*'. The lack of correspondence between a State causing the damage and a State having an obligation to inform is also evident from Principle 19 of the Rio Declaration on the Environment and Development, according to which '*States shall provide prior and timely notification and relevant information to potentially affected States on*

activities that may have a significant adverse transboundary environmental effect'.

Although this apparent progression toward compulsive notification is promising, it is subject to some ambiguities. First, thus far, any such duty to inform is generally related to 'imminent' and 'sudden' environmental dangers,³² which begs the question whether an obligation exists to reveal data relevant for the protection of the Earth natural environment that does not concern an 'immediate' danger (e.g., deforestation or climate change). Second, any such duty is currently limited to informing only the potentially affected States, a potentially ambiguous class that may include not only the States whose natural resources are directly affected but also other States, under the rubric that the environment as a whole can be regarded as a 'global common'.³³ Following this argument to its logical conclusion, one could even extrapolate this duty to require disclosure to the general public.

Consider also the case in which a State obtains data concerning the environment of *terra nullius* territories -- land that, unlike celestial bodies, is not currently claimed but subject to a future claim by occupation--³⁴ or no territory at all. Such data related, for example, to climate change, may be of significant interest to countries and institutions studying the phenomenon on a global scale. Though some environmental treaties address environmental protection of specific territories beyond any national jurisdiction³⁵ or extend the duty to inform to damages concerning these territories,³⁶ it is doubtful that this can be regarded as a general principle of international law and international law instruments, such as the United Nations Framework Convention on Climate Change, only refer to a general duty to exchange information.³⁷

Principle X of the Remote Sensing Principles seems promising. It provides that '*remote sensing shall promote the protection of the Earth's natural environment. To this end, States participating in remote sensing activities that have identified information in their possession that is capable of advertent of any phenomenon harmful to the Earth's natural environment shall disclose such information to the State concerned*'. This provision neither links the duty to inform to the State causing environmental harm nor limits it to the existence of an imminent danger. But Resolutions of the United Nations General Assembly are not legally binding and the legal value of this provision is strictly dependent on peer pressure within the international community or otherwise considered as expressing customary international law.³⁸ Three possibilities might be analysed in this respect.

Firstly, Principle X could be the expression of a pre-existing custom originating by State practice and the *opinio iuris* expressed through the afore-mentioned international environmental instruments.³⁹ We have already examined how the duty to inform as formulated in the Remote Sensing Principles slightly differs (especially in relation to the lack of ‘imminent’ character of the danger) from its definition in general environmental law, but it could be argued that this fact does not undermine the possibility that Principle X affirms a pre-existent customary obligation considering that the underlined differences would only be a result of the application of the custom to a specific sector.⁴⁰

Secondly, we could view Principle X as expressing *opinio iuris* requiring a new specific duty to inform in relation to remote sensing data. In this respect, it could even be argued that it *per se* creates a customary obligation on the basis of the *consensus* in the adoption of the Remote Sensing Principles⁴¹ and the fact that the *opinio iuris* often leads to coherent State practice, as ably argued by Bin Cheng through his instant customary law doctrine.⁴² And even apart from the development of ‘instant customs’, Principle X, where accompanied by consistent State practice and in absence of persistent objectors,⁴³ could have important legal value.

Thirdly, considering that the formation of customary law is a complex, dynamic process, might a better approach be to looking at these aspects as a whole in determining whether the duty to inform embodied in Principle X is a customary law obligation binding on any State active in remote sensing activities?⁴⁴ Even supposing that States were legally obliged to inform, it is important to discern whether that duty has been respected by States in practice and though other statements of *opinio iuris*. For example, a number of bilateral agreements related to the conduct of outer space activities, recognise the need to co-operate in the use of Earth observation for the protection of the environment⁴⁵ without any specific obligation to disclose information. The most practical obligation deriving from such co-operation refers to the ‘exchange’ of data between the Parties,⁴⁶ thus implying ‘trade’ between space-faring powers. Although this exchange of data is often limited by exceptions such as ‘prevailing national security interests’,⁴⁷ it is true, nonetheless, that in practice States have often voluntarily disclosed information relevant in terms of environmental protection obtained through their satellites to interested States.⁴⁸ This trend is confirmed by recent and developing initiatives like GEOSS,⁴⁹ GMES⁵⁰ and the International Charter on Space and Major Disasters.⁵¹

Leaving aside considerations related to the specific parameters of the deriving obligation, the question remains whether we can consider such initiatives as expressing a States’ practice long enough to define the existence of a customary law duty to disclose relevant information⁵² or if we are only assisting at the formation of an emerging customary law obligation.⁵³ While many scholars consider the Remote Sensing Principles declarative of customary law, it would not be unreasonable to consider the observance of these principles is a mere coincidental fact.⁵⁴ A more detailed analysis would take into consideration also the national legal regimes that States apply to satellite data and legislative history citing their motivation to disclose or withhold the information.

The trend emerging in national legislation to limit the disclosure of remote sensing data, though relevant in delineating States’ practice, does not bear on the existence of a general legal obligation to share satellite data pertaining to environmental protection. Where it is truly relevant is in the definition of the limits and general character of an obligation to inform. This is true also with regard to the question whether information should be disclosed for free or not and, more generally, when analysing the possible shortcomings of the obligation in light of the increasing commercialisation and privatisation of outer space activities.⁵⁵ All these aspects will be partly considered in the next section.

IV. DUTY TO INFORM: PARAMETERS AND LIMITATIONS

Even supposing there is a customary law obligation for States to disclose information obtained through space applications relevant to environmental protection, it is important to understand the real parameters of the obligation. What kind of information has to be disclosed? To whom? Are there any limitations or exceptional circumstances that allow States to keep relevant information? Does this obligation imply a free disclosure and access or a payment has to be provided?

The language of Principle X of the Remote Sensing Principles reveals a common character of the duty to inform, both in relation to general environmental protection and use of satellite data for the benefit of the environment: the lack of clear definitions. Political motives⁵⁶ and the use of generalized phraseology in space and environmental law instruments (without regard to the possible customary law nature of the obligation) could explain such shortcoming. Principle X, for instance, refers to ‘*information capable of adverting any phenomenon harmful to the Earth’s natural environment*’ that shall be disclosed to the ‘*State concerned*’. Incredibly, this is the central obligation of the Principle, yet none of these terms are

defined in the Remote Sensing Principles. This lack of definition will eventually hinder the effectiveness of a legal obligation to release relevant information and make any attempted enforcement impossible. Indeed, States would be free to interpret at will the relevance of information, the level of environmental harmfulness of a phenomenon and the definition of 'concerned State'. Can any State be regarded as 'concerned' when it comes to protection of the natural environment or is a 'concerned State' only one whose territory is directly affected by the potential environmental damage?⁵⁷

These issues are not illuminated by Principle XII of the Remote Sensing Principles either, according to which: *'as soon as the primary data and the processed data concerning the territory under its jurisdiction are produced, the sensed State shall have access to them on a non-discriminatory basis and on reasonable cost terms. The sensed State shall also have access to the available analysed information concerning the territory under its jurisdiction in the possession of any State participating in remote sensing activities on the same basis and terms, particular regard being given to the needs and interests of the developing countries'*. To begin with, the provision only refers to the 'sensed State' and 'information concerning the territory under its jurisdiction', thus excluding the case in which information is relevant to environmental protection of territories beyond any national jurisdiction (not to mention the relevance of data for climate change). It also excludes the possibility that States other than the 'sensed' one may advance any request for the information.⁵⁸ In addition, Principle XII seems to distinguish between primary/processed data and analysed data deriving from remote sensing activities, limiting the sensed State's access to the latter only when they are 'available'.

This analysis raises the question whether the notion of 'relevant information' contained in Principle X has to be interpreted in the light of the language in Principle XII. If so, we may anticipate additional problems, as not every country has the capability to analyze remote sensing data. In addition, it is arguable whether Principle XII, stating only that the sensed State shall have access to data on a non-discriminatory basis, paves the way to other possible limitations to such access/duty to inform. Finally, the expression 'reasonable cost terms' is undefined and its vagueness is open to interpretation. Does it refer to a sort of reimbursement or does it allow the introduction of commercial fees? Does it apply to any circumstance or are there possible exclusions?

The same lack of clarity also appears in Principle XI of the Remote Sensing Principle.⁵⁹ Recognizing the benefit of remote sensing data for the protection of

mankind from natural disasters (inherently including protection of the Earth environment), Principle XI unhelpfully uses terms such as 'information that may be useful' and 'transmit such data to the State concerned as promptly as possible'. As already mentioned, an analysis of the duty to inform as general principle of environmental law does not lead to many further clarifications. Searching for elucidations in State practice, through bilateral agreements to cooperate in space activities and national legislation concerning the disclosure of data, yields nothing helpful. Invariably, the choice of terms remains vague, especially in respect to possible limitations linked to 'relevant information' and 'national security' interests.⁶⁰

A detailed review of related States practice and *opinio iuris*, even if desirable, is beyond the scope of the present analysis. For the time being, no clear definition of the parameters and possible limitations of a duty to disclose information obtained through space applications and potentially important for the protection of the Earth natural environment can be found in relevant instruments and States practice. Perhaps clarification will come in the future, especially considering the increasing attention to the potential beneficial impacts deriving from the use of space applications for the benefit of the environment. State practice and new legal and political instruments may even lead to the establishment of more specific customary rules in this respect. Nonetheless, even admitting the existence of a general customary law obligation to disclose such information, its practical relevance would be hindered by the lack of any clear definition of its 'essence' and perhaps this ambiguity is the price we pay for reaching a consensus on issues as to which parties hold vastly different views.

V. LIABILITY FOR LACK OF DISCLOSURE OF RELEVANT INFORMATION AND DISCLOSURE OF WRONG INFORMATION

Assuming the existence of some customary obligation to disclose satellite data potentially relevant for the protection of the Earth environment, can a State be held responsible for the wrongful failure to disclose important information (or conversely, for disclosure of wrong information) and be liable for damages resulting from the non-disclosure or faulty disclosure? Aside from the practical difficulties of defining damage and establishing the causal link to the act or omission (especially where only the State in possession of a certain information is aware of its existence), it is here necessary to recall Article VI and VII of the Outer Space Treaty. According to Article VI '*States Parties shall bear international responsibility for national activities in outer space (...) whether such activities*

are carried on by governmental agencies or by non-governmental entities (...)'.⁶¹ If States have a duty to inform, this provision, supplemented, where necessary, by general principles on State responsibility,⁶² could make the State internationally responsible for the lack of disclosure/disclosure of erroneous information, regardless of whether the wrongful act/omission is committed by its organs⁶³ or private entities.⁶⁴

Identifying an international obligation and the consequent possible wrongful act/omission is an essential requirement for State responsibility.⁶⁵ Here, the existence of an obligation and the possible character of its breach are far from certain.⁶⁶ In addition, whereas State responsibility for actual sensing is covered by the notion of '*national activities in outer space*', it is unclear whether the same is true for the distribution and dissemination of data, as they are not activities carried out in outer space.⁶⁷

Even more doubts arise in terms of liability. Article VII of the Outer Space Treaty provides that each launching State '*is internationally liable for damage (...) by such object or its component parts on the Earth (...)*'. In addition, Article III of the Liability Convention provides for absolute liability for damage caused by its space object on the surface of the Earth and makes the causal link between space object and damage an essential requirement in terms of State absolute liability.⁶⁸ The failure to disclose information obtained through the use of a space object (or disclosure of wrong information) may be difficult to link up to the damage it is alleged to have caused, since so many other elements -- a State's own failure of vigilance, failure to mitigate or even the failure to take reasonable safeguards -- may be more direct causes for damage from a disaster. Consequently, the space law treaties would not likely cover this potential liability.⁶⁹

General principles of international law may be instructive. The so-called 'Good Samaritan doctrine' enacted as domestic law in many countries and generally regarded as a customary international law⁷⁰ waives liability for a volunteer who does not have any relationship with a victim and who attempts to rescue this victim in imminent danger without expectation of reward, but negligently causes injury.⁷¹ In our scenario, its relevance is limited to cases of erroneous conduct. It would be inapplicable when no data is disclosed (lack of action), the environment harm is not 'sudden' or 'immediate' (lack of emergency) or the wrong data are disclosed for payment.

A liability mechanism -- if the international community is truly interested in compliance with the notion of sharing data relevant to terrestrial environmental and natural disaster conditions -- is necessary. Provisions which provide legal certainty

and clarity, so that all States know what is expected of them, should be adopted either as an additional protocol or an amendment of a current Resolution.

VI. CONCLUSIONS

The current legal regime allows and even promotes the use of space applications for the purpose of the protection of the Earth natural environment. Nonetheless, there is no specific legal obligation in this regard. In particular, it is controversial whether the States that come into possession of space applications data potentially relevant in terms of environmental protection have a legal obligation to disclose the information. Even admitting the existence of a customary law obligation, whether based on the applicability to space activities of general principles of environmental law or originating from new *opinio iuris* and State practice specifically concerning the use of space data, the lack of clear definitions and parameters of such obligation, together with the absence of a specific liability regime, hinders its practical value.

Opinio iuris and State practice seem to define a stronger obligation and more defined parameters in case of 'sudden' natural or man-made disasters than when intangible and lengthy environmental phenomena are concerned. Similarly, affirming the existence of a customary rule to inform seems to be easier whether the damage concerns the territory of the States requiring the information (especially if it is also the 'sensed State'). Consequently, the best solution could be the adoption of a 'code of conduct' or other 'soft law' instrument establishing a comprehensive regime related to the use of space application data for environmental purposes. Indeed, this would guarantee, *inter alia*, not only more certainty in relation to the existence and 'characters' of an obligation to disclose information relevant for environmental protection, but also a more uniform development of State practice, leading to more clear and precise customary rules.

Finally, it is evident that the recognition and setting of legal rules related to the beneficial impacts in terms of environmental protection that can derived from the use of space technologies could be made useless by the absence of an effective regime protecting the Earth environment *from* damages caused by space activities, especially considering their increasing amount. The space treaties contain some specific provisions,⁷² including Article 7 of the Moon Agreement, which requires States to '*take measures to avoid harmfully affecting the environment of the Earth through the introduction of extraterrestrial matter or otherwise*' (emphasis added). This provision, however, is binding only with respect to the few States that have ratified it and, in any event, suffers from the infirmity of other treaty provisions in the use of ambiguous phraseology.

Liability is part and parcel of an effective enforcement regime. But the vague definitions of “compensable damage” and “space object” in Article I of the Liability Convention are of no assistance when environmental damages are concerned. Can any environmental damage be regarded as ‘impairment of health’ or ‘loss of property of a State’, especially considering the distinct legal status of different environmental resources (e.g. object re-entered in the high sea or terra nullius)?⁷³ Can the definition of space object as ‘including its component parts, launch vehicle and parts thereof’ cover any possible ‘space’ source of environmental damage (e.g. fuel, space debris)?⁷⁴ These questions require discernment not apparent in any established legal form and may only be decided in litigation, in the absence of voluntary consensus or the establishment of national space legislation.⁷⁵ It suffices here to underline that any recognition in terms of use of space activities for the protection of the Earth natural environment cannot be completely discerned from the research of clear legal answers to these questions.

¹ A.A. Cocca, ‘Principles for a Declaration with Reference to the Legal Nature of the Moon’, *Proceedings of the First Colloquium on the Law of Outer Space (1958)*, at 34.

²The expression refers collectively to the five space law resolutions and treaties finalised through the auspices of the United Nations Committee on the Peaceful Uses of Outer Space (‘UNCOPUOS’). The treaties are: (i) *Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and other Celestial Bodies* (hereinafter ‘Outer Space Treaty’), UNTS Vol. 610; (ii) *Agreement on the Rescue of Astronauts, the Return of Astronauts and the Return of Objects Launched into Outer Space*, UNTS Vol. 1023, at 15; (iii) *Convention on International Liability for Damage Caused by Space Objects* (hereinafter ‘Liability Convention’), UNTS Vol. 961, at 187; (iv) *Convention on Registration of Objects Launched into Outer Space*, UNTS Vol. 1023, at 15; and (v) *Agreement governing the Activities of States on the Moon and other Celestial Bodies* (hereinafter ‘Moon Agreement’), UNTS Vol. 1363, at 3. In addition, there are five sets of Principles adopted by the United Nation General Assembly which, though not legally binding, contribute to the existing body of international space law. These are: (i) *Declaration of Legal Principles Governing the Activities of States in the Exploration and Use of Outer Space*, UN Doc. A/RES/1962 (1963); (ii) *Principles Governing the Use by States of Artificial Earth Satellites for International Direct Television Broadcasting*, UN Doc. A/RES/37/92 (1982); (iii)

Principles Relating to Remote Sensing of the Earth from Outer Space (hereinafter ‘Remote Sensing Principles’), UN Doc. A/RES/41/65 (1986); (iv) *Principles Relevant to the Use of Nuclear Power Sources in Outer Space*, UN Doc. A/RES/47/68 (1992); and (v) *Declaration on International Cooperation in the Exploration and Use of Outer Space for the Benefit and in the Interest of All States, Taking into Particular Account the Needs of Developing Countries* (hereinafter ‘Benefit Declaration’), UN Doc. A/RES/51/122 (1996).

³ See P.G. Dembling and D. M. Arons, ‘The Evolution of the Outer Space Treaty’, *XXXIII Journal of Air Law and Commerce* (1967), at 428.

⁴ See B. Cheng, ‘The 1967 Outer Space Treaty: Thirtieth Anniversary’, *XXIII/4-5, Air & Space Law Journal* (1998), at 158.

⁵ *Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space*, *supra* note 2.

⁶ See, e.g., *inter alia*, F. Tronchetti, ‘The Exploitation of Natural Resources of the Moon and other Celestial Bodies: a Proposal for a Legal Regime’ (2008), at 8. See also C.Q. Christol, ‘Space Law: Past, Present and Future’ (1991), at 453.

⁷ *Agreement governing the Activities of States on the Moon and other Celestial Bodies*, *supra* note 2.

⁸ *Ibid.*, Article 4.1.

⁹ The Moon Treaty has been ratified by Australia, Austria, the Netherlands, Uruguay, Pakistan, Peru, Philippines, Kazakhstan, Lebanon, Mexico, Morocco, Belgium and Chile.

¹⁰ Article I of the Outer Space Treaty (partly restated in Article 4.1 of the Moon Agreement) is recognized by States and international legal experts as constituting customary law. See Tronchetti, *supra* note 6, at 11 and V.S. Vereshchtein and M. Danilenko, ‘Custom as a Source of International Law of Outer Space’, *13/1 Journal of Space Law* (1985), at 33.

¹¹ Two elements are necessary for the formation of international customary laws: *opinio iuris* (as expression of the States’ conviction that a certain practice is legal and just) and State practice (as actual practice of States carried on with such consistency to create clear and definite expectations related to what has to be regarded as ‘normal conduct’ among Nations). See *North Sea Continental Shelf case* (Federal Republic of Germany v. Denmark/Federal Republic of Germany v. The Netherlands), Judgment, (1969) ICJ Rep p. 3, at 45. See also J.L. Kuntz, ‘The Nature of Customary International Law’, *47/4 The American Journal of International Law* (1953), at 666-667.

¹² See U.M. Bohlmann, ‘Legal Aspects of the ‘Space Exploration Initiatives’’, in M. Benko and K. Schrogl

(Ed.) 'Current Problems and Perspectives for Future Generations' (2005), at 228 and A. Kiss and D. Shelton, 'International Environmental Law' (2004), at 17. In the present paper the expression 'general principles of international law' and 'general international law' would be generally used as to indicate 'international customs' without going into the controversial distinction between 'general principles of international law' and 'customary law' as set in Article 38 of the Statute of the International Court of Justice and on the basis of the fact that, for our purposes, the important element is that they both have legal binding value. On the topic see, *inter alia*, B. Cheng, 'The UN and the Development of Space Law', in B. Cheng, 'Studies in International Space Law' (1997), at 177.

¹³ See A.A. Cocca, 'The Advances in International Law through the Law of Outer Space', 9/1&2 *Journal of Space Law* (1981), at 17. For a general overview on the topic see, *inter alia*, V. Kopal, 'Benefits from Space Exploration through International Co-operation', *Proceedings of the Twenty-seventh Colloquium on the Law of Outer Space 336-340* (1984).

¹⁴ On the meaning of these terms in the present paper see *supra* note 12.

¹⁵ See, for instance, e.g., the general principle of 'protection, preservation and conservation'. Kiss, *supra* note 12, at 218.

¹⁶ See, e.g., Article 2.2 of the *Vienna Convention for the Protection of the Ozone Layer* (1985, entered into force on 22 September 1988, UNTS Vol. 1513, at 324), Article 4 of the *United Nations Framework Convention on Climate Change* (1992, entered into force on 21 March 1994, UNTS Vol. 1771, at 107) and Article 7 of the *Geneva Convention on Long-Range Trans-boundary Air Pollution* (1979, entered into force on 16 March 1983, UNTS Vol. 1302, at 217).

¹⁷ Even if not considered as constituting a general principle of international law as such, these provisions can be regarded as an expression of the principle of international co-operation in relation to natural resources that has been recognised as a general principle of international environmental law by, *inter alia*, the International Court of Justice. See 'Fisheries Jurisdiction case' (*United Kingdom and Northern Ireland v. Iceland*), *Merits*, (1974) ICJ Rep. p. 3.

¹⁸ *Stockholm Declaration on the Human Environment* (hereinafter *Stockholm Declaration*, 1972, UN. Doc. A/CONF. 48/14).

¹⁹ *Ibid.*, Principle 18. See also *International Convention for the Prevention of Pollution from Ships* (1973, entered into force on 2 October 1983, UNTS Vol. 1341, at 61), Article 6.1.

²⁰ See, P. Sands, 'Sustainable Development: Treaty, Custom, and the Cross-fertilization of International Law', in A. Boyle and D. Freestone (Eds.),

'International Law and Sustainable Development: Past Achievements and Future Challenges' (1999), at 39 *t seq.* See also *United Nations Millennium Declaration*, UN Doc GA/Res/55/2, 8 September 2000, at IV.

²¹ *Declaration on the Use of Science and Technological Progress in the Interest of Peace and for the Benefit of Mankind*, UN Doc. GA/Res/3384 (XXX), 10 November 1975.

²² See, *inter alia*, P. Sands, 'Sustainable Development: Treaty, Custom, and the Cross-fertilization of International Law', in A. Boyle and D. Freestone (Eds.), 'International Law and Sustainable Development: Past Achievements and Future Challenges' (1999), at 39 *t seq.* See also *United Nations Millennium Declaration*, UN Doc GA/Res/55/2, 8 September 2000, at IV.

²³ *Declaration on the Use of Science and Technological Progress in the Interest of Peace and for the Benefit of Mankind*, UN Doc. GA/Res/3384 (XXX), 10 November 1975.

²⁴ *Principles Relating to Remote Sensing of the Earth from Outer Space*, *supra* note 3.

²⁵ *Declaration on International Cooperation in the Exploration and Use of Outer Space for the Benefit and in the Interest of All States, Taking into Particular Account the Needs of Developing Countries*, *supra* note 2.

²⁶ "The term 'remote sensing' means the sensing of the Earth's surface from space by making use of the properties of electromagnetic waves emitted, reflected or diffracted by the sensed objects, for the purpose of improving natural resources management, land use and the protection of the environment; (...)" Principle I(a), *Remote Sensing Principles*, *supra* note 2.

²⁷ Though this paper focuses on remote sensing technology, telecommunication technology is also subject to binding obligations to protect the Earth environment, for state parties to the *Tampere Convention on the Provision of Telecommunication Resources for Disaster Mitigation and Relief Operations* (hereinafter *Tampere Convention* – 1998, entered into force on 8 January 2005, UNTS Vol. 2296, at 5). According to Article 1.6, 'disaster' means 'a serious disruption of the functioning of society, posing a significant, wide spread threat to human life, health, property or the environment'. Consequently, Article 1.12 defines 'relief operations' as 'those activities designated to reduce (...) damage to property and/or environment caused by the disaster' (emphasis added).

²⁸ See, *inter alia*, N. Jasentuliyana, 'Article I of the Outer Space Treaty Revisited', 17/2 *Journal of Space Law* (1989), at 130.

²⁹ See Kiss, *supra* note 12, at 191 and D.G. Partan, 'The Duty to Inform in International Environmental

Law', 6 *Boston University International Law Journal* (1988), at 43. But see contra O. McIntyre, 'The Role of Customary Rules and Principles of International Environmental Law in the Protection of Shared International Freshwater Resources', 46 *Natural Resources Journal* (2006), at 163, according to whom such provisions have only a 'declarative value'.

³⁰ See, for instance, Article 14 of the *Convention on Biological Diversity* (1992, entered into force on 29 December 1993, UNTS Vol. 1760, at 76); Article 11 of the *Convention for the Protection of the Rhine against Chemical Pollution* (between U.S. and Canada) (1976, entered into force on 1st February 1979, UNTS Vol. 1124, at 425); Article 10 of the *Helsinki Convention on Trans-boundary Effects of Industrial Accidents* (1992, entered into force on 19th April 2000, UNTS Vol. 2105, at 457). In addition, see again Kiss, *supra* note 12, at 191. See also International Law Commission, *Draft Articles on Prevention of Trans-boundary Harm from Hazardous Activities, Yearbook of the International Law Commission Vol. II (2001)*, Article 8. In this respect such duty to notify is strictly linked to the customary law principle of 'sic utere tuo, ut alienum non laedas' as embodied in the Stockholm Declaration (Principle 21) and recognized by the International Court of Justice in, *inter alia*, the 'Corfu Channel case' (*United Kingdom and Northern Ireland v. Albania*), *Merits*, (1949) ICJ Rep. p. 244 and 'Pulp Mills case' (*Argentina v. Uruguay*), *Merits*, ICJ (2010). See also 'Trail Smelter arbitration' (*United States v. Canada*) (1941) 3 *Rep. Intl Arbitral Awards* 1980.

³¹ *United Nations Convention on the Law of the Sea* (1982, entered into force on 16 November 1994, UNTS Vol. 1833, at 400).

³² See, again, *inter alia*, Article 189 of the *United Nations Convention on the Law of the Sea* and Article 15 of the *Madrid Protocol on Environmental Protection to the Antarctic Treaty* (1991, entered into force on 14 January 1998, UNTS Vol. 402, at 71). See L.M. Jurgielewics, *Global Environmental Change and International Law: Prospects for Progress in the Legal Order* (1996), at 60.

³³ *Ibid.*, at 61.

³⁴ *New Jersey v. New York*, 523 US 767 (1998) (Even as to terra nullius, like a volcanic island or territory abandoned by its former sovereign, a claimant by right as against all others has more to do than planting a flag or rearing a monument. Since the 19th century the most generous settled view has been that discovery accompanied by symbolic acts give no more than an inchoate title, an option, as against other states, to consolidate the first steps by proceeding to effective occupation within a reasonable time). See also, I.

Brownlie, *Principles of Public International Law* 146 (4th ed. 1990).

³⁵ See again, for example, the *United Nations Convention on the Law of the Sea*, *supra* note 32.

³⁶ See, for instance, Article 14 of the *Convention on Biological Diversity*.

³⁷ *United Nation Framework Convention on Climate Change*, Article 4(h).

³⁸ See, e.g., M. Schwebel, 'The Effect of Resolutions of the U.N. General Assembly on Customary International Law', 73 *Proceedings of the American Society of International Law* (1979), at 303.

³⁹ See Kiss, *supra* note 12, at 192 and F. von der Dunk, 'Big Brother or Eye in the Sky? Legal Aspects of Spcae-Based Geo-Information for Disaster Management', in P. van Ostervom (Ed.), 'Geo-Information for Disaster Management' (2008), at 44.

⁴⁰ See C. Q. Christol, 'The 1986 Remote Sensing Principles: Emerging or Existing Law?', *Proceedings of the Thirtieth Colloquium on the Law of Outer Space* (1987), at 274.

⁴¹ E.D. Gaggero, 'Remote Sensing in the UN: Returning to the Way of Consensus', *Proceedings of the Thirtieth Colloquium on the Law of Outer Space* (1987), at 312.

⁴² See B. Cheng, 'United Nations Resolution on Outer Space: 'Instant' International Customary Law?', 5 *Indian Journal Law of International Law* 22-48 (1965).

⁴³ According to the so-called principle of the 'persistent objector', a State that has persistently objected to a rule of customary international law during the course of the rule's emergence is not bound by that rule. See, *inter alia*, T.L. Stein, 'The Approach of the Different Drummer: The Principle of the Persistent Objector in International Law', 26/2 *Harvard International Law Journal* (1985), at 457.

⁴⁴ In this respect, (emerging) general legal principles on environmental protection and sustainable development will assist in the interpretation and application of the rule of international space law. See S. Marchisio, 'Remote Sensing for Sustainable Development in International Law', in G. Lafferanderie and D. Crowther (Eds.), 'Outlook on Space Law over the Next Thirty Years: Essays published for the 30th Anniversary of the Outer Space Treaty (1997), at 350.

⁴⁵ See, for instance, Article 3 of the *Basic Agreement between the Government of the French Republic and the Government of the Federative Republic of Brazil concerning co-operation in the field of study and use of outer space for peaceful purposes* (1997 – UNTS Vol. 2383, at 229) and Article 1(a) of the *Agreement between the United States of America and the Russian Federation concerning co-operation in the exploration*

and use of outer space for peaceful purposes (1992, UNTS Vol. 2362, at 459).

⁴⁶ See, e.g., *Basic Agreement*, *supra* note 45, Article 4.1(g).

⁴⁷ Article 8.3 of the *Agreement between the Government of Australia and the Government of the Russian Federation on co-operation in the field of exploration and use of outer space for peaceful purposes* (2001, UNTS Vol. 2438, at 147).

⁴⁸ See G. Catalano Sgrosso, 'Sharing of Remote Sensing Data Concerning Environmental Protection for Public Benefit', *Proceedings of the Thirty-Ninth Colloquium of the Law of Outer Space* (1996), at 103. In particular, we can recall here the U.S. LANDSAT programme's international data dissemination policy that provides for the disclosure of information relevant in terms of environmental protection (as underlined by the U.S. delegation at the UNCOPUOS 50th Legal Subcommittee, 29th March 2011).

⁴⁹ The 'Global Earth Observation System of Systems' (GEOSS) aims at proactively link together existing and planned observing systems around the world and support the development of new systems where gaps currently exist.

⁵⁰ The 'Global Monitoring for the Environment and Security' (GMES) will be the primary European contribution to GEOSS. GMES is an Earth observation initiative led by the European Union (elaborated in co-operation with the European Space Agency – hereinafter ESA) and carried out in partnership with the Member States. See also *European Commission Decision 210/67/EU* (5th February 2010), *OJEU L 35/23, Preamble*.

⁵¹ The 'International Charter on Space and Major Disasters' has been signed on 20 October 2000 and has been operational since November 2000.

⁵² As already mentioned by quoting the so-called 'instant customary law doctrine' there is no international consensus on the time over which a practice has to be followed in order to acquire a value in terms of establishment of customary law. See, *inter alia*, A.T. Guzman, 'Saving Customary International Law', 27 *Michigan Journal of International Law* (2005), at 149.

⁵³ See *Report of the International Law Association (Space Law Committee) Toronto Conference* (2006), at 5.

⁵⁴ *Ibid.*

⁵⁵ See, *inter alia*, M. Bourelly, 'Legal problema Posed by the Commercialization of Data Collected by the European Remote Sensing Satellite ERS-1', 16/2 *Journal of Space Law* (1988), at 132-133 and Marchisio, *supra* note 44, at 348.

⁵⁶ In terms of compromise between interests of sensing States and needs of sensed States. See V. Kopal,

'Principles Related to Remote Sensing of the Earth from Outer Space: a Significant Outcome of International Co-operation in the Progressive Development of Space Law', *Proceedings of the Thirtieth Colloquium on the Law of Outer Space* (1987), at 326.

⁵⁷ Following a literal interpretation of the wording of Principle X, it could be argued that, for instance, every State has the right to obtain relevant information related to climate change as the *United Nation Framework Convention on Climate Change*, whose acceptance is almost universal, defines climate change as 'common concern of mankind' (Preamble).

⁵⁸ See G.M. Danilenko, 'Principle Relating to Remote Sensing of the Earth from Space: Territorial Sphere of Application', *Proceedings of the Thirtieth Colloquium on the Law of Outer Space* (1987), at 290.

⁵⁹ Principle XI reads: 'Remote sensing shall promote the protection of mankind from natural disasters. To this end, States participating in remote sensing activities that have identified processed data and analysed information in their possession that may be useful to States affected by natural disasters, or likely to be affected by impending natural disasters, shall transmit such data and information to States concerned as promptly as possible.'

⁶⁰ See *Agreement between Australia and the Government of the Russian Federation on cooperation in the field of exploration and the use of outer space for peaceful purposes* (2001, UNTS Vol. 2438, at 147) Article 8.3.

⁶¹ Principle XIV of the Remote Sensing Principles does not define a specific regime of international responsibility related to remote sensing activities but recalls Article VI of the Outer Space Treaty and the applicability of the norms of international law on State responsibility.

⁶² *Draft Articles on Responsibility of States for Internationally Wrongful Acts, Yearbook of the International Law Commission, Vol. II* (2001) – UN. Doc. GA/RES/56/83 (2001).

⁶³ *Ibid.*, Article 4.

⁶⁴ See Christol, *supra* note 6, at 247.

⁶⁵ N.L.J.T. Horbach, 'The Confusion about State Responsibility and International Liability', 4/1 *Leiden Journal of International Law* (1991), at 49.

⁶⁶ A. Ito, 'Issues in the Implementation of the International Charter on Space and Major Disasters', 21 *Space Policy* (2005), at 148. See also F. von der Dunk, 'Liability versus Responsibility in Space Law: Misconception or Misconstruction?', *Proceedings of the Thirty-fourth Colloquium on the Law of Outer Space* (1991), at 363.

⁶⁷ T. L. Zwaan and W.W.C. de Vries, 'Regulating Remote Sensing of the Earth from Outer Space, Taking

into Account the Present Trend of Privatisation of these Activities', *Proceedings of the Thirtieth Colloquium on the Law of Outer Space (1987)*, at 411.

⁶⁸ In particular, the compensable damage, even if subsequent or indirect, must be a result of the initial damage caused by the space object itself. See S. Hobe, B. Schmidt-Tedd, K. Schrogl and G. Goh, 'Cologne Commentary on Space Law – Vol. 1- Outer Space Treaty' (2009), at 142.

⁶⁹ F. Tronchetti, 'Space Treaties and Disaster Management', *Proceedings of the Fiftieth Colloquium on the Law of Outer Space (2007)*, at 679.

⁷⁰ See von der Dunk, *supra* note 39, at 46.

⁷¹ L. Kovudhikulrungrsi, 'Legal Issues – Using Earth Observation Satellites for Pre-Disaster Management' (2009), at 74.

⁷² See, in particular, Article IV, IX of the Outer Space Treaty and Article 5(a) Rescue Agreement.

⁷³ But see, in this respect, P. Sand, 'The Effectiveness of International Environmental Agreements: A Survey of Existing Legal Instruments', *United Nations Conference on Environment and Development Preparatory Committee (1992)*, where the Liability Convention is defined as enforcing environmental protection by making States liable for space activities (at 127). See also, for instance, the claim of Canada in relation to the Cosmos 954 accident (see E. Galloway, 'Nuclear Power Satellites: The USSR Cosmos 954 and the Canadian Claim, XII/3 *Akrón Law Review* 401 (1978-1979). Nonetheless, the applicability of this Convention to environmental damages remains arguable as underlined by Professor Bin Cheng during the Space Law Committee International Law Association Conference held in London in 2000. See *Report of the International Law Association London Conference (Space Law Committee)*, at 11. In addition, more doubts can arise when a State is not Party to the Liability Convention but only to the Outer Space Treaty, thus bound only by Article VII.

⁷⁴ The lack of legal certainty in this regard is proven by the adoption by the International Law Association (Space Law Committee) of the 'Buenos Aires International Instrument on Protection of the Environment from Damage Caused by Space Debris' in 1994. See A. Golrounia and M. Bahrani, 'The Draft of the International Law Association for a Convention on Space Debris (Buenos Aires). Can it Meet the Needs of the 21st Century?', *Proceedings of the Thirty-Ninth Colloquium on the Law of Outer Space (1996)*, at 223 *et seq.* On the other hand, nonetheless, by applying the interpretation means set by the *Vienna Convention on the Law of the Treaties* (1980 - UNTS Vol. 1155, at 331 - see, in particular, Article 31.3(b)), we could argue that successive State practice has showed how space debris can be regarded as space object. Indeed,

space debris have been considered as space objects and returned to the State of registry in the application/implementation of the Rescue Agreement. See some cases as reported in F.G. von der Dunk, 'A Sleepy Beauty Awakens: The 1968 Rescue Agreement after Forty Years', *34 Journal of Space Law (2008)*, at 427-431.

⁷⁵ Through the establishment of national space legislation States seek, *inter alia*, to pass onto their private entities parts of the financial burden connected to their liability for damages related to space activities. Consequently, it is important to emphasize that some of the current national space regimes refers (usually as a pre-requisite to authorization) to environmental protection standards. See, e.g., Article 5.1 and 8 of the *Belgian Law on the Activities of Launching, Flight Operations or Guidance of Space Objects* (2005); Article 1 and 5 of the *French Loi n° 2008-518 du 3 juin 2008 relative aux opérations spatiales* (2008); Section 5(e) of the *United Kingdom Outer Space Act* (1986). But see *contra* *Dutch Space Activities Act* (2006), which refers only to the environmental protection of outer space (Section 3.3(b)) and *South African Space Affairs Act* (1993), which does not include any environmental requirement.