World Journal of Environmental Biosciences

Available Online at: **www.environmentaljournals.org**

Volume7, Issue 4: 48-55

ISSN 2277- 8047

The Linkage between International Environmental law and Natural Sciences: Challenges and Solutions

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ABSTRACT

International environmental law has been fully tied to scientific disciplines in that it relates to natural aspects of human life. Scientific features of legal discussions and legal aspects of natural sciences form the structure of environmental law. It can be argued that this field of law is the most scientific branch of law. Natural sciences play a significant role in the international environmental law, because mere legal doctrines and principles are not sufficient to eliminate and resolve the environmental challenges and problems. The assessment of the risk of harm and determination of damages caused by destructive environmental activities are not possible without scientific methods. In addition, environmental law mostly encompasses natural issues including pollution, greenhouse gas, climate change, preservation of rare species, biodiversity, and the management of water resources. Thus, it is imperfect and useless to study the environmental law without addressing natural sciences. In the present paper, challenges and solutions in respect of the linkage between environmental law and natural sciences have been overviewed.

Keywords: *Environmental Law, Natural Sciences, Pollution, Climate Change, Biodiversity, Natural Resources.*

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Received: 21 August 2018
Accepted: 25 November 2018

1. INTRODUCTION

Natural and social scientists may interact with each other at miscellaneous levels or degrees. First, the situations in which the scientists of a special area in order not to be restricted to their knowledge area, "borrow" ideas from other fields of study. The second situation for the interaction may occur when scientists try to develop their study on a fringe area. The third level of interaction may be identified when the collaboration among various knowledge areas bring about new research fields. There have been several outstanding disciplines which have kept pace to improve the interaction between the natural and the social sciences, like political ecology, ecological economics, and popular epidemiology (Milanez, 2015: 2336-2337). Environmental law is also a field that seeks to reinforce the dialogue between the natural science and law as a branch of social sciences. It lies in the very nature of the environmental sciences and the complexity as well as the changeability of the natural world.

The natural world is complex and ever-changing. As the science of ecology has blossomed over the past several decades, our understanding of the uncertainties and complexities inherent in the natural world has grown. There is a need for intricate scientific understanding to find out how human activities affect the natural world. The scientific studies are needed to estimate the amount of an effect, the long-term consequences of an effect, and the ability of the natural world to recover from a special effect. Neither science standing alone nor law standing alone can fully address the environmental issues we face. Ultimately, environmental decision making must be based on the integration of science and policy (Angelo, 2008: 1529-1530).

The desire for sustainability emerges in the "real world"; hence, any field of study that aims to play a role in obtaining a more sustainable world must have the ability to start a communication with society in promoting awareness and motivating modifications. Furthermore, studying social-environmental conflicts includes not only comprehending the modifications occurring in the environment, but also understanding the people's ideas on these modifications, and helping them to avoid or adjust themselves to those modifications. Hence, these conflicts can be solved by the cooperation between the social and natural scientists (Milanez, 2015: 2346).

In the mid-twentieth century, the new scientific recognition of ecology led to the advent of the environmental law. Although, science has majorly contributed in the environmental law, its role has been more restricted than may sound proper for an area of law that is so dependent on science to make sound decisions. Many scientific ideas developed in universities and other research institutions throughout the world have not been completely used by the environmental law. And, in the legal arena, these new scientific ideas that could help in making appropriate decisions regarding the environment don't seem to be considered properly (Angelo, 2008: 1527). It may have resulted from the divergent foundations of law and

environmental sciences on the one hand, and the diversity of the factors that impact these two fields on the other.

Experts in law should compose the laws considering the scientific evidence and other values (e.g., cultural, social, health, and economic). Although, the human beings' perspective and expertise is in the natural sciences area, social science plays major roles in the environmental policy (Moore et al, 2018). Although the impacts of natural sciences can be seen both in national and international areas, empirical research findings and scientific predictions play a far more significant role in international law. This is because environmental issues are transnational and cannot be confined to national territories. Problems such as air pollution, climate change, ozone layer depletion and dust storms are at the core of global discussions.

With respect to primary law, there is already an agreement, supported by the international law and policy instruments, that environmental protection is part of the global public interest. This common acknowledgement of the importance of environmental protection, including the protection of public health and the quality of life, has been elevated to one of the basic norms of law; in other words, it is a part of the *Grundrecht* of Public International Law, if Kelsen's phraseology in the ―Pure Theory of Law‖ is to be followed. The primary International Environmental law includes, inter alia, general principles of law, general principles of International Law and common principles deriving from domestic Environmental legislations. There is also treaty-based law, namely principles and legislation that derive out of main multilateral environmental agreements, from the framework conventions and main protocols and non-legally binding documents (Avgerinopoulou, 2011: 204-205).

Future developments in the international law would take place in a number of forums, spurred by a range of environmental threats and related legal and policy issues. Two critical concerns would be the continuing impact of climate change on the global environment and the concomitant and often overlapping role of pollution in threatening human health and the environment. While both climate change and pollution may have impacts on states and people around the world, they would cast an especially long shadow on ocean and coastal states, in particular on small island developing states (SIDS) and their vulnerable populations. These states have been already feeling the effects of sea level rise attributable to the climate change, or anticipate the impacts in the near future. If predictions are correct, many may suffer inundation, increasing storm events, and the need to address displaced populations. For the most part the engine of the problem is greenhouse gas (GHG) emissions from land-based facilities, located primarily in the developed or rapidly developing nations. In addition to warming the oceans and fuelling sea level rise, the emission of carbon dioxide, a particular greenhouse gas, has a direct impact on ocean waters, acidifying them, with dire effects for oceanic calcifying organisms such as coral reefs and shellfish (Powers, 2010: 19).

It is true that both a lack of scientific knowledge and scientific certainty exist and prevail in many environmental issues. However, science has already offered solutions and informed guidelines to help the international legislative bodies adopt appropriate laws to effectively address a series of environmental problems (Avgerinopoulou, 2011: 3).

The main purpose of this paper was to clarify challenges and present solutions to improve decision-making in the context of environmental law on the basis of natural sciences considerations.

2. CHALLENGES

A part of the explanation for failure of the international environmental law to address global environmental challenges also lies in the fact that, throughout the development of the international environmental law, little attention has been paid to the "effectiveness" of this new body of law (Leary & Pisupati, 2010: 5). In addition, many scientific studies in the environmental arena have been influenced by the political pressure, business pressure, or the impacts of the advocacy science that are inevitable when profit-making motives are pitted against the environmental or public-health protection (Angelo, 2008: 1531). National state policies may sometimes seem to be in favour of public welfare. For instance, job creation and welfare policies such as the establishment of polluting industries or the construction of highways through habitats may satisfy the ordinary people of a certain state, but adversely impact on the sanitary protection not only within the relevant state, but also in the territories of neighbouring and even faraway countries. Putting in other words, environmental phenomena know no borders.

While some scientific developments easily get accepted and are utilized in the law, others, which seem to be equally useful, remain unknown or unutilized. There is a number of factors which seem to limit the environmental law to adapt to and incorporate new scientific developments that could dramatically improve the environmental decision making. Some of these factors have been rooted in the inherent conflicts between science and law, while others are mostly related to the scientific idea under discussion (Angelo, 2008: 1528).

The relationship between science and law in the context of environmental issues is a complicated one. The first reason is that the legal principles and rules are largely founded on deductive reasoning, while natural sciences are mainly based on inductive argument. In other words, there is a divergence in the methodology of research, in that legal fields are dependent on logical reasoning, while natural sciences usually rely on the experimental and empirical findings. As the second reason, we can refer to non-legal factors including political, financial and cultural considerations that may affect environmental decision-making.

Last but not the least, the complicated relationship between science and law has been caused by the naturally different purposes and processes of the two disciplines, which can not easily match to each other. The goal of science is finding the truth, while the goal of the law is finding justice. The scientific process uses scientific methods to assess hypotheses. Whatever has inspired a scientific hypothesis, it should be tested and confirmed to be reproducible in order to be accepted. The falsifiability of science, at least in theory, is the main factor that represents something is science or not. In other words, in theory the hypothesis could be rejected by an

experimental result. On the other hand, law inherently deals with human behaviour, which can not be falsified by experimentation. Another critical distinction is that while science emphasizes on the cumulative progress in understanding the world, each experiment builds on previous ones to increase the cumulative knowledge, law emphasizes "process."' In other words, law's primary purpose is to resolve human disputes rather than to continually add to a body of testable knowledge (Angelo, 2008: 1530-1531).

Considering the climate change, the ambiguity of the international law documents has caused problems. This uncertainty can result from either the lack of the clarity of the wording of those documents or dissenting the interpretations of such instruments. Furthermore, the customary international law in the context of the environmental law has not been developed enough for overcoming this problem.

The vagueness of the phrases and terms in the provisions of both the ''United Nations Framework Convention on Climate Change'' (UNFCCC) and the Kyoto Protocol reflects the scientific uncertainty which prevailed in the past, regarding both their objectives and the specific policies to combat climate change. For instance, according to Article 2, the UNFCCC seeks "the stabilization of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system". The UNFCCC does not, however, stipulate what the level of the "dangerous anthropogenic interference" (DAI) with the climate environment should be. Neither did the agreement associate this objective with any specific emission reduction target or any upper threshold in the temperature rise. In a separate paragraph (not related to the DAI goal) it merely "urged" Annex I countries to reduce their GHG emissions to 1990 levels by 2000, mixing its binding legal nature with soft law. Nor is a subsequent interpretation of the meaning of this provision an easy matter, since assessing what actions lead to DAI involves complex scientific and evaluative judgements. There continues to be a scientific dispute over where to set the threshold after which the anthropogenic interference with the climate system will become dangerous. It would ordinarily be desirable to set a goal that embodies a comfortable margin of safety, but even small increments where the goal has been set can have serious effects on the economic and social development. Thus, setting the goals is a matter of enormous scientific, economic and political complexity and difficulty. Fortunately, the global scientific community has largely moved on from the question of whether human activities are contributing to the climate change (Gerrard et al, 2010: 152).

The problem is developing this in a way that does not take the appearance (or reality) of unfair treatment, or is heavily dependant on the professional judgment that renders the unpredictable or unenforceable regulations. If restoration activities are given special accommodation, it will be especially important for the project proponents to demonstrate that the restoration goals were actually met. In addition to enabling existing laws to accommodate restoration in a more effective manner, these laws should be able to meet their goals of actively promoting environmental restoration. The studies done to date have shown that this has been difficult to be accomplished either legally or politically. The idea of whether the increasing attention to restoration in the scientific and activist communities will help in the implementation of environmental laws toward their restoration goals, or indicate the need for the new regulation for the environmental restoration, should be tested (Bowman, 2002).

Environmental problems in various areas including high seas, dams and mines indicate that these problems are not unique. The complexity of such issues results from the inherent divergence. The nature of problems is not alike; as regards high seas, there are competing jurisdictions in the exploitation of natural resources, mostly among the coastal states on one hand, and third states on the other. For example, 'straddling stocks' may cause a competition for these fish species. However, such competition is rarely seen in respect of dams and mines which are often located in a certain state. Rather, a border mine as well as a dam constructed on a border river may result in bilateral disagreement on water resources and management. These problems are more easily resolvable than that of high seas.

The high seas regime of freedom and its corollary of the exclusive flag state jurisdiction leads, as it is known, to two related governance problems. First, unbridled exercise of the freedom leads inexorably to the overexploitation and the tragedy of the commons. Second, flag state jurisdiction is ineffective in halting or addressing this tragedy. In the absence of any international rule-making structure, individual sovereign states take decisions to exploit or enforce in their own interest rather than that of the international community. States may refrain from becoming party to particular treaties, or they may object to and therefore "opt out" of any particularly onerous measures adopted by treaty bodies of which they are a party. Despite growing recognition of the benefits of peer review and performance audit, no effective international machinery exists to hold states accountable for their failure to engage with or comply with generally accepted measures. Those international organizations that do exist are only as effective as their weakest or most reluctant member state, and may be wholly undermined by non-member states (Rayfuse, 2010: 207). Thus, in case of marine pollution caused by the exploitation of natural resources of high seas, there is no effective guaranty for constraining harmful activities.

In spite of the attempts done to protect the environment, the environmental restoration projects like dam removal cause a deviation from the status quo (although positive). Consequently, laws can indeed hinder the restoration activities, while they concentrate on preventing deviations from the status quo to meet their protection aims. As a good example of this problem, dam removal can be considered. Although dams are being removed to fulfil the ecological restoration goals, these removals are often being done in spite of the environmental laws which have been designed to protect those resources. Instead, the decision for removing a dam may be made regarding the laws designed to permit a balancing of interests and negative deviations from the status quo, like a hydropower dam pursing the Federal Power Act and state dam safety laws (Bowman, 2002).

Mining which affects both nature and society in various ways, can easily bring along an environmental and social dispute. Regarding the environmental side, the changes in the landscape, air pollution, and water contamination can be mentioned. And, erosion and deforestation can be regarded as

the example of changes in landscape. For accomplishing mining projects, large areas are needed not only for the mine itself, but also for disposing the overburden and tailings, as well as for its supporting structure which includes concentration plants, pipelines, railroads, etc. These problems become even more challenging when constructing the open-pit mines, which need more space and make greater amounts of overburden in comparison with the underground ones. These modifications in the landscape can make specific effects on the habitat fragmentation and loss of biodiversity. Regarding air pollution, it is necessary to consider that ore extraction is an energy intensive activity, demanding high amounts of fossil fuels. In Brazil, mining was responsible, in 2005, for 2.6% of total CO2 emissions from fossil fuels. Another important issue related to air pollution is the emission of particle matter from the mine and ore processing activities. Studying the atmospheric emission is an important field to bring together nature and social scientists. First, it is important to develop mathematical models that help understand local climate, pollutant dispersion etc. Second, health scientists might try to estimate how pollution affects communities. Water consumption and contamination are also problems associated with mining activities. Considering consumption, it has been estimated that iron ore concentration demands around 1.4 m3 /t of water. Additionally, while digging down the mines, companies need to reduce the underground water bodies which affects springs in the area. And also, depending on the mineral, toxic products like cyanide and mercury, or hazardous by-products like red sludge (a side product of the transformation of bauxite in alumina, which has high concentrations of sodium hydroxide) are required to accomplish the concentration processes (Milanez, 2015: 2341).

3. SOLUTIONS

Environmental decision-making is governed by laws, regulations, and policies—the realm of policy-makers and lawyers. These regulatory processes are needed to be informed by scientific evidence, in order to do so, there should be a link between law and science. For scientists interested in contributing to environmental sustainability through regulatory processes, it is not always clear how to do scientific activities that can be incorporated into these processes. Scientists and lawyers who would like to make a relationship between science and environmental law should find out how various scientific activities affect the different phases of the cycles of policies, laws, and regulations. The regulations related to the environment can improve through time, if regarded by a simplified policy cycle. A specific policy formulation will often be designed to give hints for making decisions, after which it is then implemented (Moore et al, 2018).

However, players in environmental law are various groups from ecologists and environmental experts to lawyers and politicians. Although not all of them necessarily participate in decision-making process, their opinions are heard and may be taken into consideration by decision-makers. Even policy-makers who formulate environmental policies may be affected by various experts' views.

Environmental law is a system which includes several statutes, rules, policies, and court decisions that try to decrease or delete special harms to humans and the environment. To decrease or delete harms, understanding the harms along with understanding other things, such as: whether the risk of harm exists; what the nature of the harm is; under what circumstances or at what levels of exposure the harm is likely to occur; how the risk of harm changes as circumstances change or as levels of exposure change; what technologies, processes, or alternatives can be employed to reduce the risk of harm; how effective those technologies or processes are at reducing that risk; and how cost-effective the different alternatives are, is needed. Science can provide information that can help to answer virtually all of these questions (Angelo, 2008: 1529). Putting in other words, a proper assessment of the environmental harms requires scientific data and information. Furthermore, it is impossible to ascertain damages without detailed empirical survey because mere legal criteria and rules such as causality (direct and indirect causation), requisite and sufficient conditions and so on cannot exactly determinate the damages caused by marine and air pollution. For example, the effects of pollution across a marine zone which will last for years or decades cannot be merely evaluated by legal formulation.

Scientists have been demanded by policy makers to prognosticate the occurrence, magnitude, and effects of natural and human caused environmental phenomena ranging from hurricanes and earthquakes to global climate change and the behaviour of dangerous waste. Billions of federal dollars are spent annually on such activities, in the United States. These expenses seem reasonable considering the belief that scientific predictions can be regarded as a valuable tool for improving environmental and related policies (Steel et al, 2004: 3).

Contemporary perspectives on the proper roles of scientists in the policy process are potentially related to how science is defined and understood. The traditional model of the role of science and scientists in the policy process is an outgrowth of the enlightenment and the philosophy of positivism. The role of scientists in this model is to provide relevant expertise about scientific data, theories, and findings that others in the policy-making process can use to make decisions, not to make the decisions themselves or to be advocates of particular policy positions. The assumption is that they are neither policy experts nor trained in the intricacies of environmental management. Moreover, scientists should not become biased by the involvement in the environmental policy or become "advocates". In this model, science is respected by resource managers and the public, and has a special authority in the environmental management, because of its independence and its power to objectively interpret the world. However, scientists can lose their credibility as scientists if they cross the line between science and policy, and science and management (Steel et al, 2004: 4). Environmental law is therefore an amalgamation of various scientific, managerial, legal and economic considerations which are interconnected. It is lawyers' duty to balance these disparate factors.

The second developing model challenges the first model, not the authority of the scientific information and the acceptability of the positivism, but the appropriate functions of research scientists in management (Kay, 1998). This model suggests that such scientists should have more effective roles in management and policy processes. Research scientists should

come out of their labs, and based on their field studies, get directly involved in public environmental decisions within the natural resource agencies and venues like courts and public meetings. The model proposes that more science is needed in these processes and decisions, and this need can be fulfilled if research scientists themselves get engaged more actively. Furthermore, this model suggests that scientists should make quick judgments to provide special management choices, if the preponderance of evidence and their own experience and judgment directs them to the certain practical directions. They are, after all, in the best position to interpret the scientific data and findings and thus are in a special position to advocate for specific management policies and alternatives (Steel et al, 2004: 4).

Concerning territories that are mainly outside of national sovereignty— such as the International Seabed, the High Seas, the polar environment and Outer Space— international scientific collaboration and the successful initiation and adoption of treaties have been more successful. In conventions regulating the marine environment, it seems that scientific findings have influenced the relevant international conventions more than in other fields. Regarding the marine environment, developing a common understanding of how to maintain bountiful resources in the marine environment was essential from the outset. As a result, conventions relating to extra-national territories tended to be based on shared information, common methods of analysis, and the consent of the States to be the subject to the same standards and regulations for harvesting resources. This has been especially true in the framework of the 1982 United Nations Convention for the Law of the Sea (LOS Convention.) (Avgerinopoulou, 2011: 78). Accordingly, those provisions of the LOS Convention which reflect the customary international law including Articles 44,54,76,77, 83 (3), 88-90 and 92(1) contain similar requirements.

While political bodies, comprised of state representatives, should hold the lawmaking power and main responsibility for the adoption of primary rules, expert bodies should be competent to design and adopt secondary implementation rules. The delegation of lawmaking powers to expert bodies, in combination with majority voting and opting-out possibilities seems more appropriate for the adoption of the implementation rules. It better serves the timely adaptation of international environmental law to new technological evolutions, and the speedy response to the environmental emergencies, and avoids the delays that political negotiations de novo may cause. Most importantly, it prohibits the States to act against the purpose of the primary rules by not adopting effective implementation rules (Avgerinopoulou, 2011: 542-543).

Science-based international environmental laws will increase in quantity and prescriptive density in the future, while technology advances and more scientific certainty occurs, and environmental problems become so acute as to leave only limited space for the politically-driven choices. Such delegation of lawmaking competences endows administrative agents with so much wide discretion, that it breeds concerns of unaccountability, recklessness and, corruption. Most importantly, delegation of lawmaking powers to experts might result in disrespect for the democratic choices. The same concerns also stand true in the realm of domestic jurisdictions (Avgerinopoulou, 2011: 543). In some legal systems like Iran, delegated legislation has been appeared as endowment of lawmaking powers of high councils which are considered as organs of the executive branch. Their broad powers for decision-making in various areas including culture, security and environment have undermined the exclusive lawmaking competence of the legislature.

Initially, certain officials in the United States and some of the other major GHG emitters invoked scientific uncertainty surrounding questions regarding the anthropogenic sources of climate change, the degree of severity of the phenomenon and the appropriate measures to combat climate change, as grounds for their refusal to ratify the Kyoto Protocol. However, in response to popular demand and the overwhelming scientific evidence presented by the Intergovernmental Panel on Climate Change (IPCC) and other prestigious national scientific institutions, most of the signatory parties to the UNFCCC, apart from the United States, eventually ratified the Kyoto Protocol (Gerrard et al, 2010: 152).

Nanotechnology is best described as a "platform technology". One area where this platform technology is showing promising signs is in responding to climate change. Nanotechnology will not, by itself, have a dramatic impact on climate change, but its incorporation into larger systems, such as the hydrogen-based economy, solar power technology or next-generation batteries, potentially could have a profound impact on energy consumption and hence greenhouse gas emissions. A recent report commissioned for the United Kingdom government has recognized that nanotechnology has the potential to contribute to efforts to reduce harmful greenhouse gas emissions, and therefore assist in responding to climate change in a range of areas, including: the development of efficient hydrogen-powered vehicles; enhanced and cheaper photovoltaics or solar power technology; the development of a new generation of batteries and supercapacitors (i.e. devices that can store and subsequently release electricity) which could make the more widespread use of electric cars a reality; improved insulation of buildings; and fuel additives that could enhance the energy efficiency of motor vehicles (Leary & Pisupati, 2010: 227-228). In addition, the development of solar panels in order to produce hot water and electricity has improved the quality of air in some nations.

A view of future regulation of nanotechnology as requiring a governance response does not, of course, exclude a role for law, and international environmental law in particular. New or existing international environmental treaties may form a part of future regulatory frameworks for nanotechnology. But, they should not be the only regulatory mechanisms that may be appropriate in the future. Law and international environmental law in particular, will only be a part of an overall international governance response to the emergence of nanotechnology, as it will be for the other new technologies and new environmental challenges (Leary & Pisupati, 2010:227-228). Today, international environmental law has been tied to the other fields of international law such as fishery law, space law, law of the sea, international human rights law, as well as some of domestic law disciplines including industrial law, constitutional law and law of tort.

The focus on the conservation and sustainable use of marine biodiversity has predominantly emerged from the annual meetings of the United Nations Informal Consultative Process on Oceans and the Law of the Sea (UNICPOLOS) which, since 1999, has discussed a range of ocean issues, and suggested a number of initiatives aimed at improving oceans governance. In 2004, on the recommendation of UNICPOLOS, the UN General Assembly established an Ad Hoc Open-ended Informal Working Group specifically to study issues relating to the conservation and sustainable use of marine biological diversity beyond areas of national jurisdiction (BBNJ Working Group). Other multilateral bodies, such as the Conference of the Parties to the Convention on Biological Diversity (CBD COP), regional fisheries management organizations (RFMOs), the Food and Agriculture Organization (FAO) and its Committee on Fisheries (COFI), and the International Maritime Organization (IMO), have also been engaged in discussions on improving the protection of high seas biodiversity and the marine environment (Rayfuse, 2010: 205).

The international community has accepted the need for an integrated and improved legal regime for the conservation and sustainable management of marine biodiversity in areas beyond the national jurisdiction, to better protect the interests of the international community as a whole. Such a regime will need to significantly modify many aspects of the freedom of the high seas if it is needed to finally eliminate the detrimental consequences of the Grotian legacy, and achieve real long-term conservation and sustainable management, and use high seas biodiversity in areas beyond the national jurisdiction (Rayfuse, 2010: 216). Since Article 89 of the LOS Convention has stated the invalidity of claims of sovereignty over the high seas, there is a common and global obligation to conserve and manage marine biodiversity in areas beyond national jurisdiction.

While not being completely new technologies, synthetic biology and synthetic genomics introduce novel problems for those concerned with the governance of biotechnologies generally. In the realm of the environmental law, especially with respect to the planned releases of synthesized organisms, it will be critical to determine where synthetic biology specifically differs from the genetic modification. At the same time, societal concerns about the technologies that cannot necessarily be resolved through legal and regulatory means will nonetheless have to be taken into account by policymakers (Garfinkel and Friedman,2010, 288-289).

Lawyers and legal scholars can communicate with scientific audiences by choosing special journals. Organizers of environment-related conferences (e.g., ecology, hydrology, and conservation to name a few) can actively ask lawyers and NGOs to participate in this area. Similarly, organizers of environmental law conferences can demand scientists to participate. Learning should be bilateral, as environmental lawyers can learn much from scientists, and scientists can learn much from legal experts. Prominently, the science–law interface is a comfort zone for many NGOs and Indigenous governments, which can increase law–science relations (Moore et al, 2018). Furthermore, the combination of data and information as well as the applicable proposals can improve the position of environmental law. Scientists are able to present detailed solutions that are compatible with empirical considerations which could not be found in legal sources. Lawyers can explain legal impacts of new provisions on the process of environmental protection.

Existing laws that are effective at ensuring environmental protection will not probably be effective at promoting environmental restoration activities such as dam removal. The resulting question is how to permit positive deviations from the environmental status quo while not weakening laws and creating loopholes that will lead to more negative deviations from the status quo. Basic exemption from the environmental protection laws for the restoration projects is not advisable, because the environmental restoration projects have effects that should be reviewed and minimized. Providing a regulatory direction or guidance that helps a decision maker present some accommodation for projects with restoration as their main goal can be considered as a better approach. For example, a state or federal agency could establish a policy that enables flexibility in the interpretation of permitting requirements when a proposed project's primary purpose is environmental restoration. An agency could also allow the officials to regard the long-term benefits of a restoration project as mitigating factors in order to identify whether the short-term effects of the project are admissible (Bowman, 2002).

However, official authorities and governmental experts who give priority to social expediency considerations may sacrifice long-term benefits for short-term advantages. The U.S. recent decision on the Paris Agreement on climate change is a good example in this regard. The U.S. president Donald Trump announced on 1 June, 2017, that the U.S. would withdraw from the Paris Agreement and immediately stop acting based on the agreement which includes implementing the Nationally Determined Contributions (NDCs) and financial contributions. This decision was majorly taken by the U.S. domestic politics and Trumps personal preferences rather than any challenges on the U.S. imposed by the Paris Agreement. The Trump Administration is closely tied to the fossil fuel industry, and interest groups are a defining feature of American politics (Hai-Bin et al, 2017: 221-222). In order to avoid this, the environmental activists should inform officials of adverse consequences which may be resulted from inappropriate environmental decisions. Public opinion and mass media can also play a significant role in that regard. In a global context, politicians cannot easily take decisions to the detriment of the environmental protection, provided that the universal community is acquainted with disastrous effects of those decisions.

While some scientific ideas have been easily considered and proliferated in the environmental law, others are still waiting to be noticed. One example of a scientific idea that has become common in environmental law is that of "risk assessment," a mainstay in modem environmental law. An example of a scientific idea that has been mainly considered by scientists, regulators, resource managers, and legal scholars, but that has not been regarded in the law yet, is that of "adaptive management." (Angelo, 2008: 1528).

Of course, the role of science should not be exaggerated. Science can be very effective in decision making, but it cannot answer policy questions, such as how much risk we would like to bear or how much money we would like to spend on decreasing a risk. Pure science may tell us what is likely to happen as a result of a certain action, but it cannot in itself tell

us whether that outcome is "good" as a matter of policy. On the other hand, the value of a policy decision about a desired outcome is little without scientific information indicating whether a particular action would lead to the desired outcome. Because of the stark differences existing between their two disciplines, lawyers and scientists attempt to solve problems in ways that do not always make sense to one another. However, there is no question that both are needed to have sound environmental decision making (Angelo, 2008: 1529). In fact, a better understanding can lead to a broader and more strengthened cooperation between lawyers and scientists in environmental protection.

4. CONCLUSION

There are several challenges regarding the linkage between natural sciences and environmental law. First, despite the development of international environmental law, little attention has been paid to the efficiency of this new body of law. Second, political and profit-making motives may affect policies and decision-making in the context of environmental law. Third, the relationship between science and law in the context of environmental issues is a complicated one. The main reason is that legal fields including environmental law largely use deductive reasoning, while natural sciences are tied to the inductive argument. In other words, there is a grave difference in the methodology of research, in that legal fields are dependent on logical reasoning, while natural sciences usually rely on the experimental and empirical findings. Last but not the least, for making the relationship between science and law, the inherently different purposes and processes of the two disciplines, which can not be easily harmonized, should be considered. The purpose of science is to search the truth, whereas the law searches justice or at least reasonable and fair resolution to solve the conflicts. The scientific process depends on the ability to test hypotheses through the scientific method. The issues related to the environmental problems such as climate change, air and marine pollution, greenhouse gas, dam removal, mining and preservation of biodiversity are at the core of the relationship between natural sciences and environmental law.

Various solutions have been presented for resolving above-mentioned problems. To reduce or eliminate the harms which may result from the destructive environmental activities, it is necessary to understand the harm by gaining an understanding of, among other things, including: whether the risk of harm exists; what the nature of the harm is; under what circumstances or at what levels of exposure the harm is likely to occur; how the risk of harm changes as circumstances change or as levels of exposure change; what technologies, processes, or alternatives can be employed to reduce the risk of harm; how effective those technologies or processes are at reducing that risk; and how cost-effective the different alternatives are. Science can give information to virtually answer all of these questions. Lawyers and legal scholars can communicate with the scientific audiences by choosing special journals. Organizers of environment-related conferences (e.g., ecology, hydrology, and conservation to name a few) can actively ask the lawyers NGOs with experience in this area to participate. Similarly, organizers of environmental law conferences can invite scientists to take part. Learning should be mutual, as environmental lawyers can learn much from scientists, and scientists can learn a lot of things from legal experts. Science-based international environmental laws will increase in quantity and prescriptive density in the future, while technology advances and more scientific certainty will occur, and environmental problems will become so acute as to leave only limited space for the politically-driven choices. Such delegation of lawmaking competences endows the administrative agents with so much wide discretion, that it breeds concerns of unaccountability, recklessness and, corruption. Most importantly, the delegation of law making powers to experts might result in disrespect to the democratic choices. The same concerns stand true also in the realm of domestic jurisdictions. In order to avoid this problem, the environmental activists should inform the officials of adverse consequences which may result from the inappropriate environmental decisions. Public opinion and mass media can also play a significant role in that regard. In a global context, politicians cannot easily take decisions to the detriment of the environmental protection, provided that the universal community is acquainted with disastrous effects of those decisions. While some scientific ideas have easily gained a position in the environmental law, others are still waiting to be noticed. One example of a scientific idea that has become common in the environmental law is that of "risk assessment," which is a mainstay in modem environmental law. An example of a scientific idea that has been greatly considered by scientists, regulators, resource managers, and legal scholars, but that has not yet regarded in the law, is that of "adaptive management.".

REFERENCES

1. Angelo, Mary Jane (2008), Harnessing Power of Science in Environmental Law: Why We Should, We Don't, and How We Can, 86 Texas, 1527-1573.
2. Avgerinopoulou, Dionysia-Theodora (2011), Science-Based Lawmaking: Effective Integration of Science in International Environmental Law, PhD Thesis in the Science of Law, Columbia University.
3. Bowman, Margaret B. (2002), Legal Perspectives on Dam Removal, 52 (1) Bioscience, 739-747.
4. Garfinkel, Michele S. & Friedman Robert M. (2010), Emerging Technologies: Nanotechnology, in: The Future of International Environmental Law, David Leary & Balakrishna Pisupati (Eds), 269-291.
5. Gerrard, Michael B. & Avgerinopoulou, Dionysia-Theodora (2010), Development and the Future of Climate Change Law, in: The Future of International Environmental Law, David Leary & Balakrishna Pisupati (Eds), 149-178.
6. Hai-Bin, Zhang (2017), U.S. Withdrawal from the Paris Agreement: Reasons, Impacts and China's Response, 13 (5) Climate Change Research, 439-447.
7. Kay, James (1998), Ecosystems, Science and Sustainability, at: http:// www.ecologistics.com.
8. Leary, David & Pisupati, Balakrishna (2010), The Future of International Environmental Law, David

Leary & Balakrishna Pisupati (Eds), United Nations University Press.

9. Milanez, Bruno (2015), Dialogues between Social and Natural Sciences: Contribution to the Debate on Socio-environmental Conflicts, 87 (4) Annals of the Brazilian Academy of Science, 2335-2348.
10. Moore, W. Jonathan et al (2018), Towards Linking Environmental Law and Science, 3 FACETS, 375-391, at: http//www.facetsjournal.com.
11. Powers, Ann (2010), Climate Change and Pollution: Addressing Interesting Threats to Oceans, Coasts and Small Islands Developing States, in: The Future of International Environmental Law, David Leary & Balakrishna Pisupati (Eds), 19-41.
12. Rayfuse, Rosemary (2010), Moving beyond the Tragedy of the Global Commons: The Grotian Legacy and the Future of Sustainability Management of the Biodiversity of the High Seas, in: The Future of International Environmental Law, David Leary & Balakrishna Pisupati (Eds), 201-224.
13. Steel, Brent et al (2004), The Role of Scientists in the Environmental Policy Process: A Case Study from the American West, 7 Environmental Science & Policy, 1-13.