

Name of the Author- Anahita Gaiind (3rd Year)

Name of the Co-author- Suraj Singh (4th Year)

College- Army Institute of Law, Mohali

Mobile no. 9914020166

Email id- surajsingh1694@gmail.com

BAMBOO: A NEW SOURCE OF ENERGY

The 'Bamboo' is called poor man's timber, a perennial woody grass belonging to the family Gramineae, is widely distributed across Asia, and has been utilized as a feedstock¹. It is found almost in every corner of India and it is one of the fastest growing plants on the planet, but currently bamboo is considered to be a weed in a forestry practice that suppresses the growth of other trees because of its extraordinary growth rate. However, bamboo can be used for the production of fuel ethanol, biogas and other valuable products due its rapid growth rate and high content of holocellulose.

As environmental problems are increasing rapidly there is a need to use alternative energy sources like bio-ethanol which satisfies both energy and environmental goals. Research has shown that bamboo can be used as a raw material for the production of bio-ethanol. Japan where other feedstock, such as agricultural residue is limited, bamboo is used for the production of bio-ethanol.²

Advantages of Bamboo

Bamboo can be used as a source for alternative fuels. It helps to lower the ethanol production with minimal costs to environment. Bamboo causes no harm to environment as it does not need any nutrients and fertilizers to grow. There are different quality of bamboo available for example Bambusa Edulis which is a special variety of bamboo whose root does not spread wildly in the ground. It produces 800% more gallons of ethanol per acre than the corn.³ The most important feature of bamboo is that it can be easily grown and is least dependent on weather. Bamboo can be found in northern part of India as well as north-eastern, and southern part of India.

Bamboo: A Hope for India

The forest area, over which bamboos occur in India, on a conservative estimate, is 9.57 million hectares, which constitutes about 12.8% of the total area under forests. Bamboo areas in the States of Arunachal Pradesh have 19,790 km², Assam 10,000 km², Manipur 2500 km², Tripura 750 km² and West Bengal 164 km² FAO. All this facts shows that India has good amount of bamboo production and it can be used for the production of fuel. North eastern part of India which has deficiency of energy from different sources can use this as a alternative source of energy without any damage to the environment.

Bamboo which constitutes a 12.8% of the total forest area, if utilised properly can replace the lot of environmental problems of not only India but also of world. The process of converting Bamboo into ethanol does not harms environment it has been verified in research by various institutions.

¹ <https://www.deepdyve.com/lp/elsevier/production-of-fuel-ethanol-from-bamboo-by-concentrated-sulfuric-acid-3PlusB2Vsw> (last visited on 5th August 2016)

² <http://www.unep.org/ietc/Portals/136/Publications/Waste%20Management/WasteAgriculturalBiomassESTCompendium.pdf> (last visited on 5th August 2016)

³ <https://ecoenergynews.wordpress.com/why-invest-us/bamboo-can-lower-the-costs-of-ethanol-production/> (last visited on 5th August 2016)

People can be encouraged to produce bamboo in their fields and this can be done by the government. Government can encourage people to produce by buying their production and government can utilise it for production of fuels.

India which wants to stop importing crude oil has to search for some alternative and Bamboo can serve the purpose upto some extent.

Recently Union Minister Nitin Gadkari said that bamboo can prove to be a great economic and environment change agent. A bamboo sub-group is likely to be constituted under the Niti Aayog. Bamboo can give employment to at least 50 lakh people in rural areas. Bamboo can be employed for generating green power. Apart from livelihood opportunities, we will have an alternative to petrol, diesel and gas, which pollutes environment.⁴ The statement of Union Minister shows seriousness on his part as India also wants to become the zero petroleum import country.

India at present is incurring a massive Rs 4.5 lakh crore on crude imports which is a very huge amount and even if half of the amount is used for the research and various schemes for production of bamboo it will be of great help to India. Later other half money can be used in the development of various other sectors of India. India will not have to be dependent to other countries for oil.

Growing bamboo will also help in the afforestation which will help in improving the environmental problems which is at its peak for example air pollution problem in Delhi. IIT Bombay researchers have found that deforestation in northeast India and north-central India has led to a 100-200 mm reduction in summer monsoon rainfall in these two regions.⁵

Conslusion:

Due to huge potential of bamboo to convert into a good alternative source of energy government of India should take this on top priority. Seeing the increasing environmental problems on rise because of use of various fuels which harm the environment bamboo can be used as a alternative sources of energy. As research has already revealed that it does not causes any damage to the environment and takes least nutrients from ground to grow.

Problem of deforestation can also be solved by this and afforestation will help in the increasing the green field on this earth and good monsoon can be expected.

People can be encouraged to grow bamboo by various schemes which can be launched by government to promote the production of the bamboo which will ultimately help the environment and government also. It will also corroborate in achieving the dream of India to become the zero import oil country.

⁴ http://articles.economictimes.indiatimes.com/2015-12-06/news/68809238_1_bamboo-plantation-union-minister-nitin-gadkari-bamboo-exports (last visited on 5th August 2016)

⁵ <http://www.thehindu.com/sci-tech/science/deforestation-caused-reduced-rainfall-in-ganga-basin-ne-india/article9025901.ece> (last visited on 5th August 2016)

Climate Change - It's Consequences on Environment & Legal Remedy

Dr. Sujata Shrivastava
Principal, A. P. N. Law College Cantt. Jabalpur (M.P.)

Introduction

Climate change is one of the most serious environmental challenges facing by the modern world. It is a complex phenomenon and a difficult concept to define. A general definition is a short-term or long-term alteration of the statistical properties of a climate system. Such a change can be temporary or permanent. It can occur regionally or globally. The United Nations Framework Convention on Climate Change (UNFCCC) defines it as "a change of climate which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and which is in addition to natural climate variability observed over comparable time periods." Currently climate change is synonymous with global warming. In recent times the main focus is on human activity that is responsible for climate change.

Causes for Climate Change

Some natural factors accountable for this occurrence are variations in solar radiation, deviations in the Earth's orbit, mountain-building, continental drift and changes in greenhouse gas concentrations etc. The results of human activity that influence climate change are observable in a relatively short period of time. It is also the actions of humans that are supposed to threaten their own survival. Deforestation, industrial and domestic emission of toxic material into the atmosphere, oceans, rivers, and soil, the rupture of the ozone layer due to the release of Chlorofluorocarbon gas are some of the factors that are attributed to global warming and other adverse climate changes.

Environment and Pollution

The word *environment* is most commonly used describing natural environment and means the sum of all living and non living that surround an organism, or group of organism. The environment includes all things which are important to live for human being and this environment is polluted by human being.

Pollution is the introduction of contaminants into a natural environment that causes instability, disorder, harm or discomfort to the ecosystem i.e. physical systems or living organism. Pollution is often classified as point source or non point source pollution. There are many types of pollution like air pollution; light pollution; noise pollution; soil pollution and water pollution.

Consequences of the Climate Change

Climate change affects all regions around the world.

Melting Ice and Rising Seas-When water warms up it expands. At the same time global warming causes polar ice sheets and glaciers to melt. The combination of these changes is causing sea levels to rise, resulting in flooding and erosion of coastal and low lying areas.

Extreme Weather and Shifting Rainfall-Heavy rain and other extreme weather events are becoming more frequent. This can lead to floods and decreasing water quality, but also decreasing availability of water resources in some regions.

On Developing Countries-Many poor developing countries are among the most affected. People living there often depend heavily on their natural environment and they have the least resources to cope with the changing climate.

On Human Health: Ozone pollution causes respiratory disease, cardiovascular disease, throat inflammation, chest pain and congestion etc. There has been an increase in the number of heat-related deaths in some regions and a decrease in cold-related deaths in others.

On Economy of World-Damage to property and infrastructure and to human health imposes heavy costs on society and the economy. Between 1980 and 2011 floods affected more than 5.5 million people and caused direct economic losses of more than 900 billion dollars. Sectors that rely strongly on certain temperatures and precipitation levels such as agriculture, forestry, energy and tourism are particularly affected.

On Wildlife- Climate change is happening so fast that many plants and animal species are struggling to cope. Many terrestrial, freshwater and marine species have already moved to new locations. Some plant and animal species will be at increased risk of extinction if global average temperatures continue to rise unchecked. The world lost about 16% of all coral reefs in 1998. These impacts are expected to intensify in the coming decades.

The International View on the Climate Change

In 1980s evidence of climate change was mounting and became worldwide concerning issue. Thus, efforts have been made at the international level.

In 1988 a panel was set up by the UNO known as the International Governmental Panel on Climate Change (IPCC) which brings together thousands of scientists from all over the world to study the impact of climate change. They reported that there is a discernible human influence on global climate changing.

In 1992 more than 160 countries signed an international environmental agreement i.e. the United Nations Framework Convention on Climate Change (UNFCCC) in Rio de Janeiro. The objective of the treaty is to "stabilize greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system". The treaty itself set no binding limits on greenhouse gas emissions for individual countries and contains no enforcement mechanisms. Instead, it provides a framework for negotiating specific international treaties that may set binding limits on greenhouse gases. The UNFCCC was adopted on 9 May 1992, and came into force on 21 March 1994. In 2015, UNFCCC has 197 parties.

In recent years the international measure on climate change has found recognition in a number of treaties/conferences. Some of them are:

The Kyoto Protocol 1997- This treaty legally binds developed countries to emission reduction targets. The Protocol's first commitment period started in 2008 and ended in 2012. The second commitment period began on 1 January 2013 and will end in 2020.

The Copenhagen Conference 2009 - This conference had been represented by the 192 countries and main objectives of this conference include helping developing countries in reduction of emissions, to preserve forests and adapt to climate change.

The Cankun Conference 2010 - In this conference 194 countries participated and all countries were agreed to produce less emission. They had also decided to develop the less carbon produces technology.

The Durban Conference 2011- Durban conference delivered a breakthrough on the international community's response to climate change.

The Doha Amendment 2012- Through this amendment several articles of the Kyoto Protocol were updated for the second commitment period.

Recently in 2015 United Nations Climate Change Conference, COP 21 was held in Paris, France (30 Nov.-12 Dec.). It was the 21st yearly session of the Conference of the Parties (COP) to the UNFCCC, 1992 and the 11th session of the Meeting of the Parties to the 1997 Kyoto Protocol. Representatives of the 196 countries attended it.

Legal Remedies in India

India is a country among top five countries contributing to the green house effect and the Government is already adopting stricter policies to curb carbon dioxide emissions. The efforts is only in bits and pieces as more than 90% of the population is not much aware of global warming or consequences of climate change.

Remedies play very important role the field of environmental law. Any law without remedies is castle in the air. The remedies available for environmental pollution in India comprise common law, constitutional writs and statutory laws.

Basis of remedies in India is:

Constitution: The Constitution of India commands the State and citizens to protect and improve environment and to safeguard the forest and wildlife in the country under Article 48A and Article 51A (g) respectively.

Enforcement of Statutes: There are more than two hundred central and state statutes that have some bearing on environmental protection. Among them most important are the Environment (Protection) Act, 1986 and National Green Tribunal Act, 2010.

Administrative Regulations: Government through Coastal Regulation Zone Notification 2011 brought action for the enforcement of environment issues.

The legal remedies are:

Common Law Remedies- In common law countries this action can be brought in form of nuisance or negligence. These actions are generally brought for property damage, economic loss and personal injury arising from environmental harmful activity.

Types of remedies provided for this are (a) Injunctive Relief (b) Criminal Sanction

(c) Civil Penalties (d) Damages (e) Restitution or Remediation and (f) Continuous Mandamus.

Statutory Remedies –The provision of Sec.133 CR.P.C., 1973 comes under this category.

Writ Jurisdiction- Public Interest Litigation: NOG or individual bring action to prevent or stop a harmful activity. Normally monetary damage not sought civil penalty by the law.

Indian judiciary is well prepared and informed of the rapidly expanding environmental law and plays a critical role in the implementation and enforcement of environmental law, through the successful conclusion of environmental cases.

Conclusion

Sir Edmund Hillary said ‘Environment problems are really social problems. They begin with people as the cause and ends with people as victims’. Climate change poses risks to all people and all countries, but some are subject to more grievous losses than others are. All human beings are responsible for it, thus it is our duty to save our planet and environment for future generation. It is suggested that the use of carbon and carbon monoxide emitting fuel consumption should be minimized. Instead substitute energy sources such as solar power, wind force, hydro-electricity, and subterranean steam power are harnessed. A kind cooperation from all sectors is required to make our environment pure and pollution free. Lets us hope for a better and greener tomorrow.

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**NEW ENVIRONMENTAL POLICY: THE ENVIRONMENTAL LAWS OF INDIA
AND OTHER COASTAL LAWS VERSUS THE MENACE OF AQUACULTURE – A
CRITICAL ANALYSIS AND RECOMMENDATIONS**

By: 1. Siddhant Rai Sethi, BBA LLB(H), 9th Semester, USLLS, IP University, Delhi

Email: siddhantraisethi@gmail.com

And

2. Shubhangi Joshi, BA LLB(H), 5th Semester, USLLS, IP University, Delhi

Email: shubhangij31@gmail.com

1. INTRODUCTION:

Development comes at a cost, the cost is often the degradation of the environment. This Article focuses on such degradation to our coastal lands by the menace of aquaculture. Human agglomerations in the coastal zone bring about unprecedented changes which adversely affect the coastal areas. Aquaculture has been considered as an option to cope with the world food demand and also to meet economic ends in a developing economy but the rapid growth of intensive aquaculture for species with high commercial value intended for export has already caused dreadful environmental damage and the displacement of many local farmers and fishers whose livelihoods have been destroyed.¹ A clear picture has emerged recently on the deterioration of the highly fragile and sensitive zone of the coastal ecosystem due to overexploitation of living and non-living resources. The formulation of “coastal regulation zones” (CRZ) in this context necessitates the proper management and conservation of these regions by identifying areas that require adequate attention for preservation and development.² The CRZ, 2011 and the Coastal Aquaculture Authority Act (CAAA), 2005 have had a positive impact on the preservation of our coasts, however, it is not free from loopholes and thus, this article will also focus on recommendations to these laws.

¹ Marcel Martinez & Luis R. Martinez, World Aquaculture: Environmental Impacts and Troubleshooting Alternatives, The Scientific World Journal, Volume 2012 (2012), Article ID 389623

² <http://www.sciencedirect.com/science/article/pii/S0964569100000417>

2. WHAT IS AQUACULTURE?

"Aquaculture" means artificial culturing, under controlled conditions in ponds, pens, enclosures or otherwise, in coastal areas, of shrimp, prawn, fish or any other aquatic life in saline or brackish water.³ It implies an ownership of the organisms by one organization and includes the exploitation and use of public resources with or sometimes without licenses.⁴ It denotes the cultivation of fresh water fish and aquatic marine species. It involves their breeding, feeding, protection from predators and creation of favorable circumstances which protect their growth.⁵

3. THE NEXUS BETWEEN THE MENACE OF AQUACULTURE AND THE LAW

The current generation, government and beneficiaries ought to understand that to meet their needs; they must not hamper the opportunity of future generations to meet their needs.⁶ On the Aquaculture front, many researchers, aquaculturists and conscious governments have advocated that sustainable aquaculture must happen and made possible but it all bottles down to the way it is managed.⁷ It has social, cultural, economic and political implications.

Now, a problem arises when aquaculture is overused and misused. It is a double-edged sword. It provides food, economic benefits in trade and commerce, huge employment opportunities and helps in the development of coastal villages⁸. However, its overuse causes depletion of the food source, exploitation of the indigenous population and destruction of the water eco-system⁹.

³ Section 2 Coastal Aquaculture Authority Act, 20005.; Madireddy Padma Rambabu and Ors.Vs. District Forest Officer, Kakinada, E.G. District and Ors, AIR 2002 AP 256.

⁴ Maheshwari fish seed farm Vs.T. Nadu Electricity Board and Anr. , AIR 2004 SC 2341

⁵ Concise Oxford Dictionary, The New Edition for the 1990's, pg. 53, Oxford University Press

⁶ World Commission on the Environment and Development (WCED), Our Common Future, Oxford University Press, New York, NY, USA, 1987.

⁷ R. R. Stickney and J. P. McVey, Responsible Marine Aquaculture, World Aquaculture Society, New York, NY, USA, 2002

⁸ M. D. Smith, C. A. Roheim, L. B. Crowder et al., "Sustainability and global seafood," Science, vol. 327, no. 5967, pp. 784–786, 2010.

⁹ FAO, The State of the World Fisheries and Aquaculture 2008, FAO, Rome, Italy, 2009

3.1 Provisions of Law Regulating and governing Aquaculture.

It is trite that our legislature and the Supreme Court have been active and prudent in the cause for protection of the coasts and water resources from the abuse of aquaculture. The legislations such as Indian Fisheries Act, 1897, Environment Protection Act, 1986, Water Act, Wildlife Protection Act, the CRZ 2011, the CAAA, 2005 and some other regional legislations.¹⁰ The SC has also passed some very effective guidelines in 1997 after the *Jagannath Case*¹¹ known as **Notification SO 88 (E) (1997)**.

An analysis of these legislations gives us the following points which can be said to be the legal framework regarding aquaculture in India:

1. Some of these legislations are really old and can be said to be ancient, they do not discuss the technological changes and the changes in the process of aquaculture and thus the regulations and processes mentioned therein are now redundant.
2. They basically deal with the duty of organizations and individuals taking permissions and sanctions from the authorities such as the Aquaculture Authority of India established by the CAAA, 2005. The permissions and sanctions relate to:
 - a. The Quantity and Quality of the Stock of the species
 - b. The quality and the salinity of the soil
 - c. the uses and the effects of the chemicals
 - d. the area and the land demography where such farms are being set up
 - e. The Compliance of the CRZ which deals with the distance from the coast where such farms are being set up.
 - f. Compliance of the security and the compensation of the fisherfolk community as per the CRZ.

¹⁰ http://www.fao.org/fishery/legalframework/nalo_india/en#tcNB0019

¹¹ AIR 1997 SC 811

g. The Act also provides for some regulations such as the use of higher technology, the land resource test, an inquiry by the authority on whether to grant the license or not, and periodic tests and surveillance.¹²

3. The EIA Notification, 1991 also regulates the waste generation from such farms.

4. The feed is regulated by the Export (Quality Control and Inspection) Act (1963) regulates the feed of the species and states that the feed is to be in accordance with the International Standards set by the WTO, WHO, Network of Aquaculture in Asia and the Pacific (NAAPA) and other bodies.¹³

3.2 Target Areas where Excessive Aquaculture is degrading the Environment

The Environment and the Ecosystem has always had a way to regenerate and replenish itself, however, even nature has a limit. Excessive abuse and exploitation takes away the power of replenishment from the environment and leaves it with the disease of degradation.

The following target areas where such a disease can be identified as under:

a) *The Mangroves*: Mangroves are inherently an ecological marvel providing a rich source of resources and diversity fostering many species of flora and fauna¹⁴ and are the primary source of organic resources to a coastal ecology. However, due to excessive aquaculture, the mangroves all over the world are being destroyed rapidly. Various researchers and studies have attributed the loss of mangroves to aquaculture. The basic issue here is the taking away of the organic components from the Mangroves and the construction of dams, barriers and trading and processing units at these Mangroves, which is causing a mass scale deforestation and removal of the Mangroves¹⁵. Fisheries and aquaculture are the main causes for mangrove deforestation in India, approximately 1,50,000 ha of mangroves were destroyed to promote and set up aquaculture in India and Bangladesh in the past century¹⁶, which is not sustainable.

¹² Sections 3, 11, 13, 14

¹³ Order SO 729 (E) (1995), Order SO 729 (E), Order SO 477 (E) (2002)

¹⁴ D. M. Alongi, "Present state and future of the world's mangrove forests," *Environmental Conservation*, vol. 29, no. 3, pp. 331–349, 2002

¹⁵ Bhatt JR, Kathiresan K (2011) Biodiversity of mangrove ecosystems in India. In: *Towards conservation and management of mangrove ecosystem in India*.

¹⁶ Vyas P (2013) Sundarban Biosphere Reserve, India: Conservation and management of mangrove ecosystem: In: *Mangroves in India: their biology and uses*, pp. 33-56

The importance and the need for protecting the mangroves was emphatically stated in *S. Jagannath v. Union of India*.¹⁷

b) *The Soil and the Coast*: Aquaculture involves a wide use of chemicals and treatments to the soil to make it fit for breeding and sustaining the imposed species onto the area. This leads to high salinization and acidification of the soil which further leads to mass erosion.¹⁸ This causes the people indulged in aquaculture to eventually abandon the area leaving the soil and the land unusable. In India, it is causing large scale erosion, contamination of drinking water, chemical absorption by food source and changes and effects to the humans by consuming such chemicals through water and sea-food.¹⁹

c) *The Flora and the Fauna*: An over-dedication to the growth and culture of one species will always have adverse effect on others. By cultivation of shrimps alone a great deal of flora and fauna has been destroyed, also leading to mass waste product generation. Producing 3 tons of fresh water fish via aquaculture results into as much waste as community of 240 people per annum would.²⁰ A study has found that for each million of shrimp larvae cultivated, four-seven million of other species die as a result of getting trapped in the nets for shrimp cultivation.²¹ Also, the introduction of exotic and non-indigenous species to the area leads to elimination and displacement of the indigenous species often causing imbalances to the biome of the area.²²

d) *Changes in the Natural Structure and the Dimensions of the Coastline*: Erosion, salinization, acidification, removal and depletion of the natural flora and fauna have caused an unprecedented change in the land use, the changes in the natural structure of the land and the ecological and geographical changes in the dimensions of the coastline in India.²³ This is

¹⁷ AIR 1997 SC 811

¹⁸ Pathak, S. C., Ghosh, S. K., & Palanisamy, K. (2000). The use of chemicals in aquaculture in India.

¹⁹ Ibid

²⁰ Y. Avnimelech, Biofloc Technology. A Practical Guide Book, The World Aquaculture Society, Baton Rouge, La, USA, 2009.

²¹ H. A. González-Ocampo, L. F. Beltrán Morales, C. Cáceres-Martínez et al., "Shrimp aquaculture environmental diagnosis in the semiarid coastal zone in Mexico," *Fresenius Environmental Bulletin*, vol. 15, no. 7, pp. 659–669, 2006.

²² R. L. Naylor, R. J. Goldberg, J. H. Primavera et al., "Effect of aquaculture on world fish supplies," *Nature*, vol. 405, no. 6790, pp. 1017–1024, 2000

²³ Dr. K. Krishna Dorababu, Impact of aquaculture on land use patterns, environment and economy: a case study of west Godavari district, Andhra Pradesh, India, *International Journal of Current Research*, issue 5 Vol 7, 2013

causing depletion of natural biome and would eventually lead to loss of the indigenous ecosystem and would eventually culminate with a loss to the indigenous communities residing in these areas.²⁴

e) The overall sustainability of the sea-food resource: Sea-food is regarded as a very important source of protein and its use and importance in trade and commerce is extremely high.²⁵ This creates an even higher responsibility on the current generation to think and use this resource sustainably and carefully. We must leave resources for our future generations. Also, the chemicals and the pesticides which are entering the sea-food resource is killing the resource and causing biological alterations which imposes a great threat on this precious resource.²⁶ We must protect it, it is our fundamental duty.

4. RECOMMENDATIONS

1. The evaluation of the land, the soil, the components and the indigenous species: None of the legislations deal with the study and calculation of the indigenous species present in the proposed area. The indigenous species are highly important to the sustainability of the water and food source. It is recommended that the legislation should focus on the existing indigenous species and only allow such commercial species to be cultivated which adversely do not affect the indigenous species. The evaluation of the soil and the land source is limited to the levels before the process of aquaculture and not after, policies must be framed to improve and to basically reconstitute the land source of its nutrients and balance after aquaculture is completed there.

2. Cultivation of similar species at the same time which counter each other's ill-effects: This process is known as Polycultures or Integrated Multitrophic Aquaculture (IMTA). This basically denotes the cultivation of similar species of aquatic organisms which have opposite waste generation to counter the ill-effects of one species from the other. It has scientifically been proven that Polycultures reduce the Nitrogen poisoning of the soil and also reduces the

²⁴ Krishnadevi Malchand Kamathia and Ors. Vs. Bombay Environmental Action Group and Ors, AIR 2011 SC 1140

²⁵ M. D. Smith, C. A. Roheim, L. B. Crowder et al., "Sustainability and global seafood," Science, vol. 327, no. 5967, pp. 784–786, 2010.

²⁶ Dr. T. Patanjali Sastry, President, Environment Centre Vs. Chairman, Andhra Pradesh Pollution Control Board and Ors., MANU/AP/1510/2001

waste generation by the other species.²⁷ A regulation mandating Polyculture can go a long way in protecting the soil pollution.

3. Stricter regulations on the chemicals used: The laws regulating the chemicals and the pH levels and toxin levels are old and outdated, many new target chemicals with lower toxicity but higher degrading effect to the human body and the flora and fauna have been developed²⁸, and our law must change to tackle this change in the structure of chemical compounds.

4. Feeding Strategies: For sustainable use of aquaculture, one very important change which must be made is to the feeding strategies, these are again outdated and not very scientific. Studies have shown that the current feeding practice is one which involves a high protein diet to the species which leads to greater waste generation which the soil can't handle. The best option is for mandating feed with higher hydrostability which means feed which results into waste products which are soluble in the water

5. Setting up of Authorities with greater Scientific Know-How: Dedicated authorities with scientific know-how and the sole objective of improving the technology for aquaculture and reducing the costs related to it must be established. This will aid in improving the sustainability of the aqua feed and thus protect the environment.

6. More research and development with Education: Another huge challenge is imparting education about existing improvements in the process of aquaculture and the negative impact of the abuse of aquaculture, so the legislature and the Supreme Court must look into the prospect of establishing an authority which imparts education and some technical knowledge to the aquaculture stakeholders.

5. CONCLUSION

No doubt, aquaculture must flourish and is needed. The food source of sea-food is perhaps an essential for a country like India with such a large coast line. However, this must be used prudently and sustainably. The laws in place have improved the situation by the regulations

²⁷ T. Chopin, A. H. Buschmann, C. Halling et al., "Integrating seaweeds into marine aquaculture systems: a key toward sustainability," *Journal of Phycology*, vol. 37, no. 6, pp. 975–986, 2001.

²⁸ J. M. E. Hussenot, "Emerging effluent management strategies in marine fish-culture farms located in European coastal wetlands," *Aquaculture*, vol. 226, no. 1–4, pp. 113–128, 2003.

imposed. However, primarily these legislations are old and the times have changed. The recommendations provided in this article are an attempt to bring the legislation up to date with the modern developments, as a pre-requisite for protecting the environment.

PRESENT AND FUTURE OF KYOTO PROTOCOL 1997 ON CLIMATE CHANGE: AN ANALYTICAL STUDY

“The ultimate test of man's conscience may be his willingness to sacrifice something today for future generations whose words of thanks will not be heard.”

-Gaylord Nelson

(Founder of Earth Day)

1. Introduction:

Climate change is the most devastating threat faced despite signing the UN framework convention on Climate change more than 20 years ago. The notion of sustainable development which was incepted with the report of the “*World Commission on Environment and Development(WCED), Our Common Future(The Brutland Report)* of 1987” clearly states the “development is which meets the need of the present generation without compromising the ability of future generations to meet their own needs”. However, there seems scant acknowledgment in practical life.

Over the past few decades, there has been a rapid and progressive development of binding International agreements concerning environmental protection at both global and regional levels.¹These rapid developments have been characterized by multiple multilateral negotiations, but have failed to achieve successful implementation.²

The climate change is causing increase in floods, droughts, storms and sea-level rise, leading to starvation, new forms of disease, scarcity of water and mass displacement. The Intergovernmental panel on Climate change (IPCC) reported in 2007 that climate change impact is already being felt especially in the poorest nations although they have the least historical responsibility for climate change.³

The linkage between climate change and its repercussions was discussed for the first time in the UN Framework Convention on Climate Change (UNFCCC) in 1992, which came into force in the year 1994. The first session of the Conference was held in Berlin leading to the formation of

¹ JANE BULMER, Promoting compliance in an evolving climate regime 56 (Cambridge University Press, 2012).

² *ibid.*

³ Intergovernmental Panel on Climate Change, *Climate change synthesis Report* [hereinafter IPCC Synthesis Report 2007] available at < http://www.ipcc.ch/pdf/assessment-report/ar4/syr/ar4_syr.pdf > (last visited: August 20, 2016).

regulatory provisions, which came to be known as the Kyoto Protocol in 1997. Kyoto Protocol was, however, enforced in the year 2005 with an objective to mitigate emissions from all the industrialized countries. The regulatory provisions of the Kyoto Protocol were destined to expire by the end of 2012. Thus the diplomats were busy delving into different mechanisms to explore other procedures on mitigation. This led to the famous Cancun pledges in 2010 wherein policies with respect to climate changes were discussed. If fully implemented, the pledges might reduce emissions in 2020 about one-tenth below the diffusion level that would have existed otherwise.⁴

2. History of Kyoto Protocol:

Kyoto Protocol was agreed for the first time in the year 1997. However, it took eight long years for countries to ratify the Kyoto Protocol. Under the Kyoto protocol regime, industrialized countries were legally obliged to cut their greenhouse gas emissions by 5% on 1990 levels by 2008-2012.

However, there were no restrictions put on the developing countries such as China, India, Brazil and South Africa. They were just encouraged to adopt policies to promote green growth.⁵ To make the situation better, Kyoto offered different market mechanisms by investing in low carbon projects in poorer parts of the world. Kyoto Protocol also introduced the ideas of Clean Development Mechanism (CDM) and rules for reporting, accounting and verifying emissions. It offered support to poorer countries by the establishment of the Adaptation Fund and through instruments designed to incentivize green investments in the developing world. It even encouraged UK to set up low carbon legislation across the world. Even setting up of Kyoto Protocol encouraged the countries to bring domestic Climate legislation. However, despite the best efforts, due to rise in greenhouse gases', threatening sustainable development Kyoto Protocol is considered to be a failure.

⁴ Fifth Assessment Report of Intergovernmental Panel on Climate Change which was finalized in November 2014.

⁵ Kyoto Protocol: 10 years of the world's climate change treaty, *available at* <http://www.climatechangenews.com/2015/02/16/kyoto-protocol-10-years-of-the-worlds-first-climate-change-treaty/> > (last visited: August 20, 2016).

3. Reasons for failure of Kyoto Protocol:

Kyoto Protocol which sets the legally binding agreements has proved to be failure. Example of US would best set the situation. US signed the Kyoto Protocol but never quantified and complied with the agreements. Similarly, Countries such as Brazil, China and India have been parties to Kyoto Protocol for years but still they are ignorant of Common but differentiated responsibility principle. Looking at the figure only 27% global energy related problems have been taken into consideration.⁶ The claim made by different countries is that Kyoto Protocol flawed by omitting three countries which have the highest share of global carbon-dioxide emissions. China (23% share of global emissions) and India (5%) denied signing the treaty, while the United States (14.7%) signed but never ratified the deal. The countries who have met the targets are not the highest emitter of greenhouse gas. For example, Latvia, Lithuania, Romania and Ukraine, if added would account for only about 1% of the world's share of carbon-dioxide emissions. Though Kyoto was the first attempt made to test the various grounds to check emissions but at the end it proved to be arbitrary. Canada who ratified Kyoto protocol with the aim to reduce emission 6% lower than its base year has ended up being more than 20% above its base year when it Japan, The Protocol's first commitment period started in 2008 and ended in 2012. A second commitment period was agreed in the year 2012, known as the Doha Amendment. In this 37 countries have binding targets i.e. Australia, the European Union (and its 28 member states), Belarus, Iceland, Kazakhstan, Liechtenstein, Norway, Switzerland, and Ukraine.⁷ Russia, New Zealand, the U.S. and Canada are not the part of Doha Amendment in any capacity. The countries who are actually participating in the second phase are Norway and Monaco which are the lowest emitters in the world. Further, the Kyoto Protocol has been criticized for the lack of ambition of its emission reduction obligation and measures to support adaptation to climate change, its overly complicated policy tools and ineffectual enforcement mechanisms.

In addition, the compliance was not fixed for corporate, non-state bodies. However, to note they are not party to the treaty and it gets more difficult to control their polluting pace because of lack of regulatory regime. These points were however, not considered while laying down provisions for Kyoto Protocol. Furthermore, many assent problems result from gaps in economic, regulatory

⁶International bar Association, '*Achieving Justice and Human Rights in an Era of Climate Disruption*' in Climate Change Justice and Human Rights Task Force Report, (2014).

⁷ See n 156, Richardson, Le Bouthillier, McLeod-Kilmurray and Wood (2009), 13.

and technical capacity issues: for example, the current IMO regulation of ocean fertilization and other geo-engineering proposals relies on states' willingness to grasp the precautionary principle, rather than comprehensive mandatory regulation.⁸

Another reason lies in the problems with the principles for environmental protection and progressive development. Though no-harm principle, precautionary principle, polluter pays principle are accepted in International Law but are somewhat unclear because of its versatile and differentiated meanings. The problems with the principles are in the fact that most of them are non-binding or just a directive or guiding principle. Also, principles are just being given to be observed by the private bodies rather being enforced by the law. Examples can be seen where the challenges can be highlighted and the new strategy needs to be implemented. In the "No Harm Principle it crops up that preventative principle is an attempt at curtailing the negative environmental impacts of human activities that do not identifies political and territorial boundaries, and also tends to absolutely prohibit extra territorial damage."⁹ Additionally, polluter pays principle has been said to be the modern innovation in fixing liability against the polluter, but again, it is difficult to challenge the amount of environmental damage the polluter has done, by whom it has been done and the compensatory amount which needs to be paid. Sustainable Development though a wide looking concept aimed at balancing the economical and development needs, with broad range of disciplines have been criticized for its uncertain, vague and flexible meaning. The greatest problem of the document which has been encountered is that they are in essence non legal documents. However, they create the essence of preserving the natural resources. Another Principle of Inter-Generational Equity is simply considered as a utopian concept. It says that "the next generation of mankind must receive a stock of Environmental assets; no less than the stock inherited by the present generation".¹⁰ But to bring advancement the concept should be that the present generation must raise the standard with technological development which will reduce the irrational use of resources. Thereby, making it available to the future generation along with new technological advancement.

⁸ S Murase, International Law Commission, First Report on the Protection of the Atmosphere A/CN.4/667 (14 February 2014).

⁹ WILKINSON, D., *Environment and Law*, 109 (London: Routledge, 2002).

¹⁰ J. THORNTON, S. BECKWITH, *Environmental Law*, 45 (London: Sweet 7 Maxwell, 1997).

The Principle of “Common but differentiated responsibility” is again overloaded with the conflicts between the developed and the developing Nations. Developing nation is of the view that developed nation has been able to develop at the expense of the environment, however, the same is being denied to the developed nation. Step are being taken to get financial and economic help from the developed nation but that needs to be done at a fast pace.

Another reason for failure is rewards were provided for planting trees or funding for sustainable energy but no rewards were given for preservation and conservation. The most important reason being developing countries was excluded, what was seen by developed countries as an economic advantage.

However, steps have been taken in the Paris Agreement held on 12th Dec, 2015 where concept of Intended Nationally Determined Contributions (INDCs) emerged. The agreement does contain a “ratchet mechanism”. Countries will be required to inform after every five years what they are doing to tackle climate change analysis– what will now be called their nationally determined contribution. Each successive NDC “will represent a progression beyond” the countries antecedent one. It will include both developed and developing nations to make comparable changes in emission and pledge to increase low carbon energy.¹¹

Refusal of US to join Kyoto Protocol:

Kyoto protocol was perceived as an “environmentally strong and economically sound”¹² deal by US president Bill Clinton. Nonetheless, the principle of ‘common but differentiated responsibilities placed a heavy burden on developed countries.’¹³ Therefore, to avoid itself from the plethora of litigation US decided to withdraw in the year 2002.

¹¹ <http://www.theguardian.com/environment/2015/jun/02/everything-you-need-to-know-about-the-paris-climate-summit-and-un-talks> (last visited: August 21, 2016).

¹² Climate Action: Paris Agreement, available at http://ec.europa.eu/clima/policies/international/negotiations/paris/index_en.htm (last visited: August 21, 2016).

¹³ Kyoto Protocol: 10 years later <http://news.nationalpost.com/news/world/kyoto-protocol-10-years-later-was-the-deal-to-combat-greenhouse-emissions-successful-and-what-of-its-future> (last visited: August 21, 2016).

4. Paris Agreement

Paris Agreement has been finally accepted by 195 countries. The legally binding agreement is to come into force from 2020. The agreement is set out to curb climate change by limiting the global warming well below 2%.¹⁴

As, the Paris Agreement has been signed by 180 signatories along with 22 States ratifying the same. This has finally led to the approval of 1.08% of the total greenhouse gas emissions.¹⁵ The key elements included in the Paris Agreement are to bridge the gap and bring climate neutrality. Government has agreed to long term goal of reducing emissions and comprehensively setting the targets. Government has also agreed to meet after every 5 years and track progress through a robust transparency and accountability system. Also, for better environmental impact assessment government has agreed to cooperate, understand the need of emergency preparedness and risk insurance. Further, developed countries have agreed to extend their cooperation worth USD 100 billion per year by 2020 and extend till 2025.

“Parties are encouraged to take action to implement, including through results-based payments, the existing framework as set out in related guidance and decisions already agreed under the Convention for: policy access and positive incentives for activities relating to reducing emissions from deforestation and forest degradation, and the role of conservation, sustainable management of forests and enhancement of forest carbon stocks in developing countries; and alternative policy approaches, such as joint mitigation and adaptation approaches for the integral and sustainable management of forests, while reaffirming the importance of incentivizing, as appropriate, non-carbon benefits associated with such approaches.”¹⁶

The agreement also provides that the Financial Mechanism of the Convention, including the Green Climate Fund (GCF), shall serve the Agreement. International cooperation on climate-safe technology development and transfer and building capacity in the developing world are also

¹⁴ Supra Note 7.

¹⁵ UNFCCC: Status of Ratification http://unfccc.int/paris_agreement/items/9444.php (last visited: August 21, 2016).

¹⁶ How do Governments enhance action on capacity building <http://bigpicture.unfccc.int/content/capacity-building/how-do-governments-enhance-action-on-capacity-building.html> (last visited: August 21, 2016).

strengthened: a technology framework is established under the agreement and capacity building activities will be enhanced through, inter alia, enhanced support for capacity building actions in developing country Parties and appropriate institutional arrangements.¹⁷

5. Will Paris Agreement solve our problem?

To point out, the Kyoto Protocol in the year 1997 was taken as a dramatic turning point. Similarly, the Paris agreement is being given the same strata in the year 2016. However, arguably as the population will swell to more than nine billion there is less chance of reduction of fossil fuels. According to International Energy Agency, energy demand will grow by 37% by 2040. So, what we need today is cheaper and renewables like solar and wind energy replacing coal. While the deal is being described as legally binding, countries can withdraw from it without ramification, as Canada did from the Kyoto Protocol. And time has nearly exhausted for limiting warming to 2 °C. “If we delay until 2020, it will be too late. “We need renewable energy, nuclear power, zero-carbon transport, energy efficiency, housing changes,”

6. Conclusion:

To, conclude tackling Climate Change and Sustainable Development is the facet of the same coin and demands for fair justice systems, ensure social cohesion and end to corruption. The universal approach needs to be made in such a manner as to curb Greenhouse Gas emissions, de- carbonize CO₂ and overcome the issue of ultraviolet radiation. With the help of various transnational organizations the goals set for Millennium Development needs to get fragmented for Social, Economic and overall development of all countries and groups, agreeing to the contention that no goal or target should be considered unless it is in full coherence with international standards. The Paris agreement, which covers the period 2020 to 2030, is a better deal than many expected, and if countries stick both to the spirit and the letter of the agreement, it could give us a good chance of limiting global warming to under 4 °C and perhaps even under 3 °C. But if actions taken are not appropriate; seas will rise by more than 5 meters over the coming centuries, and droughts, floods and extreme heat waves will ravage many parts of the world.

¹⁷ <http://bigpicture.unfccc.int/#content-the-paris-agreement> (last visited: August 22, 2016).

JUDICIAL ACTIVISM TOWARDS ENVIRONMENTAL PROTECTION

**Devina Srivastava,*

Symbiosis Law School, Pune,

Symbiosis International University, Pune

The Supreme Court has, through intense judicial activism, the proponents claim, become a symbol of hope for the people of India (Upadhyay 2014). In the past three decades, the Supreme Court has opened its doors to public-spirited citizens, expanded the frontiers of fundamental rights, and even ‘rewritten parts of the Constitution’ (Sathe 2001). The Court has transformed itself, through the exercise of its public interest jurisdiction, into an arena in which political, social and economic battles are fought, and socio-economic justice is delivered (Rajamani 2007). The article is an attempt to delve into the use of this tool of judicial activism to combat growing environmental hazards and establish safeguards for the environment. It is based on doctrinal research and discusses the judicial verdicts that highlight the use of judicial activism by the courts in innovative ways to deliver judgments that bring out the true essence of justice. The ultimate aim is to familiarize the reader with the intricacies of judicial activism, in particular, public interest litigation, and the use of the same by the judiciary towards answering questions of environmental concern.

INTRODUCTION

The ancients have stated that ‘God sleeps in the mineral, awakens in the vegetable, walks in the animal and thinks in man’. The sublime prospect that unfurls before civilization through the advances of science is darkened by the devastating misuse of technology to poison and pollute the biosphere and thereby to hold humanity in terrible peril of total liquidation of the life process.¹ In such a scenario, certain men, constituting the corpus of judiciary have assumed a subsidiary role in enforcement of environmental protection practices. In addition, courts now play a role in determining the adequacy of quantification of environmental damage.² Prior to 1980s, only the aggrieved party could personally knock the doors of justice and seek remedy for his grievance and any other person who was not personally affected could not do so as a proxy for the victim or the aggrieved party. But around 1980, the Indian legal system,

*Student, Symbiosis Law School, Pune, Symbiosis International University, Pune. (e-mail: devina.srivastava@symlaw.ac.in)

¹ Lavanya Rjamani, “Public Interest Environmental Litigation in India: Exploring Issues of Access, Participation, Equity, Effectiveness and Sustainability”, 19(3) JEL 293 (2007)

² S.P. Sathe, “Judicial Activism: The Indian Experience”, 6 Wash. U. J.L. & Pol’y 29 (2001)

particularly the field of environmental law, underwent a sea change in terms of discarding its moribund approach and instead, charting out new horizons of social justice.³ This period was characterized by not only administrative and legislative activism but also judicial activism. As a result of judicial activism, India's Supreme Court has delivered a new normative regime of rights and insisted that the Indian state cannot act arbitrarily but must act reasonably and in public interest on pain of its action being invalidated by judicial intervention.⁴ The power of public interest litigation (PIL) in India lies in its freedom from the constraints of traditional judicial proceedings. PILs in India have come to be characterised by a collaborative approach, procedural flexibility, judicially supervised interim orders and forward-looking relief.⁵ The courts, time and again have used this weapon of judicial activism, to answer questions of environmental concern and play its part, in safeguarding the environment. A look at some of these judgments is essential to broaden the understanding about the role of the judiciary in environmental protection.

PUBLIC INTEREST LITIGATION: INSTRUMENT OF ENVIRONMENTAL PROTECTION

Public interest litigation has emerged as a growing mechanism in the field of environmental protection in India. Most of the cases in the sphere of environmental protection arose in the form of PIL initiated by a public spirited citizen or by public interest groups rather than by the affected party as environmental issues relate more to the diffused interests of a group of people than to ascertainable rights of individuals. In India, class action against public nuisance can be brought under section 91 of the Code of Civil Procedure and section 133 of the Code of Criminal Procedure. It is through invocation of the original jurisdiction of the Supreme Court under Article 32 and that of the High Court under Article 226 that the PIL relating the environment has grown in recent times. It is owing to the Supreme Court that the right to unpolluted environment and preservation and protection of nature's gifts has also been conceded under Article 21 of the Constitution of India.

At this juncture, it is pertinent to discuss the cases that lay down the foundation of judicial activism in the sphere of environmental protection and form the cornerstones of the principles of *justice, equity and good conscience*.

³ Dr. Minal H. Upadhyay, "P.I.L. and Environment Protection", 2(3) ILRSML 2321 (2014)

⁴ Bharat H. Desai, "Enforcement of the Right to Environment Protection through Public Interest Litigation in India", 33 IJIL 27 (1993)

⁵ P.N. Bhagwati, "Judicial Activism and Public Interest Litigation", 23 CJTL 561 (1985)

In the landmark judgment of *M.C. Mehta v. Union of India*⁶, the Supreme Court first utilized the tool of judicial activism in the sphere. Mr. Mehta brought to the notice of Supreme Court that the discharge of trade effluents by tanneries near Kanpur into the municipal civil lines and ultimately in river Ganga had caused considerable damage to the life of the people who use the water of the river and to the aquatic life of the river. The tanneries gave an undertaking before the Supreme Court for establishing primary treatment plants within a period of six months. It was held by the Supreme Court that it was not possible to adopt a policy of not having any chemical or other hazardous industries merely because they pose hazard or risk to the community. If such a policy were adopted, it would mean the end of all progress and development. Such industries, even if hazardous have to be set up since they are essential to economic development and advancement of well-being of the people. The court directed for the payment of compensation in case of escape of chlorine gas resulting in death or injury to the workmen or other, the management of Shri Ram Food & Fertilizer Industries should deposit Rs. 20 lack with the Court by way of security for payment of compensation to the victims of gas leakage.

This case enlarged the scope of the right to live and said that the state had power to restrict hazardous industrial activities for the purpose of protecting the right of the people to live in a healthy environment. This case is significant as it evolved a new jurisprudence of liability to the victims of pollution caused by an industry engaged in hazardous and inherently dangerous activities.

In the case of *Rural litigation and Entitlement Dehradoon v. State of U.P.*⁷, a group of citizens brought to the notice of Supreme Court that the quarry owners had mined progressively skipper slopes, depriving them of trees and damaging natural structure for extracting more and more time stone available in the valley. This led to land slides and blocked the underground water channels which fed many rivers and springs in the river valley. On the basis of the report of Bharagava Committee appointed by the Supreme Court, the court directed that quarries falling under C category which were situated in city limits would not be cleared unlike decision of another committee appointed by the Supreme Court. Quarries falling under category A outside the city limits of Massorrie were allowed to be operated subject to the compliance of the relevant provisions of statutes, rules and provisions. The closing of the mines was a price that had to be paid for the protection of the rights of the people and for controlling any

⁶ 1987 SCR (1) 819

⁷ AIR 1985 SC 652

disturbance of ecological balance. It was the first of its kind in the country invoking the issues relating to environment and ecological balance. In another case by the same parties the Supreme Court held in February, 1987 that it was for the government and the Nation, and not for the Court to decide whether the limestone deposits should be exploited at the cost of ecology and environmental conditions or industrial requirements should otherwise be satisfied.

In *Kinkri Devi. v. State of Himachal Pradesh*⁸, the High court directed the closure of mining activities dangerous to environment. The court held that to ensure the attainment of Constitution goal of the protection and improvement of natural wealth and environment and of the safeguarding of forests, the lakes, the rivers and the wildlife and to protect the people inhabiting the vulnerable areas from hazardous consequences of the arbitrary exercise of the power granting mining leases without due regard to their life, liberty and property the court will be left with no alternative but to intervene effectively by issuing appropriate orders and directions including the closure of mines.

In case of *L.K. Koolwal v. State of Rajasthan*⁹, it was held that it is the primary duty of the Municipal Council to remove filth, rubbish, night soil or any other notions matter. The maintenance of health, preservation of sanitation and environment fall within the purview of Article 21 as it adversely affects the life of citizen and it amount to slow poisoning and reducing the life of the citizen because of the hazard created, if not checked. Moreover, a citizen has a right to know about the activities of the State and its agencies working for health and sanitation.

In *Calcutta Youth Front v. State of West Bengal*¹⁰, by a writ petition the petitioners had challenged the legality and propriety of the grant of licence by the Calcutta Municipal Corporation of the Subsoil of Satyanarayan Park to respondent No. 14 M/s. Happy Homes and Hotels private limited for a period of 30 years of the implementation of development scheme, namely, construction of a two-storied air-conditioned underground basement market and parking place on the manifold grounds inter alia that the construction of said underground market would affect the ecological balance because the park was situated in densely populated area like Burra bazar in the Metropolitan City of Calcutta that the construction would affect traffic jams in or about the said area leading to a further ecological imbalance and that the corporation had no authority to grant the licence of the subsoil of the part for the implementation of any development scheme which was not for the development of the park by way of proper and adequate utilization of such part.

⁸ AIR 1988 HP 4

⁹ AIR 1988 Raj 2

¹⁰ 1988 AIR 436

The Court held, ‘*There would be parch green in the thickly congested Burra bazar area which would tend to improve rather than retard, ecological balance and there would be a place of recreation for all and in particular for the children as a playground.*’

In *Indian Council for Environlegal Action v. Union of India*¹¹, Supreme Court felt that such conditions in different parts of the country being better known to them, the high courts would be the appropriate forum to be moved for more effective implementation and monitoring of the anti-pollution law.

The apex court in landmark judgment of *S. P. Gupta v. Union of India*¹², elucidated in the following words: "*but we must hasten to make it clear that the individual who moves to court for judicial redress in cases of this kind must be acting bona fide with a view to vindicating the cause of justice and if he is acting for personal gain or private profit or out of political motivation or other oblique consideration, the court should not allow itself to be activated at the instance of such person and must reject his application at the threshold*".

In *T. N. Godavarman Thirumulpad v. Union of India*¹³, the Supreme Court took on the issue of forest cover and found itself issuing orders dealing with the rights of forest dwellers, employment in the wood products and timber industries, and the respective powers of federal and state forestry officials. The case is on a “continuing mandamus,” meaning that the case remains open for court orders and actions relating to it; the Court has issued new orders flowing from the case virtually every week since 1995.

EVOLUTION OF DOCTRINES FOR ENVIRONMENTAL PROTECTION

The formulation of certain principles to develop a better regime for protecting the environment is a remarkable achievement of judicial review in India. These doctrines include:

1. **The Polluter Pays Principle-** In *Vellore Citizen’s Welfare Forum v. Union of India*¹⁴ the Supreme Court has declared that the polluter pays principle is an essential feature of the sustainable development.

2. **Precautionary Principle-** The Supreme Court of India, in *Vellore Citizens Forum Case*¹⁵, developed the following three concepts for the precautionary principle:

¹¹ AIR 1996 SC 1446

¹² AIR 1982 SC 149

¹³ (1998) 2 SCC 59

¹⁴ (1996) 5. SCC 647

¹⁵ *Vellore Citizen’s Welfare Forum v. Union of India*, (1996) 5. SCC 647

- i.Environmental measures must anticipate, prevent and attack the causes of environmental degradation
- ii.Lack of scientific certainty should not be used as a reason for postponing measures
- iii.Onus of proof is on the actor to show that his action is benign

3. **Public Trust Doctrine-** The Public Trust Doctrine primarily rests on the principle that certain resources like air, water, sea and the forests have such a great importance to people as a whole that it would be wholly unjustified to make them a subject of private ownership. It was evolved in *M.C. Mehta v. Kamal Nath and Others*¹⁶.

4. **Doctrine of Sustainable Development-** As per Brundtland Report, Sustainable development signifies “development that meets the needs of the present without compromising the ability of the future generations to meet their own needs”. There is a need for the courts to strike a balance between development and environment.

In *Rural Litigation and Entitlement Kendra v. State of UP*¹⁷, the court for the first time dealt with the issue relating to the environment and development; and held that, it is always to be remembered that these are the permanent assets of mankind and are not intended to be exhausted in one generation.

CONCLUSION

Thus, even a cursory study of the judgments of the Indian courts especially the Supreme Court would reflect the consistent commitment of the courts towards the protection of the environment. However, the protection of environment is a common subject to all, Article 48-A of the constitution of India provides that the State shall endeavour to protect and improve the environment and to safeguard the forests and wild life of the country. Article 51-A of the Constitution imposes as one of the Fundamental Duties on every citizen the duty, to protect and improve the natural environment including forests, lakes, rivers and wild life and to have compassion for living creatures. Thus, it needs to be acknowledged that the efforts of the courts can only achieve marginal success unless there is social, political and economic change in the Government as well as of people towards adhering to a model of sustainable development us to maintain our commitment to the protection of our environment.

¹⁶ (1997)1 SCC 388

¹⁷ 1985 SC 652

