LOCAL ADAPTATION STRATEGIES TO CLIMATE CHANGE: LEARNING FROM LADAKH

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Abstract

There is no denying the fact that people living in the mountains and their livelihoods are vulnerable to the adverse impacts of climate change. Disproportionate rates of poverty, prevalence of high food insecurity, poor health, marginalisation, high dependency on natural resources and limited livelihood diversity are the underlying causes of vulnerability. The breakdown of livelihoods which are dependent upon ecosystem is likely to remain the primary driver of long-term migration during the next two to three decades. This paper tries to argue that climate change will act as a stressor and exacerbate the migration situation unless vulnerable populations, especially the poorest in the mountain communities are provided assistance in building livelihoods which are climate-resilient.

I Introduction

"When all is said and done, the final decisions about your land, must come from you".

—The Woodland Steward.

IN THE COURSE of a stubborn struggle against nature which the Indian peasant had carried out for thousands of years the cultivated stretch of the Great Plains, the valleys and hill-slopes of India have been created. In endless cycles forest and waste have retreated, recovered and again retreated before the peasant's hoe and plough. Therefore, besides its political and military boundaries every period in Indian history has had, its 'forest line' and desert frontier. This boundary line between man's domain and nature is obviously of great importance for the study of Indian environmental history in any of its aspects. Besides defining the area under cultivation, the boundary line between man's domain and nature always served as an index of the growth of population in the different parts of the country. The existence of economic organization and particular systems of productions are equally related to the boundary line between man's domain and that of the nature. Permanently

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settled cultivation, hoe-cultivation, migratory agriculture, were all historical stages in the evolution of productive techniques, determined largely by the extent to which virgin land was available for fresh occupation in the respective periods.[1]

II Climate change adaptation

In the context of climate change, the capacity to adapt can be explained as "the ability of a system to adjust to climate change (including climate variability and extremes), to moderate potential damage, to take advantage of opportunities, or to cope with the consequences."[2] Climate change adaptation has a somewhat shorter history, emerging in the United Nations Framework Convention on Climate Change (UNFCCC) signed in 1992. However, the UNFCCC and Kyoto protocol predominantly addressed climate change mitigation and policies and measures to reduce the emissions of greenhouse gases. It was not until quite recently that adaptation came to the forefront as a key concern within the UNFCCC.[3] The possibilities for Least Developed Countries to develop National Adaptation Programmes of Actions (NAPAs) and the Nairobi Work Program which was a 5 year (2005-2010) initiative under the UNFCCC,[4] were important first steps towards both enhancing the understanding of adaptation and catalyzing action on adaptation. The Bali Action Plan(BAP), agreed upon at the UNFCCC Conference of Parties (COP) in Bali, provides a roadmap towards a new international climate change agreement to be concluded by 2009 as successor to the Kyoto Protocol.The BAP puts adaptation on an equal footing with mitigation.[5]

The ability to adapt to climate change can be seen as an opportunity through which social reform can be brought about. At the same time adaptation also provides us with opportunity wherein we can question the values that is responsible for creating inequalities in development as well as our short term relationship with environment which is unsustainable. Refuting the certainty of the outcome, growing evidence suggests that most of the time adaptation is generally thought of as a domain related to technology with the least of political affiliation. In other words it is perceived narrowly as technological instead of political. Its implementation instead of being taken in progressive spirit is taken more in a defensive spirit.

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1 Irfan Habib, *The Agrarian System of Mughal India* 1 (Asia Publishing House, New York, 1993).

2 IPCC2007b *Climate change 2007' Impacts, Adaptation and Vulnerability Working Group II Contribution to the Intergovernmental Panel on Climate Change Fourth Assessment* Report (Cambridge University Press, Cambridge, 2007).

3 Scott Leckie, Ezekiel Simperingham, *et.al*., (eds.) *Climate Change and Displacement Reader* 20(Earth Scan New York,2012).

4 *Ibid*.

5 *Ibid*.

Adaptation as a technique to combat climate change is understood more in terms of preservation and protection rather than what can be achieved and gained. The irony lies in the fact that flourishing of culture or health of the ecology is given low priority in comparison to economy which needs to be preserved first. Policies and practices on adaptation should therefore focus on encouraging developments in the field of culture, society and economy instead of solely concentrating on the preservation of the economic core. Adaptation policies and practices should also aim towards incorporating the interests of the marginalized, non-human entities and the future generations. Equity and justice should form the basic framework of adaptation policies and practices in both letter and spirit.[6]

The Himalayan Region is spread throughout twelve states, and covers a total land area of 61.5 million hectares. This total land mass is, hence, regulated by twelve different kinds of land, water, and forest laws, besides the Central Acts such as the Forest Conservation act and the Land Acquisition Act which apply to all States. Since large parts of the state of J&K are in the plains, the laws do not make a distinction between the plains and the mountains and they are applied uniformly. The geographical and socioeconomic conditions of the mountains are, however, distinctly different from those of the plains.[7]

As far as climate change adaptation is concerned the scope in the field of environmental law is an evolving area. Professor J.B. Ruhl enunciates the trends that will have profound normative and structural impacts on how environmental law fits in the climate change adaptation policy as[8]:

> *The rapid evolution of property rights and liability rules associated with natural capital adaptation resources, accelerated merger of water law, land use law, and environmental law, incorporation of a human rights dimension in climate change adaptation policy.*

III Special needs of the mountain areas: Legal lacunae

6 Mark Pelling, *Adaptation to Climate Change*: *From Resilience to Transformation* 3(Routledge, New York, 2011).

7 Chhatrapati Singh, *The Role of Law in Mountain Environmental Management* 6 (MEM Series No.7, ICIMOD, Nepal, 1991).

8 J.B.Ruhl, "Climate Change Adaptation and the Structural Transformation of Environmental Law" 40 *Environmental Law* 363-431(2010).

There are special needs of the mountains which are not covered by the general land laws. The most significant amongst them are issues concerning avalanche, landslides and seismicity. Since the Himalayas are a comparatively young mountain range, change in landmass formation and contours are ubiquitous aggravated further by climate change. Hundreds of lives and property worth crores of rupees are lost every year because of climate induced disasters. No special legal provisions for compensation or rehabilitation exist. The land laws do not even take into consideration these special problems in the mountains. Compensation and rehabilitation is an *ad hoc* arrangement left to the wishes of the government. There are no zoning laws which can guide the administration to execute town or rural planning in a manner that will take the problems of landslides and seismicity into account. [9]

Ladakh represents a core region and a comprehensive legal study to assess the current and potential impact of climate change is necessary to understand various problems peculiar to it and to suggest remedies to such problems. Moreover the role of law in mountain management system and the attention paid to it is has been very lukewarm.[10]

The above account outlines some of the major legal concerns with respect to mountain regions. The account is comprehensive but not exhaustive. An exhaustive account must specify in details, laws, rules, ordinances, court judgments, and customary laws relating to each of the problematic issues, namely, land settlement, land classification or demarcation, delegation of powers among department, afforestation, landslides, grazing, livestock, water use, water rights, powers and duties of panchayats and municipalities, the legal status of the *ad hoc* local organizations, and community resource management systems.[11]

IV Community based capacity building as a means of adaptation to climate change: An illustrative case of an NGO from Leh

To cope with natural disasters and other hazards people living in the mountains have evolved fine tuned social systems by the use of customs and traditional ecological knowledge.[12] Studies on the Tibetan Plateau show close connection between land use, rural

9 *Ibid.*
10 *Ibid*.
11 *Ibid*.
12 JianchuXu *et al*., "The Melting Himalayas: Cascading Effects of Climate Change on Water, Biodiversity, and Livelihoods,"23(3) *Conservation Biology* 526(2009).

livelihood, human health and climate change.[13] So far only few studies have been carried out on the adaptive capacities of the communities in region. Similarly, on the vulnerabilities of the mountain communities to the predicted changes of climate change not enough and substantial studies have been taken so far despite the fact that there is not dearth of information on the current and future impacts of climate change. Identification, prediction and filtration of the numerous ways in which local communities will face the cascading effects of climate need to be viewed and solved through cultural contexts which have not happened so far.[14]

V Innovation of artificial glacier as a mode of adaptation to climate change

The innovation of artificial glacier in Ladakh has been explained as a mile stone in the current efforts to adapt to the impacts of climate change. It is also hailed as great mountain engineering. The explanation and techniques of this has been described as follows:[15]

> A decentralised approach to water harvesting through artificial glaciers is an example of how grassroot communities are adapting to climate change. The only water source is glacier water coming down the mountains. When glaciers melt in summer, they release a little water that is used by the people of Ladakh to irrigate their crops. The artificial glacier comes as a bonus for farmers. Tsewang Norphel[16] is a Ladakhi engineer who builds artificial glaciers to maintain a consistent and constant water supply to thirsty villages in all regions of Ladakh. Norphel's innovation involves channelizing water to the shadow area of a mountain close to a village. After going through metal pipes, the water freezes, creating a glacier close to the village. It enables them to get water a whole month before the snow starts melting on the mountain tops. This is particularly useful to start sowing, as the sowing season ends before water from natural glaciers begins to flow down the mountain. Ladakhi communities are trying to build resilience through traditional water &

[13] *Ibid*.
[14] *Ibid*.
[15] *Available at*: http://www.siwi.org/documents/Resources/Synthesis/Abstract_Volume_2010.pdf (last visited on April 26, 2015).
[16] A retired Civil Engineer, who was conferred the Padma Shri award by the Hon'ble President of India in 2015.

agriculture systems besides working on flood preparedness like deepening of channels to meet future threats.

Pics. No. 5.1.& 5.2: Artificial glacier innovated by Padma Shri. Chhewang Norphel near Leh.Copyright@ Leh Nutrition Project.

5.5. Artificial Glacier Technology: A Project Assisted by the Department of Science and Technology (Govt. of India)

ImagesNo: 5.3.& 5.4: Artificial glacier innovated by Padma Shri. Chewang Norphel near Leh.Copyright@ Leh Nutrition Project.

VI Leh Nutrition Project: [17]

This technology innovated by Padma Shri. Tsewang Norphel received national and international recognition as a unique and cost effective technique for high altitude water

[17] LNP is a registered NGO (Societies Registration Act-registration No.147-S of 988) and FCRA Holder (No. 109421145) based in Leh.

harvesting and conservation. Artificial glacier technology has proved to be an effective solution to the adverse effect of global warming and extreme climatic conditions, addressing depleting water resources due to retreating glacial cover. Several projects are at various stages of implementation in 4 villages in the Leh district with financial support from the Department of Science and Technology, Government of India and 'Operation Sadbhavana' of the Indian Army.

VII Target group

i. Construction of artificial glaciers is done in close proximity to the villages.

ii. Beneficiaries are farmers of villages.

iii. Contribution of the community plays an important role in the sustainability of the project. In this way the community accrues long term benefits also. Towards the construction and maintenance of the artificial glacier the role of the community is pivotal.

VIII Financing

i. For more than a decade the technique of artificial glacier have been in operation in the Ladakh region. For the first time it was experimented at a village called Phuktse in the year 1987.[18]

ii. Under the watershed development programme a limited fund is allotted for the construction of artificial glacier.

iii. In the year 2008 financial grant for the construction of one artificial glacier was granted under the mission Sadhbhavana, which is a civic military programme of the Indian army.

iv. There is variation in the costs involved in the construction of artificial depending on the location/sites. Generally, the cost is about Rupees 3 to 10 lakh. (Euro 5000 – 16600).

IX Methodology of implementation

i. Through the participation and mobilization of community.

ii. For the sustainability of the project the main stake holders are the villagers. Their active involvement is crucial for the success of the project.

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18 *Available at:* http://www.tribuneindia.com/2009/20091206/spectrum/main1.htm (last visited on June 28, 2016).

iii. To discuss about the following things meetings are arranged with the villagers:

a. Availability of Water in the stream during peak winter time

b. Along the course of the stream whether shady areas are present or not.

c. Sunrise and sunset timings.

d. History of the village with respect to the availability of water and wasteland for future development.

e. Whether artificial glacier is located in close proximity to village. It is required that it should be close to the village.

X Benefits of artificial glaciers

Economic benefits

i. Production in the field of agriculture increases over time. It also contributes to increase in annual family income.

ii. Early spring availability of water helps farmer in meeting irrigation requirements for the fields which enables them to grow two crops in a year which was not possible earlier.

iii. Food security

iv. Expansion in tree cover. The economic benefits of tree cannot be discounted. They are in huge demands as the branches, trunks and twigs are used in the construction of houses. Trees are also a rich source of fuel and fodder which increases the biomass of the earth.

v. The water generated through artificial glacier can be used for the development of pastureland which is conducive for the rearing of cattle.

Environmental benefits

vi. Artificial glacier helps in the recharge of groundwater and also rejuvenates the spring water.

vii. Increase in agricultural land holdings were witnessed after the introduction of artificial glacier.

viii. Artificial glacier serves as an important mitigative step against the adverse impacts of climate change. It helps to prevent unaccounted damages and loss to human, crops, and livestock population.

ix. It helps in maintaining balance in ecology which is constitutive of water, land and vegetation by applying the best practices of harnessing and conserving natural resources as aforementioned.

x. It creates conditions which are conducive for plantation and agriculture as a result of the conservation of soil moisture.

xi. The more the numbers of cattle population the more the increase in the usage of local manure. It cuts down the demand for chemical fertilizer.

Social benefits

xii. Disputes and Conflicts between neighbours over water are reduced to a great extent since the artificial glacier has made water accessibility and availability abundant.

xiii. Encourages agricultural practices such as farming because dividends in the form of cash are earned by the farmers. It boosts confidence among the farmers and retains them into the traditional fold.

xiv. To an extent the migration from villages to towns in search of employment has been reduced.

xv. The standard of living as well as cultural and social life of the villagers has improved.

xvi. Human drudgery has been reduced after the construction of artificial glacier. Now it is not required to fix the headrace of the irrigation canal which is located up hill.

Constraints and lessons learnt

i. Since the work takes place in severe winter which is an off season for labourers. It therefore is a challenging task to find labour. For the proper maintenance and monitoring of water distribution system human resource is a must.

ii. To reduce manual and frequent monitoring work the operations of distribution chambers and headrace need to be mechanized.

iii. Following are the reasons for the high cost involved in the construction of artificial glacier. The actual cost of an artificial glacier is very high due to following reasons:

a. Usually it is at an elevation of 4600 m above sea level.

b. It cannot be accessed via road.

c. Efficiency of labour is low.

d. Costs involved in the transportation of material are very high.

XI The first artificial glacier in Ladakh: A brief description

Padma Shri TsewangNorphel, a civil engineer built the largest and the first artificial glacier in the year 1987 in a village called Phuktse Phu. It was built on an experimental basis.

i. It stretches to a length of about 2km and in breadth it is about 30-100m.Its average depth is about 1.60 m. It caters to the irrigation needs of four villages viz. Shara, Phuktse Sharmos and Phuktse Phu.

ii. About 1580 Euro was spent on the construction initially.

iii. LNP took the lead in spearheading this movement. Drawing inspiration from the success of glacier at Phuktse, more than ten glaciers were built by LNP in its area under Watershed Project.

iv. In regions having similar geo-climatic conditions to that of Ladakh the technique of artificial glacier can be easily replicated which is simple and easy. Areas such as Spiti in Himachal Pradesh and even some countries in Central Asia like Kyrgyzstan and Kazakhstan, etc.

However, the following requirements must be met in order to successfully replicate this technology:

- The location at the high altitude area should be between 4666 to 5333 meters above sea level.
- During peak winters the temperature should be between 15 to -20 degree Celsius low.
- To ensure longer formation and expansion of the glacier winter period should be long i.e. about 4-5 months.
- It is suitable for villages which are dependent primarily on snow melts and glaciers for irrigation.

XII Water shed development programme assisted by the Ministry of Rural Development (Government of India) ongoing since 1995

LNP is acting as a project Implementing Agency (PIA) for the Watershed Development Programme, which is funded by the Ministry of Rural Development, and has been allocated 44 projects in 36 villages of Leh district. The programme involves land development, plantation, construction of contour bunds and mass plantation in the designated areas which has significantly prevented soil erosion, increased the supply of fuel wood and timber availability, as well as pasture/fodder development, improvement in ancient ponds and channels have added to the cultivable land holding of the farmers. Most importantly the programme has encouraged the meaningful participation of the local population in land and water resource management techniques thereby contributing to sustainability.

XIII Leh livelihood project: Supported by RBS foundation India (July 2012-June 2015)

The main aim of the project was to promote innovative sustainable approach to land use and soil management for improved livelihood of rural population by reducing the adverse effect of drought and climate change. Under the project 10 new/ existing Women Self Help Groups (SHG) to strengthen capacity building by running income generation activities is envisaged. Renovation and construction of water reservoirs, water channels, snow barrier bunds, artificial glaciers *etc.*, to improve the crop yields by strengthening of irrigation facilities for existing agricultural lands and new waste land to be reclaimed in 11 villages of Leh and Kharu blocks of Leh District.

XIV Improving farm based livelihoods in rural areas of Leh, Ladakh: Supported by Sir Dorabji Tata Education Trust – 3 years (January 2013-December 2015)

Improving the livelihoods of the rural people through a multitude of land based and income generation initiatives to make traditional land based economy more remunerative is funded by Sir Dorabji TATA Trust, Mumbai. The main objective of the project is:

i. To improve the livelihoods and resilience of the rural population living in most vulnerable cold desert.

ii. Augmentation of natural resource base, enabling the development of land based income generation activities.

iii. Socio- Economic empowerment especially of the women.

iv. To combat desertification by reducing pressure on the natural environment both at the local and global level. To assist the rural population of the area to cope with global warming and climate change.

The project is focusing on three 3 selected villages of Kharu block, *i.e.,* Igoo, Kharu and Chemday (partially). The main activities under the project are as follows:

1. Formation and strengthening of 10 Self Help Groups by building capacities in different income generation activities through trainings/ exposure visits and provisions of tools.
2. Improvement of potato crop through training from specialist, field trials of improved potato variety, Demonstration of potato storage caller etc.
3. Improving vegetable grain crop farming by demonstration of improved green house, training on green house running, open field trials of vegetables, training on horticulture – budding/ grafting etc. setting up of nursery, fruit crop plantations etc.
4. Demonstration of agro-forestry and sea buckthorn plantation to check soil erosion.
5. Construction of artificial glacier, water diversion channel and water storage tank etc.

XV Income generation activities for the rural population in the cold desert of the western Indian Himalayas

The project was funded by the European Union and implemented by GERES, a French NGO, through a network of five local NGOs. The duration of the period was from the year 2004 to 2008.It aimed at improving the livelihood opportunities of the population living in rural areas of Ladakh which is undergoing transition from a mere reliance on subsistence agriculture to that of a market economy. In all the initiatives local specificities will be taken care of. In the present project LNP was tasked with supporting activities which could generate income in addition to conventional sources. Empowerment of women, improvement in access to health care in villages and capacity building were some of the responsibilities that were entrusted and accordingly achieved by LNP.

XVI Flood relief and rehabilitation programme: **Supported European Union humanitarian aid (2006-2007)**

An unprecedented flash flood in 2006 caused havoc in many areas of Leh and Kargil Districts, damaging infrastructure, public properties, roads, buildings and other community

assets. LNP, with support from the European Union's Humanitarian Aid Department, worked in close collaboration with local government and communities to assist flood effected families, particularly children. LNP's intervention reached 47 villages and 4071 families.

Activities carried out by the organisation in the flood hit villages of the district included repair of the main district hospital in Leh and 8 medical aid centers, repair of 19 irrigation canals, reclamation of 180 canals, distribution of learning materials to 7,200 children, provision of equipment and lifesaving drugs to 60 MACs, and the supply of tents, tarpaulins and beds in 60 villages.

XVII Corporate social responsibility initiatives of Sir Dorabji Tata Trust

The project was supported by *Sir Dorabji Tata* Trust and USAID. It was for 7 *months* from the period (Nov 2010 – May, 2011). In August 2010 severe flash floods struck the Leh region destroying many homes, roads, bridges, shops and other infrastructure and resulting in many casualties. 66 villages were badly hit by this disaster and a massive area of land with standing crops was buried under thick slush containing boulders and gravel. A significant challenge was faced to clear the fields of debris to ensure that the land becomes cultivable before the onset of the next sowing season in March-May 2011. This task involved huge costs and heavy machinery as the debris was too thick and full of boulders and gravel to be removed manually.LNP received support from the Sir Dorabji Tata Trust and USAID to act as ground implementer on clearance programmes in the villages of Igoo and Shey. This work was successfully completed prior to the 2011 sowing season.

XVIII Legal and policy issues

The Supreme Court in *Swaraj Abhiyan – (I)* v. *Union of India*[19] dealt with the situation of drought and how the various machineries of the state together can solve the drought situation. The fact of the case was that the petitioner Swaraj Abhiyan sought remedy from the court seeking directions for those states which have not declared themselves as drought hit even after 11 states *i.e.,* 1/3 of the country has already done so. The States are Haryana, Gujarat and Bihar. The petitioners contended that non declaration as 'drought-hit' will result in distress to the vulnerable lot of the population and goes against the spirit of article 21 of the Constitution.

[19] (2016(5) SCALE 506.

In the context of drought the case dealt extensively with the provisions of relevant legislations such as the Disaster Management Act, 2005(hereinafter 'the DM Act.) and the statutory responsibility of the Union Government in matters pertaining to disasters. Basically under the federal polity that we have, the authority to declare a 'drought' vests with the state and this was one of the contentious issue in the present case because the Union Government submitted before the court that it is not within its power to do so, and hence it cannot direct the states to declare a 'drought'. The court therefore held that "It cannot totally wash its hands off on issues pertaining to Article 21 of the Constitution. The Union of India has certainly to maintain a delicate and fine balance between federalism and its constitutional responsibility, and that it must do, otherwise it is ultimately the common person who will suffer and be in distress because of a situation not of his or her making."

In today's time when issue of climate change has taken a centre stage, it is very essential to appreciate and know the various institutional set up under which the adverse impacts of climate change gets addressed and the court has truly shown the way forward to tackle such challenges in a coherent way. Through this judgment some facts have been made very clear by the court. For instance even after 10 years of the coming into force of the DM Act; and as mandated by its various sections, no 'Disaster Response Force' (constituting of specialist cadre) has been established. Same is the case with the 'National disaster Mitigation Fund' and 'National Plan' (though a policy document existed). The court has directed the UOI to set up the above forums. In the climate change parlance 'adaptation and mitigation' are very important components. In this context the court directed the formulation of a national plan relating to risk assessment, risk management and crisis management in respect of disaster. In the nature of directions the court touched upon (a) timely declaration of drought (b) standardisation in the methodology to be followed in declaring or not declaring a drought by each state. (c) revision and updation of drought manual.

Enumerating on the role of the state as a protector of its citizens in times of natural disaster the court also discussed about the scope and relevance of PIL both in the historical and current context, Directive Principle of State Policy, the Preamble to the Constitution read with articles 38, 39 and 39 (A), the doctrine of *parens patriae*. While referring to the Guidelines of September, 2010[19] published by the NDMA On drought management some provisions of which are (a) Abandon the use of famine codes and varied State management plans. (b) Focus on mitigation measures (c) Adopt newer technologies (d) Adapt to the new legal framework (e) Include employment and area development programmes in drought

mitigation. (f) Prescribe standardized steps for management at the national/central level. The Hon'ble court observed that "Strangely, none of these prescriptions seem to have gained universal acceptance over the years." Further it held that, "Like other hazards, the impacts of drought span economic, environmental and social sectors and can be reduced through mitigation and preparedness. Because droughts are a normal part of climate variability for virtually all regions, characterised by extended periods of water shortage, it is important to develop contextual plans to deal with them in a timely, systematic manner as they evolve." On judicial restraint the court held that: "Notwithstanding the absence of judicially manageable standards, the judiciary cannot give a totally hands-off response merely because such standards cannot be laid down for the declaration of a drought. However, the judiciary can and must, in view of Article 21 of the Constitution, consider issuing appropriate directions should a State Government or the Union of India fail to respond to a developing crisis or a crisis in the making. But there is a Lakshman rekha that must be drawn."

The court laid emphasis on the fact on the value of prevention, preparedness and mitigation which is gaining recognition the world over, thus pointing at the development taking place in international environmental law. While referring to India it stated that: " In India in particularly, after 2005, there has been a paradigm shift from the erstwhile relief-centric response to a proactive prevention, mitigation and preparedness-driven approach for conserving developmental gains and also to minimize loss of life, livelihood and property. The other concerns raised through this landmark judgment is on humanitarian factors such as migrations from affected areas ("internally displaced people") suicides, extreme distress, the plight of women and children, availability of adequate food grains and water that ought to be kept in mind by state governments and the Union of India in matters pertaining to drought management in India.

By contextualising the environmental law aspect of this judgment, the judgment can be well summed up by referring to an article by Professor J.B. Ruhl[20] where in the context and policy dynamics of climate change adaptation, he identifies ten trends that will have profound normative and structural impacts on how environmental law fits in: 1) shift in emphasis from preservationism to transitionalism in natural resources conservation policy, 2) rapid evolution of property rights and liability rules associated with natural capital adaptation resources, 3) accelerated merger of water law, land-use law, and environmental law, 4)

[20] *Supra* note 8.

incorporation of a human rights dimension in climate change adaptation policy, 5) catastrophe and crisis avoidance and response as an overarching adaptation policy priority, 6) frequent reconfigurations of transpolicy linkages and trade-offs at all scales and across scales, 7) shift from "front end" decision methods relying on robust predictive capacity to "back end" decision methods relying on active adaptive management, 8) greater variety and flexibility in regulatory instruments, 9) increased reliance on multiscalar governance networks, and 10) conciliation.

XIX Addressing the climate change issue

To avoid the adverse impact of climate change we need to put adaptation at the top most priority. It is vital to do so if we want to avoid risks to the health and lives of the community. Sound adaptation policy and practice to address issues arising out of climate change impacts is a requirement under the Kyoto Protocol to the UNFCCC which each nation must adhere to. Strategies in adaptation include appreciating the vulnerabilities to the impacts of climate change and subsequently to find the best possible way to address them. As long as there is vulnerability risk management is part of it which gets incorporated in engineering in a routine manner. In engineering parlance (practices and calculations) if we add climate change as a risk factor then it can be addressed.[21] In the sphere of development and planning if we introduce climate change as a factor it is bound to have some effect in the allocation of budget. Introducing climate change as a factor in planning and development will necessarily have an impact on budgets. The financial aspect should be given due regard by governments and institutions while considering plans related to adaptation. For the benefit of the future generation as well as for short term it is better to invest in climate change adaptation than to wait for disasters to happen through sheer inaction. The fact that the costs associated with the impacts of climate change may be higher than the cost involved in climate change adaptation strategies should ring alarm bells in the ears of all stakeholders. The importance of adaptation cannot therefore be disregarded since its importance is underscored by virtue of the inevitability of climate change.

In the current scenario, actions on adaptation and mitigation are the focal points of attention when it comes to assisting policy makers to tackle and respond to climate change. It has been pointed out that the actions pertaining to adaptation and mitigation are not in tandem with local issues. It has also been criticized that there is a disconnect with long term priorities

[21]Pew Center on Global Climate Change. 2007. "Adaptation Planning: What U.S. States and Localities are Doing,"*available at:* http://www.pewclimate.org/working-papers/adaptation (last visited on Nov. 23, 2016).

of sustainability which will influence human response in a good measure. For example, critics say that the current focus on developing actions related to adaptation is restricted only to the assessments of climate impact which are conducted by disciplinary research teams. The needs of the users and local developmental challenges should figure prominently in adaptation actions rather than engaging in mere assessments of the impacts. What is urgently needed is an approach which does not fail to offer a wholly integrated view of climate change. This integrated view of climate change should consider explicitly the choices available in the sphere of development in a particular jurisdiction.[22]

The interface between science and policy needs to be improved and this can be achieved through the adoption of new strategies such as public participation and communication. This becomes relevant because it assists the policy makers and other stakeholders in the development of appropriate responses to climate change. Thus envisaged the strategies should have as its components an effective flow of two-way information between decision makers and scientists. In determining future outcomes this interface should be based on a common intention and choice duly recognized by both the parties. In essence the nature of choices is political and not decisions based on scientific principles. It is advisable that the engagement of all participants in the co-production of already developed knowledge should be encouraged in defining the outcomes of research.[23] In this knowledge co-production the participating stakeholders and decisions makers should involve themselves as partners with the collaboration of the team conducting research.[24]

In order to achieve a level of integration and participation between local and global issues *inter alia* the concept of 'participatory integrated assessment' (PIA) plays a vital role. Along with this approach 'scenario development' is another sound technique. The integration of socio-economic and biophysical aspects of climate change responses are facilitated by the two approaches of PIA and scenario development. The above approaches also help in the definition of problem, shared experience and in designing potential solutions to the impacts of climate change. Locally, PIA helps in activities relating to planning such as short and long term responses to climate change particularly with reference to improving the connection between policy making and science. Participatory methods such as simulation, gaming

[22]Gabriele Gramelsberger and Johann Feichter (eds.), *Climate Change and Policy: The Calculability of Climate Change and the Challenge of Uncertainty* 175 (Springer Verlag, Berlin Heidelberg, 2011).

[23]*Id*. at 176.

[24]*Ibid.*

techniques and focus group are used to include additional information and traditional knowledge. In this way scenario development and integrated models are used by PIA to achieve targets and results that is representative of the voice and concern of decisions makers at the local level.[25]

XX Conclusion

Climate change poses a formidable challenge for all countries, but its major impact will be on developing countries, especially the least developed countries, as they lack the resources, capacity, logistics, and wherewithal they need to fulfil their mitigation obligations and to undertake adaptation activities. In such a situation the importance of financial assistance from developed countries cannot be ruled out. In fact it becomes imperative. While mechanisms are being evolved to lend support to developing countries to combat the adverse impacts of climate change the robust role that International environmental law and international human rights law, can play in this respect is pivotal. The *raison d' etre* for drawing a link between human rights law to the ongoing discourse on climate change is that it will assist policy/decision makers by informing them of the perspectives and voices which are diverse in nature. It will also assist decision makers in being informed about the range of policies that they consider and ultimately adopt. Finally, the matter is urgent. Contrasted with the certainty of climate change is the uncertainty that the international community possess the political will to take effective measures to combat it.

[25] *Ibid*.