Environmental Security of India and its Implications

Dr Sanjay Kumar[1], Dr. Neelam Kumari[2]

[1]Associate Professor, Department of Defence Studies, Meerut College, Meerut, India

[2]Associate Professor, Department of Chemistry, Meerut College, Meerut, India

Abstract: *The concept of security has been changing from traditional military thinking to a non-military one by including the environmental dimension in security agenda. A broadening of the security agenda that we have seen in the post-cold war era, have introduced numerous non-traditional threats to security. Among these threats we could mention: drugs, diseases (HIV/aids), and failed states. The environment was the major single theme to affect the broadening, and that got the greatest attention and produced the most intense political discussion at least during the 1990's. [1] Amongst a broad category of traditional and non-traditional security (NTS) in the present day, energy and environmental security falls into which encompasses 'issues and factors that impinge on the security/stability of the state or individual and has become more noticeable after the demise of the Cold War.' [2] Environmental security is a new phenomenon that has emerged in the last few decades. Understanding of the relationship between environment and security has evolved in the last quarter of 20th century. India is one of the fastest growing economies of the world and will continue its rapid urbanization and economic development in the coming decades or so. This growth also presents challenges in the form of rising consumption and demand for energy, increasing greenhouse gas emissions, and constraints on critical natural resources such as land, water and biodiversity harboured by them. Indian environment has been deteriorated remarkably in the past over six decades due to rapid decline in natural resources and severe increase in pollution level. Depletion of forests, population growth, vehicular emissions, use of hazardous chemicals and various other undesirable human activities are mainly responsible for this degraded scenario of environmental health in India. [3]*

Keywords: Environment, Security, Dimension, Non-Traditional Threat, Non-Traditional Security, Cold War, Challenges

1. Introduction

The concept of security has for so long been interpreted narrowly: as security of territory from external aggression, or as protection of national interests in foreign policy or as global security from the threat of a nuclear holocaust. It has been related more to nation-states than to people. Traditional notion of human security shaped largely by the Cold War, were concerned mainly with a state's ability to counter threats to their territorial integrity, autonomy, and domestic political order, primarily from other states. However, such a classical formulation based on national security has been criticized on various grounds, giving rise to concepts such as co-operative security, comprehensive security and then finally, human security.

The inclusion of environmental threat in the ambit of security has significantly expanded the scope of the security. It has also cast a shadow on the existing national priorities and challenged the prevailing notions of security. There has been a slow but steady realisation that environmental threats may have serious socio-economic and human costs; hence, they cause insecurity and that they cannot be solved by the unilateral decisions of states. In simple words, one could say that intervention, which was understood in terms of military force earlier, has been gradually changed and countries have recognized that it could also be invaded by foreign pollutants or even by the depletion of crucial resources. [4]

The environmental security has emerged as the primary issue on the global agenda in the post Cold War scenario owing to its security implications. Consensus has recently been forged on the potential for long-term economic, national security and societal damage from insecure environmental catastrophe, as well as the intense need for technological advances to deal with the environment related threats. The damage done to India's environment has been severe and that too affects growth and inclusion as well as being a profound loss in itself. The black soot on the Himalayas accelerates melting and absorbs, rather than reflects, heat. The destruction of the forests silts the rivers, causes soil erosion, disrupts watersheds, emits carbon dioxide and destroys bio-diversity. [5]

The environment is the most transnational of transnational issues, and its security is an important dimension of peace, national security, and human rights that is just now being understood. Environmental security is central to national security, comprising the dynamics and interconnections among the natural resource base, the social fabric of the state, and the economic engine for local and regional stability. While the precise roles of the environment in peace, conflict, destabilisation and human insecurity may differ from situation to situation and as such are still being debated in relation to other security and conflict variables, there are growing indications that it is increasingly an underlying cause of instability, conflict and unrest.

The relationship between environment and security has become ever more compelling in the twenty-first century. The environment is the most transnational of transnational issues, and its security is an important dimension of peace, national security, and human rights that is just now being understood. Over the next 100 years, one third of current global land cover will be transformed, with the world facing increasingly hard choices among consumption, ecosystem services, restoration, and conservation and management. Environmental security is central to national security, comprising the dynamics and interconnections among the natural resource base, the social fabric of the state, and the economic engine for local and regional stability. While the precise roles of the environment in peace, conflict, destabilization and human insecurity may differ from situation to situation and as such are still being debated in

relation to other security and conflict variables, there are growing indications that it is increasingly an underlying cause of instability, conflict and unrest. [6]

A nation's security is inextricably linked, among other things, with the resource position and ecological balance. According to Lester Brown, 'threats to security may now arise less from the relationship of nation to nation and more from the relationship of man to nature.' Further, he is of the view that, '... deterioration of the earth's biophysical system now threaten the security of the nation everywhere.' [7] According to Barry Buzan, 'Threats to national security might also come in ecological forms in the sense that environmental events, like military and economic ones, can damage the physical base of state, perhaps to sufficient extent to threatens its idea and institutions.' [8] Lodgaard feels that the concept of environmental security challenges established frames of mind and political conflict. It conveys a message that environmental problems have a legitimate claim for a status as military problems have. [9] The present chapter underscores the nature of the linkage between environment and security. It seeks to highlight how environment security forms an important aspect of a country's national security. The chapter argues that the relationship between environment and security has become ever more compelling in the twenty-first century.

Debate over Securitising Environmental Security
Different opinion arises over securitising the environment security. Many calls for including environment as one of the key aspect of security. While many others argue against including environment as a key aspect of security with a view that it would downgrades and distorts the very sanctity of the field of security studies. The proponents of environmental security call upon the need for a holistic and multidisciplinary approach to global, regional and local environmental problems that threaten the economic well being of people, and therefore have the potential to spur conflict. It argues in favor of expanding the scope of national security to include resource, environmental and demographic issues, thereby bringing environmental concerns to the high table of priority issues where security has traditionally had a seat. [10] Barry Buzan had rightly observed that national security problems need to be understood from 'systemic security' perspective where economic, social and environmental security can be as important as political and military. [11] While, Allenby linked environmental security with national security. To him, environmental issues have been moved up from 'overhead' or ancillary to 'strategic' domain; but the culture of a country, its national security community and component institutions must subscribe to the imminent environmental threats to a state. [12]

Marc A. Levy offered an early critical account of environmental security enquiry by contesting the value of connecting environmental issues with security concerns from a policy perspective. [13] In 1989, Jessica Matthews' article 'Redefining Security' helped set the stage for the linking of environment and security. She is of the view that population growth lies at the core of most environmental trends and then went on to recommend support for international family planning as one of the four most important steps in a new security agenda. [14]

Levy accepts that environmental issues can help explain the causes of insecurity, but questions the utility of analysing this explanatory role. In Levy's words, "[t]he assertion that many environmental problems constitute security risks is correct, and is of very little importance." [15] Levy's argument suggests that maintaining continuity and analytical coherence within individual disciplines takes primacy over gaining a more holistic understanding of underlying causes of insecurity. This position mirrors those opposing security expansion more generally, and suggests that security and environmental issues should are best left to specialists in those respective fields. As the tools for addressing environmental challenges and those deployed against traditional security threats are profoundly different, the argument goes, it is counterproductive to seek convergences between the environment and security. From such a perspective, synthesising environmental and security issue areas risks creating convoluted analyses and policies that are of little practical use.

Alan Dupont argues that environmental difficulties are unlikely to be the primary cause of major conflict between states. Environmental issues, according to Dupont, interact with more direct causes of conflict to prolong or complicate existing disputes. For example, environmental degradation can create refugee crisis between two neighboring countries. Now, refugee issues may aggravate conflicts in between the neighbors. Thus environment is not the direct cause of a conflict. [16] Daniel Deudney has also vehemently opposed considering environmental degradation as a reference object of international security. According to Deudney, the concept of national security, as opposed to national interest or well-being, has been centered upon organized violence. Deudney fears that any linkage of environment with national security can beget militarisation of environment, misuse of military technologies, deviation from the real environmental problems and prevention of international cooperation. He argues that it is not apposite to associate military organisations and environment because the natures, objectives and intensions of the two are diametrically paradoxical. Thus, the thrust of the paper is to critically analyse the view points of Deudney in the form of arguments and counter-arguments. [17]

Detraz discusses three linkages between environment and security: (1) environmental degradation directly or collaterally inducing conflict, (2) environmental degradation exerting negative impacts on human security, and (3) ecological security, in which human activities pose negative impacts on the environment. [18] A separate criticism of the intentions of environmental security research comes from Dalby, who argues that the "securitisation" of the environment can be used as a ploy by developed countries to gain greater control over global environmental and resource policies. For Dalby, securitising the environment distracts attention away from the more important issues of resource sustainability and distribution which are better dealt with independently of security concerns. Perhaps more pressingly, Dalby suggests that the position of primacy given to state security concerns could lead to powerful states forcing environmental agendas upon weaker states in the name of promoting security. [19] According to the Canadian political scientist Thomas Homer-Dixon, environmentally

induced internal conflict, in turn, causes states to fragment or become more authoritarian, seriously disrupting international security. [20]

Environmental Security as a Key Aspect of National Security

Environmental security has made a recent entry in to the non-traditional paradigm of security. It represents a significant departure from traditional approaches to study. The traditional concept of security surrounded along defending territory and political integrity of a country. The state was responsible for defending its sovereignty and integrity and armed forces were assigned to this duty. [21] Today, environmental security is treated as a component of national security. [22] Though the linkage between environmental issues and national security came to the attention of the policy planners in the 1990s, it is only in recent times that environmental change is increasingly being understood as a security issue. The concept of environmental security stems mainly from an understanding of security, and more particularly national security, developed within the discipline of international relations. [23]

Considering the environment as a threat to individual, national, or global security has created a new agenda in the discourse of security studies. The increasing scope of international security now readily includes environmental degradation, global warming, and climate change. These issues have extended human understanding of environmental change, conflict, and vulnerability and explored the roles of conservation and sustainable development in promoting peace, stability, and human security. Writing in 1983, International Relations' scholar Richard Ullman argued for the redefinition of national security to include raw material shortages as well as natural disasters. According to him, there was little doubt about the rightful place of environmental issues on the national security agenda, he realised that in the military climate of the Cold War such a redefinition would be difficult to achieve and must commence with enhanced public education about the threat potential of an ill-functioning environment. [24]

The environmental degradation is such a serious threat for national security that it may lead to interstate wars caused by the scarcity of resources. The link between environment and a direct threat to national security has received attention from experts, mainly because it refers to national power. It is being widely accepted that the environmental scarcity and the environmental degradation pose a threat to the national security. Although this approach seems strictly connected to the classical state-centric consideration of national security, especially weak states, usually poor or developing countries suffer new challenges: environmental change, population growth and irregular distribution of resources. Environmental degradation will cause their economic strife and subsequently their political ruin. Hence, there is a close linkage between the environmental degradation and the national security. In the recent years, it has been widely accepted environmental security is a significant dimension of national and regional security frameworks of the nation-states. [25]

Environmental Degradation: Causes and Impacts

One of the most critical issues concerning a nation's security in the 21st century is environmental degradation, and in particular, climate change and its impact. Environmental degradation is a major causal factor in enhancing and perpetuating poverty, particularly among the rural poor, when such degradation impacts soil fertility, quantity and quality of water, air quality, forests, wildlife and fisheries.

Climate change has assumed critical importance to world security in the last few decades. Global warming due to climate change has been predicted to have a cascading affect, wherein the increasing temperatures will facilitate more frequent formation of cyclones and storms in the tropical regions and the melting of polar ice caps, in turn leading to rising sea levels and possible submerging of low-lying areas and island nations, threatening their very existence. Rising temperatures also have the capacity to foster the spread of communicable diseases, such as malaria and cholera, due to increased number of air-borne and water-borne vector carriers. Thus climate change is a serious cause for concern to nation, since it is the fountainhead for various other natural and related phenomena that may threaten the very existence of the human race in the decades to come.

Climate change may also affect agricultural production due to disruption of normal climate caused by increasing temperatures. Food scarcity is an issue that has been touted to be the most important problems that will be faced by the states in the future. Inflation in food prices is already a reality, especially in developing countries which have dense populations. Although predictions of a food deficit have not yet turned true, this cannot be ruled out in the future, as a rapidly increasing population will place additional strain on the finite land resource and the excessive use of fertilizers might result in soil infertility due to chemical imbalance.

Environmental refugees may soon become a reality, as environmental degradation and food and water scarcity may lead to mass migration of populations from the affected regions, contributing to the instability of the host states. Thus environment protection and nurturing is an urgent need of the hour, as a destabilized environment can lead to a tipping point, after which catastrophic and irreversible consequences, such as increase in the number of natural disasters, may threaten the survival of the state and its population. [26]

Volkar Boge [27] who has put forward on analytical framework for finding out the socioeconomic effects of environmental degradation, delineates these as follows:

1) *Economic problems/ Economic decline*
   - Decrease in agricultural production.
   - Insufficient supplies of basic goods for population.
   - Problems regarding industrial production, transportation system, traffic, etc.
   - Decline in production of world market and associated effects.
   - Production of industrial toxic waste and waste in general.
   - Industrial accidents/catastrophes and their economic repercussion.

- Large-scale negative effects on human health.

2) Population Displacement/ Large-scale Migration
- Environmental refugees caused by desertification, sea level rise, hurricanes, and floods, large-scale industrial catastrophes (e.g. nuclear meltdowns), overfishing of certain coastal areas, etc.

3) Domestic Problems and Differences
- Ethnic divides *inter alia* aggravated by environmentally induced migration caused by soil erosion, etc.
- Social divide *inter alia* aggravated by economic decline.
- Other manifestations of domestic destabilization with grave effects on the stability of social institutions and social structures (religions fundamentalism, organised crime, and guerilla movement).

Conceptualising the Problem of Energy Security and Climate Change

Energy is essential to improving the quality of life and opportunities in developed and developing nations. The principal energy-related challenge is access to energy, which has two distinct facets: ensuring energy supply to meet the growing demand of fuelling economic growth; and providing access to lifeline levels of clean commercial energy for the poor. To date coal remains the most realistic option for power generation in the short to medium term even though an increase in the supply of coal is constrained by the ability to raise domestic production. More than 400 million people do not have access to electricity and more than 700 million depend on non-commercial biomass for cooking. Therefore, ensuring sufficient, reliable and environmentally responsible supplies of energy at prices reflecting market fundamentals is a challenge for countries and for mankind as a whole. India is a major producer of Carbon dioxide.

Therefore, the significant challenge for India is to work out a compromise between, on the one hand, the implementation of its national development goals and on the other hand, a substantial contribution to the efforts to stop the global challenge of global warming. Climate change is the result of rapid economic development - mainly because of manifold increase of industrial, population consumption of fossil fuel and amazing change in the land terrain (settlement/infrastructural change and use of land). The scientists world wide conducted a number of studies and came up with findings more or less similar regarding the implications of climate change. Since these studies are futuristic, the variation in the findings with a wide probability could be misused by politicians and parochial nationalists and mercantilist for their national objectives. That itself is a threat to global and particularly regional security. Climate change and energy security together is projected to have severe adverse effects on India's development as it compounds the pressures on natural resources and the environment associated with rapid urbanization, industrialization, and economic growth. It can directly impact the environment for the survival of humanity, and of course it also has an unavoidable influence on military security. Energy Security and Climate change together could have significant geopolitical impacts around the world, contributing to poverty, environmental degradation, and the further weakening of fragile governments. Climate change will contribute to food and water scarcity, will increase the spread of disease, and may spur or exacerbate mass migration. Besides, they can pose a threat towards the achievement of the Millennium Development Goals and economic development, and could precipitate migration, environmental degradation or unsustainable use of natural resources, including water stress and scarcity, deforestation, desertification and land degradation.

The energy security and climate change problem is a development problem, and must be comprehensively solved in the framework of sustainable development. International cooperation on climate change must start from correctly handling the triple relationship between economic growth, social development and protection of the environment, and must place guaranteeing economic development and strengthening sustainable development to its core. It must have saving energy, improving the energy structure and strengthening ecological protection as its focus, and have scientific progress as a support, so as to continuously raise the capacity of international society to mitigate and adapt to climate change.

Climate Change and its Implications

Climate change is a global environmental problem which has been receiving intense political attention both at domestic and international levels. The United Nations Framework Convention on Climate Change (UNFCCC) defines 'climate change' 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. Climate change has as of today emerged as a serious security issue because of the way it affects collective human life and well-being in a fragile and increasingly interconnected world. The rapid degradation of our environment because of global warming itself constitutes a security threat to the quality of life of not just the present generations but also for the future generations. Climate change, in particular a rise in global temperatures, threatens the basic survival and welfare needs of people around the world, including access to water, food production, health, and the use of land. [28] Climate change has enormous implications for the natural resources and livelihoods of the people. It will have wide-ranging effects on the environmental and socio-economic and related sectors. Various studies indicate that the key sectors in India such as the agriculture, water, natural ecosystem, biodiversity, and health are vulnerable to climate change. Climate change poses a variety of challenges on the variety of issues such as agriculture and food security, water stress and water insecurity, rising sea levels, biodiversity and human health, which have immense relevance from the perspective of developing countries in general and India in particular.

Agriculture and Food Security

Climate Change is projected to have significant impacts on conditions affecting agriculture, including temperature, precipitation and glacial run off. It affects agriculture in more ways than one. It can affect crop yield as well as the types of crops that can be grown in certain areas, by

impacting agricultural inputs such as water for irrigation, amounts of solar radiation that affect plant growth, as well as the prevalence of pests.

Rise in temperatures caused by increasing green house gases is likely to affect crops differently from region to region. For example, moderate warming (increase of 1 to 3°C in mean temperature) is expected to benefit crop yields in temperate regions, while in lower latitudes especially seasonally dry tropics, even moderate temperature increases (1 to 2°C) are likely to have negative impacts for major cereal crops. Warming of more than 3°C is expected to have negative effect on production in all regions. [29] The Third Assessment Report of the IPCC, 2001 concluded that climate change would hit the poorest countries severely in terms of reducing the agricultural products. The Report claimed that crop yield would be reduced in most tropical and sub-tropical regions due to decreased water availability, and new or changed insect/pest incidence. In South Asia losses of many regional staples, such as rice, millet and maize could top 10 per cent by 2030. [30] As a result of climate change the amount of arable land in high-latitude region is likely to increase by reduction of the amount of frozen lands. At the same time arable land along the coast lines are bound to be reduced as a result of rising sea level. Erosion, submergence of shorelines, salinity of the water table due to the increased sea levels, could mainly affect agriculture through inundation of low lying lands.

Impacts on Indian agriculture

Agriculture is the mainstay of Indian economy and provides food and livelihood security to a substantial section of the Indian population. The impact of climate change as witnessed in recent times has immense potential to adversely affect agriculture in this country in a variety of ways. A large part of the arable land in India are rain-fed, the productivity of agriculture depends on the rainfall and its pattern. Agriculture will be adversely affected not only by an increase or decrease in the overall amounts of rainfall but also by shifts in the timing of the rainfall. Any change in rainfall patterns poses a serious threat to agriculture, and therefore to the economy and food security. Summer rainfall accounts for almost 70 per cent of the total annual rainfall over India and is crucial to Indian agriculture. However, studies predict decline in summer rainfall by the 2050s. [31] Semi arid regions of western India are expected to receive higher than normal rainfall as temperatures soar, while central India will experience a decrease of between 10 and 20 per cent in winter rainfall by the 2050s. [32]

Water Stress and Water Insecurity

Lack of access to water is a perturbing issue, particularly in developing countries. At present a whopping 1.1 billion people around the world lack access to water and 2.6 billion people are without sanitation. Climate change is expected to exacerbate current stresses on water resources. By 2020, between 75 and 250 million people are projected to be exposed to increased water stress due to climate change. [33]

Spreading water scarcity is contributing to food insecurity and heightened competitions for water both within and between countries. As the world population expands and the consumption of water spirals upwards, water problems are bound to intensify. By 2025, 40 per cent of the world's population, more than 3 billion in all, may be living in countries experiencing water stress or chronic water scarcity. [34]

Increase in temperature due to climate change has been widespread over the globe. Warming has resulted in decline in mountain glaciers and snow cover in both hemispheres and this is projected to accelerate throughout the 21st century. This will in turn lead to reducing water availability, hydropower potential, and would change the seasonal flow of rivers in regions supplied by melt water from major mountain ranges (e.g. Hindu-Kush, Himalaya, Andes) where more than one-sixth of the world population currently lives. [35] By 2050s freshwater availability in Central, South, East and South-East Asia, particularly in large river basins, is projected to decrease. [36]

Impacts on water situation in India

India stands to face major challenges in many fronts in so far as the impact of climate change is concerned. Water security is one of the most important threats in this regard. Water resources will come under increasing pressure in the Indian subcontinent due to the changing climate. The Himalayan glaciers are a source of fresh water for perennial rivers, in particular the Indus, Ganga, and Brahmaputra river systems. In recent decades, the Himalayan region seems to have undergone substantial changes as a result of extensive land use (e.g. deforestation, agricultural practices and urbanization), leading to frequent hydrological disasters, enhanced sedimentation and pollution of lakes. There is evidence that some Himalayan glaciers have retreated significantly since the 19th century. [37] Available records suggest that the Gangotri glacier is retreating about 28 m per year. Any further warming is likely to increase the melting of glaciers more rapidly than the accumulation. Glacial melt is expected to increase under changed climate conditions, which would lead to increased summer flows in some river systems for a few decades, followed by a reduction in flow as the glaciers disappear.

As a result of increase in temperature significant changes in rainfall pattern have been observed during the 20th century in India. A serious environmental problem has also been witnessed in the Indo-Gangetic Plain Region (IGPR) in the past whereby different rivers (including Kosi, Ganga, Ghaghara, Son, Indus and its tributaries and Yamuna) changed their course a number of times. The recent devastating floods in Nepal and Bihar due to change of course of River Kosi is a case in point.

Rise in Sea Levels

Nearly 70 % of Earth's surface comprises of water in the form of seas and oceans. Sea level rise under warming is inevitable. Sea level rise is both due to thermal expansion as well as melting of ice sheets. Thermal expansion would continue for many centuries even after GHG concentrations have stabilized causing an eventual sea level rise much larger than projected for the 21st century. If warming in excess of 1.9 to 4.6°C above pre-industrial level be sustained over many centuries then the final rise in sea level due to melting polar ice could be several meters, because it will be in addition to that of rise of sea level due to thermal

expansion. The present scenario clearly indicates that the sea level will definitely rise. [38]

Satellite observations available since the early 1990s show that since 1993, sea level has been rising at a rate of around 3 mm per year, significantly higher than the average during the previous half-century. [39] IPCC predicts that sea levels could rise rapidly with accelerated ice sheet disintegration. Global temperature increases of 3–4°C could result in 330 million people being permanently or temporarily displaced through flooding. Warming seas will also fuel more intense tropical storms. With over 344 million people currently exposed to tropical cyclones, more intensive storms could have devastating consequences for a large group of countries. The 1 billion people currently living in urban slums on fragile hillsides or flood-prone river banks face acute vulnerabilities. People living in the Ganges Delta and lower Manhattan share the flood risks associated with rising sea levels. [40]

Impacts on Coastal States in India

The coastal states of Maharashtra, Goa and Gujarat face a grave risk from the sea level rise, which could flood land (including agricultural land) and cause damage to coastal infrastructure and other property. Goa will be the worst hit, losing a large percentage of its total land area, including many of its famous beaches and tourist infrastructure. Mumbai's northern suburbs like Versova beach and other populated areas along tidal mud flats and creeks are also vulnerable to land loss and increased flooding due to sea level rise. Flooding will displace a large number of people from the coasts putting a greater pressure on the civic amenities and rapid urbanisation. Sea water percolation due to inundations can diminish freshwater supplies making water scarcer. The states along the coasts like Orissa will experience worse cyclones. Many species living along the coastline are also threatened. The coral reefs that India has in its biosphere reserves are also saline sensitive and thus the rising sea level threatens their existence too, not only the coral reefs but the phytoplankton, the fish stocks and the human lives that are dependent on it are also in grave danger.

Measures to Resolve the Serious Challenge

India cannot take the issue concerning climate change and energy security lightly owing to its serious national security implications. The climate change and energy security demands India to take up certain measures that would help meet the increasing energy demand and at the same time reduce emission of Green House Gases (GHG), which remains the main cause for the severity of climate change. Faced with the huge challenge of meeting its rapidly increasing energy demand and the reduction of the emission of GHG, India is focusing sharply on both energy efficiency improvements as well as tying up energy resources at the global level – either through purchases on the international markets or through equity investments in global assets. India would also be keenly interested in acquiring clean and efficient energy technologies. Besides, India would also be quite interested in participating in international initiatives to further develop solar and biomass technologies given its large endowments as well as strong technical skills that it has available within. The Indian Government has already

undertaken or planned for several policies and initiatives that encourage sustainable energy growth both in terms of improved efficiency of use and in terms of its environmental implications. Several policies and measures have for example focused on improving energy efficiency, enhancing renewable and clean energy forms, bringing about power sector reforms, promoting clean coal technologies, promoting cleaner and less carbon intensive fuels for transport, and addressing environmental quality. Another alternative to reduce the use of fossil fuels would be to adopt Solar-based power technologies that have practically no form of emissions. This alternative would also lead to energy security by cutting back on coal and oil requirements to meet final demand. India has also dedicated $1 billion to expand solar power infrastructure within the Nehru National Solar Mission programme. However, the opportunities to substitute India's fossil-fuels-dependent path of development with low-carbon solutions are hardly realistic. So far, none of the developing countries have addressed the challenge of providing electricity with low-carbon solutions. The efforts needed to address the climate change problem include mitigation of GHG emissions on one hand, and building of adaptive capacities on the other in developing countries to cope with the adverse impacts of climate change on various sectors of the society and economy enabled and supported by technology and finance.

India's Response to Climate Change

National Environment Policy, 2006 outlines essential elements of India's response to Climate Change. They includes adherence to principle of common but differentiated responsibility and respective capabilities of different countries, identification of key vulnerabilities of India to Climate Change, in particular impacts on water resources, forests, coastal areas, agriculture and health, assessment of the need for adaptation to Climate Change and encouragement to the Indian Industry to participate in the Clean Development Mechanism (CDM).

India's emissions are estimated to be of the order of 1331.6 million tones of the carbon dioxide equivalent Green House Gas (GHG) emissions in 2007. The emissions indicate an annual growth of 4.2 per cent from the levels in 1994. Whereas India's CO_2 emissions are only about 4 per cent of total global CO2 emissions and much less if the historical concentrations are taken into account. Still India has been conscious of the global challenge of Climate Change. [41]

In pursuance of the obligations cast on parties to the United Nations Framework Convention on Climate Change (UNFCCC), India has undertaken to communicate information about the implementation of the Convention, taking into account the common but differentiated responsibilities and respective capabilities and their specific regional and national development priorities, objectives and circumstances. The elements of information provided in the communication include a national inventory of anthropogenic emissions by sources and removals by sinks of all Green House Gases, a general description of steps taken to implement the Convention including an assessment of impacts and vulnerability and any other relevant information. India has submitted the Second National Communication (NATCOM) to the UNFCCC in 2012. The

first National Communication was submitted in 2004. As per the Second national Communication submitted by India to the UNFCCC, it is projected that the annual mean surface air temperature rise by the end of the century ranges from 3.5 c to 4.3 c whereas the sea level along the Indian coast has been rising at the rate of about 1.3 mm/year on an average. These climate change projections are likely to impact human health, agriculture, water resources, natural ecosystems, and biodiversity. [42] 10 India's strategy for addressing Climate Change is reflected in many of its social and economic development programmes.

2. Conclusion

The environmental damage is already threatening livelihoods and unless there is strong action the damage will intensify. There is much that can be done that good policy and better governance could deliver, from conserving water, to abolishing subsidies which encourage the waste of energy, to better agricultural extension services.

References

[1] Simon Dalby, *Environmental Security* (Minneapolis: University of Minnesota Press, 2002), p. xx.

[2] C. Uday Bhaskar, "Post Cold War Security", *Strategic Analysis*, Vol. XXI, No. 8, 1997, p. 1143.

[3] Y. C. Tripathi and G. Tripathi, "Some Important Environmental Problems in India and their Remedies", in Arvind Kumar (ed.), *Dimensions of Environmental Threats* (Delhi: Daya Publishing House, 2003), p. 376.

[4] Raimo Vayrynen, "Environmental Security and Conflicts: Concepts and Policies", *International Studies,* Vol. 35, No. 1, 1998, p. 6.

[5] Nicholas Stern, "Climate Change, Internationalism and India in the 21st Century", *Policy Paper,* Centre for Climate Change Economics and Policy Grantham Research Institute on Climate Change and the Environment, July 2009, p. 9.

[6] www.environmentsecurity.org

[7] Lester Brown quoted by Michal D. Purugganan, "Environment, Resource and Conflict: The Changing Context of International Security", *Development,* Vol. , No. 2, 1993, p. 29.

[8] Barry Buzan, *People, Stales and Fear: The Nation Security Problem in International Relations* (London: Harvester Wheatsheaf, 1983), p. 82.

[9] Sverre Lodgaard quoted by Narottam Gaan, *Environmental and National Security: The Case of South Asia* (New Delhi: South Asian Publishers, 2000), pp. 8-9.

[10] Gurneeta Vasudeva, "Environmental Security: A South Asian Perspective", p. 2, available at <http://unpan1.un.org/intradoc/groups/public/documents/apcity/unpan015801.pdf>.

[11] Barry Buzan, *People, States and Fear: the National Security Problem in International Relations* (London: Harvester Wheatsheaf, 1983).

[12] B. R. Allenby, "Environmental Security: Concept and Implementation", *International Political Science Review*, January, Vol. 21, No. 1, 2000, pp. 7-13.

[13] Marc A. Levy, "Is the Environment a National Security Issue?", *International Security*, Vol. 20, No. 2, 1995.

[14] Matthews, Jessica T., "Redefining Security", *Foreign Affairs,* Vol. 68, No. 2, 1989, pp. 163, 177.

[15] Ibid., p. 60.

[16] Alan Dupont, "The Environment and Security in Pacific Asia", *Adelphi Paper* 319, June 1998, pp. 75-76.

[17] Daniel Deudney, "Environment and Security: Muddled thinking", *Bulletin of the Atomic Scientists*, Vol. 47, No. 3, 1991, pp. 22-28.

[18] Nicole Detraz, "Environmental security and gender: Necessary shifts in an evolving debate. *Security Studies*, Vol. 18, No. 2, 2009.

[19] S. Dalby, "Threats from the South? Geopolitics, equity, and environmental security", in D. H. Deudney, & R. A. Matthew (Eds.), *Contested Grounds: Security and Conflict in the New Environmental Politics* (Albany: State University Press of New York, 1999), pp. 160-66.

[20] Thomas F. Homer-Dixon, "Environmental Scarcities and Violent Conflict" in *International Security*, Vol.19, No.1, 1994, pp. 5-7.

[21] Satyendra Singh Narwaria, "Environmental Degradation as a Security Threat in South Asia: Analysis of India and Bangladesh", *Global Journal of Engineering, Science and Social Science Studies,* Vol. 1, No. 2, January 2015, p. 55.

[22] Mizan R Khan, "Environmental Security in the Context of Bangladesh", *BIISS Journal*, Vol. 26, No. 2, April 2005.

[23] Jon Barnett, *The Meaning of Environmental Security: Ecological Politics and Policy in the New Security Era* (London, UK: Zed Books Limited, 2001), p.23.

[24] R. Ullman, "Redefining Security", *International Security*, Vol. 8, No. 1, 1983, pp. 129-53.

[25] Satyendra Singh Narwaria, "Environmental Degradation as a Security Threat in South Asia: Analysis of India and Bangladesh", *Global Journal of Engineering, Science and Social Science Studies,* Vol. 1, No. 2, January 2015, p. 54.

[26] Divya Srikanth, "Non-traditional Security Threats in the 21st Century: A Review", *International Journal of Development and Conflict*, Vol. 4, 2014, pp. 64-5.

[27] Volkar Boge quoted by Narottam Gaan, "Environment and Conflict: The South's Perspective", *Strategic Analysis*, Vol. 19, No. 6, 1995, pp. 832-833.

[28] C Vinodan, "Energy, Environment and Security in South Asia", *International Journal of South Asian Studies,* Vol. 3, No. 1, 2010, p. 2.

[29] IPCC Fourth Assessment Report, 2007, p.38

[30] See, Climate Change and Agriculture, available at <http:en.wikipedia.org/wiki/Climate-change-and-agriculture>.

[31] Climate Change and its Impact on India (http://www.greenpeace.org/india/campaigns/choose-positive-energy/what-is-climate-change...)

[32] Impacts of Climate Change: Western and Central India (www.cseindia.org/programme/geg/pdf/western.pdf)

[33] Climate Change 2007: Synthesis Report, IPCC, p.11, Geneva

[34] Water Conflicts Loom as Supplies Tighten; Food Security Threatened, Ecosystems in Decline, (http://www.worldwatch.org/node/1600)

[35] Climate Change 2007: Impacts, Adaptation and Vulnerability (Fourth Assessment Report of the IPCC, Geneva, 2007, p. 11.

[36] Climate Change 2007, Synthesis Report, p. 11.

[37] Pradipto Ghosh, "The Day After Tomorrow: Impact of Climate Change on the World's Water", *Terragreen*, 2008, p. 9.

[38] An Assessment of the Intergovernmental Panel on Climate Change: Climate Change 2007: Synthesis Report, p. 20.

[39] IPCC Fourth Assessment Report, p. 111.

[40] UNDP Human Development Report 2007-2008, p. 78.

[41] *Annual Report 2012-13*, Ministry of Environment and Forest, Government of India, p. 349.

[42] Economic Survey 2012-13, Ministry of Finance, p. 257.