

**TITLE- A STUDY ON THE IMPACT OF ECONOMIC  
DEVELOPMENT LEADING TO CLIMATE CHANGE IN  
THE STATE OF ASSAM**

**Baitul Alam Rahman\***

**Abstract**

Assam is one of the most energetic and vibrant states of India. The state is full of most important natural resources that have been attracting the attention of many investors to set up their production units in the state. Assam is blessed with many of the resources such as river waters, huge hydrocarbon potential, coal, limestone, dolomite and most importantly crude oil and natural gas. Too much of industrialisation, urbanisation, etc have been destroying the environment. Environment of Assam is degrading day by day and progress of economic development is occurring at the cost of environmental degradation. Several districts in Assam suffered drought-like conditions for two years consecutively in 2005 and 2006, bearing the signature of climate change as vindicated by the IPCC (Intergovernmental Panel on Climate Change) report of 2007. So this paper attempts to find the direction of changes in growth and development of the state and its associated effects on the environment.

**Keywords: Economy, Development, Climate Change**

**\* Research Scholar, Department of Economics, Gauhati University, Jalukbari, Assam**

A Monthly Double-Blind Peer Reviewed Refereed Open Access International e-Journal - Included in the International Serial Directories  
Indexed & Listed at: Ulrich's Periodicals Directory ©, U.S.A., Open J-Gate, India as well as in Cabell's Directories of Publishing Opportunities, U.S.A.

**International Journal of Research in Social Sciences**  
<http://www.ijmra.us>

**Introduction:**

Assam is the largest state among 'the seven sisters' in the North-East region of India. Assam accounts for about 2.4 per cent of total geographical area in the country and 2.6 per cent of India's population. Assam has moved from a 2% growth rate in GDP to an 8% growth. It is the largest economy of the NE India and is rapidly making strides towards employment generation and inclusive growth by a balanced pattern of industrial investment. The sectoral contribution to the Net State Domestic Product reveals that in Assam more than 30% of the contribution is from agriculture and allied activities. This is much higher than the sector's contribution to India's GDP. The state of the economy as observed from the estimates of the State Domestic Product is encouraging and in better position than before.

But growing air pollution has emerged as a serious concern in the state, with vehicular emission and dust contributing a major share of the deteriorating air quality. The floods in Assam every year are the most recent manifestation of the impact of climate change in the Northeast. Several districts in Assam suffered drought-like conditions for two years consecutively in 2005 and 2006, bearing the signature of climate change as vindicated by the IPCC report of 2007 (IPCC, 2007). Of the seven north-eastern states, Assam seems to have suffered the most from the deficit rainfall and high temperatures that prevailed in 2006. Assam's people are struggling to cope with the impact of climate extremes on their livelihoods.

Assam is developing and its growth is reflected through increasing trend of NSDP but the environment of it is also getting degraded. Now the question is that if this development is at the cost of environment.

**Environment and Development:**

Environment and development as a part study of environmental economics depicts that there is a inter relationship between environment and development. The economic activities of the humanity have a great impact on the economic development as well as to natural environment in the form of a rapid depletion of natural resource stock as well as through pollution. It is only through transformation of environmental goods into economic goods that started applying economic principles to environmental issues. The demand for economic development has

registered a sharp increase while the supply of clean air, water and other resources has considerably declined. The increase in demand for environmental resources is attributed to economic growth and development.

The environmental Kuznets curve shows the relationship between environment and development. The environmental Kuznets curve is a hypothesized relationship between various indicators of environmental degradation and income per capita. In the early stages of economic growth degradation and pollution increase, but beyond some level of income per capita (which will vary for different indicators) the trend reverses, so that at high-income levels economic growth leads to environmental improvement. This implies that the environmental impact indicator is an inverted U-shaped function of income per capita. If there were no change in the structure or technology of the economy, pure growth in the scale of the economy would result in a proportional growth in pollution and other environmental impacts. This is called the scale effect. The traditional view that economic development and environmental quality are conflicting goals reflects the scale effect alone. Proponents of the EKC hypothesis argue that “at higher levels of development, structural change towards information-intensive industries and services, coupled with increased environmental awareness, enforcement of environmental regulations, better technology and higher environmental expenditures, result in leveling off and gradual decline of environmental degradation.”

### **Objectives:**

The focus of the paper is to see to which way is the development of Assam's economy is moving toward and which important sector is contributing how like. It is also one of the objectives to find the environmental conditions of the state and to find the problems of good environment of the state. This paper also attempts to see if there is any Kuznets curve relationship between the economy and environment in the state.

### **Data and Methodology:**

The paper uses both quantitative and qualitative methods as a part of research methodology. The data are used from secondary sources collected from the Reserve Bank of India databank, Ministry of Environment and Forest, Assam Pollution Control board and from research journals.

The tables and charts are used to show the trend and comparisons.

### **Results and discussions:**

#### **Assam's Economy:**

Assam is one of the most energetic and vibrant states of India. The share of Assam economy to India's as measured by the growth rate of income, has been remarkable both in terms of past performance and in comparison to other states. Sharp changes have been seen in the fields of agriculture, industry and service sectors of Assam and their contributions to the India's GDP. Agriculture accounts for more than a third of Assam's income and one of its major contributors is tea. The state is abundant in mineral resources and is also a major producer of crude oil and natural gas.

Of the agriculture-based industries, tea occupies an important place in Assam. Assam produces 51% of the tea produced in India and about 1/6th of the tea produced in the world. It now auctions more than 150 million kg of tea valued at more than Rs 550.00 crores annually.

Assam is one of the most energetic and vibrant states of India. The state is full of most important natural resources that have been attracting the attention of many investors to set up their production units in the state. Assam is blessed with many of the resources such as river waters, huge hydrocarbon potential, coal, limestone, dolomite and most importantly crude oil and natural gas. Petroleum in the crude form is the chief mineral produced in Assam. The estimated reserves of crude oil in India as on 31.03.2012 stood at 759.59 million tonnes (MT).

Assam is rich in natural gas. It is found in the Barail group of rocks occurring at very high pressure and temperature. In 1991-92 Assam produced 2092 million cubic metres of natural gas, which rose from 2056 million cubic metres in 1985-86. This accounts for 25% of the total production of 8134 million cubic metres of gas in the country as a whole.

Assam continued to be the 3rd largest producer of Petroleum (crude) and natural gas in the country accounting for 16 % and 8% respectively of the total production of these mineral resources.

The table below shows the NSDP (Net State Domestic Product) data of Assam. It is seen that the NSDP in the year 1999-00 was 320.11 billion which has increased to 626.70 billion in 2012-13. The record has doubled within one year. The chart below shows the positive trend of increasing income.

Table : Net State Domestic Product at Factor Cost (Base Year 1999-00 )

Years	NSDP( in Billion)
1999-00	320.11
2000-01	328.21
2001-02	336.68
2002-03	357.08
2003-04	379.05
2004-05	392.07
2005-06	403.8782
2006-07	422.1185
2007-08	440.1593
2008-09	466.3771
2009-10	509.3476
2010-11	550.7808
2011-12	586.2143
2012-13	626.7085

Source: Reserve Bank of India

### Assam's environment

The Pollution Control Board Assam (PCBA) which has been monitoring the city's ambient air quality under the National Air Quality Monitoring Programme (NAMP) has recorded high levels of air pollution in all its monitoring stations in the city.

Data with the air quality monitoring station at Bamunimaidam reveals presence of respirable suspended particulate matter (RSPM) and suspended particulate matter (SPM) well above the prescribe limit since 2008.

The findings at the Dispur station also show a similar pattern with both RSPM and SPM above the prescribed limit since 2008. At another station at Gopinath Nagar, the SPM values were well within the prescribed limit but RSPM values exceeded the prescribed norms since 2007. At Santipur it was observed that the RSPM values were above prescribed the limit in 2006 and 2009, while the SPM values were also beyond the prescribed limit in 2006.

This may be due to prolonged dryness during the winter months, increasing number of vehicles on road, growing industrial activities, construction, and other human activities. The wave of flooding is reported in Assam every year after incessant rains in the catchment areas of the Brahmaputra and its tributaries. Many villages in upper and lower Assam are reported inundated. According to Assam Disaster Management Authority (ASDMA) 2012 data, around 2,391,369 people across the state (in 11 worst-affected districts) have been impacted by the floods and over 1 million hectares affected by floods and landslides. Over 109 people, including 70 children, have died in the floods and landslides. Some 17 persons are missing.

Studies on rainfall and temperature regimes in northeast India indicate that in the 'south Assam meteorological subdivision' (covering mainly the hill states of Nagaland, Manipur, Mizoram and Tripura and parts of the Barail hills in southern Assam), there has been a significant change in seasonal rainfall -- monsoon rainfall has decreased at an approximate rate of 11 mm per decade over the last century (Das, 2004, Mirza *et al*, 1998).

State	Excess (+)/Deficiency (-)	
	2005	2006
Assam and Meghalaya	-23%	-32%
Arunachal Pradesh	Normal	-25%

Nagaland	-22%	-25%
Manipur	-22%	-25%
Mizoram	-22%	-25%
Tripura	-22%	-25%

Source: IMD, Guwahati, India

Several districts in Assam suffered drought-like conditions for two years consecutively in 2005 and 2006, bearing the signature of climate change as vindicated by the IPCC report of 2007 (IPCC, 2007). In the intense drought-like conditions that prevailed in as many as 15 districts of Assam during the monsoon months of 2006 -- owing mainly to below-normal (nearly 40%) rainfall in the region -- more than 75% of the 26 million people associated with agriculture suffered crop failure and other peripheral effects. Normally, such fluctuations are considered a result of inter-annual variability in the monsoons, but climate change increases the variability of the southwest monsoon beyond the normal. According to IMD records, the amount of rainfall received by the northeast region in the 2006 monsoon season was the scantiest in 25 years since 1982.

Assam seems to have suffered the most from the deficit rainfall and high temperatures that prevailed in 2006. Transplanting and sowing of rice were severely hampered. Between 1991 and 2000, only four years saw normal or above-normal rainfall in the region. Conventionally, it becomes difficult to complete agricultural operations with heavy and continuous showers. However Heavy rainfall and soil erosion are believed to have increased in upstream areas of the Brahmaputra basin. As a result there have been many more flash floods in the hills, affecting vast areas of the floodplains. The intensity, frequency and duration of riverine floods have also changed.

Assam's forests are vanishing since they are being cut in wasteful and unsustainable commercial logging and slash-and-burn clearing for agriculture. Forest Cover Change Matrix, 2011, (13) reveals that there has been a decrease of 17 sq km of dense forest, and 154 sq km of moderately dense forest, and an increase of 152 sq km of open forests in the state over 2009. Central Pollution Control Board has laid down national air quality monitoring network with

the help of State Pollution Control Boards. The parameters are Sulphur Dioxide, Oxides of Nitrogen and Respirable Suspended Particulate Matter.

Air borne emissions emitted from various industrial areas are a cause of major concern. These emissions are of two forms, viz. Solid particles (SPM) and gaseous emissions (SO<sub>2</sub>, NO<sub>2</sub>,

SO <sub>2</sub>			NO <sub>2</sub>			RSPM		
µg/m <sup>3</sup> (annual)			µg/m <sup>3</sup> (annual)			µg/m <sup>3</sup> (annual)		
Max	Min	Avg	Max	Min	Avg	Max	Min	Avg
21	2	6	33	5	13	450	16	89

CO,etc.). Liquid effluents, generated from certain industries, containing organic and toxic pollutants are also a cause of concern. Heavily polluting industries were identified which are included under the 17 categories of highly polluting in industries for the purpose of monitoring and regulating pollution from them.

Table: SO<sub>2</sub>, NO<sub>2</sub> and RSPM in residential areas under national ambient air quality monitoring programme (NAMP) during 2008 of Assam.

Source: Central Pollution Control Board

A research team from Desert Research Institute, Reno, Nevada, USA with support from NASA calculated that, on an average, this high level of pollutants has given rise to a daily temperature increase of 2 deg Celsius. The research done by Rajan K. Chakrabarty, Mark A. Garro, Eric M. Wilcox and Hans Moosmüller reveals the role of black carbon (BC) aerosols (emitted from vehicles and other combustion sources) in the atmosphere of the region. Strong radiative heating due to wintertime black carbon aerosols in the Brahmaputra River Valley causes health hazards apart from rising temperature. It should be mentioned that the recent report of the Indian Association of Health Administrators, it says "There has been a rapid increase in Asthma cases in recent years in many parts of India. In Assam, 3% of the population was reported to be



suffering from asthma. The reported level of asthma is 3278 per 100000 population in Assam, which is higher than the level reported for India as a whole, which is 2468 per 100000 population."

Guwahati has one of the highest Black Carbon pollution levels in the world. The winter-time BC mass concentration observed in the city was higher than those measured in the mega cities of India and China, and much higher than in urban locations of Europe and USA. Majority of the vehicles plying on Guwahati roads could be emitting excessive amounts of BC and other very toxic pollutants. The other reason which is affecting Guwahati is unplanned and open burning of solid waste disposal right in the city itself. A week-long study using a micro-Aethalometer was conducted during January–February 2011 to measure black carbon (BC) aerosol mass concentrations in Guwahati (India), the largest city in the BRV region. Daily median values of BC mass concentration were 9–41  $\mu\text{g m}^{-3}$ , with maxima over 50  $\mu\text{g m}^{-3}$  during evenings and early mornings.

### Findings

1. Assam has been contributing positively to the country's GDP and its contribution has been seemingly increasing as depicted by the trend of NSDP data. The major contribution has been coming from petroleum and natural gas, agriculture and natural gas etc.
2. Agriculture and allied activities have overriding importance as a source of livelihood to the people of Assam. It still contributes more than one-third (35.1 per cent in 1995-96) of its NSDP and supports about 70 per cent of its population. On top of it, 92.6 per cent of the cultivated land is flood prone.
3. Floods have been another exogenous source of handicap to the development of Assam. Floods in the Brahmaputra and Barak valleys of Assam cause "serious erosion, loss of life and livestock and heavy damage to infrastructure and property retarding agricultural productivity on account of risk avoidance and sand casting, disrupting communications and education and posing health hazards. The floods damage to crops, cattle, houses and utilities in Assam alone between

1953 and 1995 is estimated at Rs 4400 crore with a peak of Rs 664 crore in a single bad year.” (Shukla Commission, 1997)

4. Air borne emissions emitted from various industries are a cause of major concern. These emissions are of two forms, viz. Solid particles(SPM) and gaseous emissions(SO<sub>2</sub>,NO<sub>x</sub>,CO,etc.). Liquid effluents, generated from certain industries, containing organic and toxic pollutants are also a cause of concern.

5. Industrialization and urbanization have resulted in a profound deterioration of Assam,s air quality. Sources of air pollution come in several forms, including vehicular emissions and untreated industrial smoke. Apart from rapid industrialization, urbanization has resulted in the emergence of industrial centres without a corresponding growth in civic amenities and pollution control mechanisms.

6. The mean temperature has also been rising of the state and the major reason behind this is excessive deforestation, emission of green house gases etc. Majority of the vehicles in Guwahati roads are emitting excessive amounts of black carbons and other very toxic pollutants causing rise in air pollution and temperature.

7. Kuznetts curve relationship in Assam’s context- The figures and data show that the state’s economy has been increasing rapidly while showing a positive trend in growth and development. But at the same time it is also found that the state’s environment is also getting degraded in one way or the other. Due to unavailable time series data of indicators of pollution, and other environment related problems of the state the Kuznetts curve couldnot be drawn. But subjectively it can be said that the Assam’s position of economy- environment relationship is perhaps within the first stage of the Kuznett’s curve where both the income and environmental pollution has been increasing. If this is relevant than growth of the state is taking place at the cost of environment degradation. So, sustainable development in this large state is still under question. Perhaps in the later state of development the state will be able to use sustainable development measures or techniques when the growth of the state will be more rapid and the quality of environment will also be increasing.

**Conclusion and Policy recommendations:**

1. The environmental issues are very complicated because it has trade-offs between economic growth and environment. Higher economic growth means higher utilization of resources without considering its far-reaching consequences on the future generations. The resources consumed in the present period will not be available in the next period (in future). So there judicious use is necessary. The difficulty in maintaining balance between economic growth and environmental degradation is not only an uphill task but also a major policy implication for the developing countries like India, which have been striving hard for sustainable economic growth since long.

2. There are many propositions to prevent polluters from polluting environment, but effective method is to assign price to environmental resources. The problem is that the economic agents face difficulty in pricing the environmental resources as well as assessing the correct value of the environment in all decision-making. Markets and private investors often regard the environment as a free resource: its scarcity value is seldom reflected in investment decisions. The only effective way to underscore the value of the environment is to put a price on it.

3. It is generally observed that strong environmental policies complement and reinforce development. It is mostly poor who suffer from consequences of pollution and environmental degradation. Unlike the rich the poor cannot afford to drink clean water and clean air and pure food because they will have to spend much of their time on the streets, roads, breathing polluted air in the cities. Similarly, in rural areas they are more likely to cook on open fire of woods, haling dangerous fumes, their lands are most likely to suffer from soil erosion. In such an adverse situation, the policies must target poor communities.

4. At national level a suitable legal framework must support the implemental of waste management strategy to ensure standardized system. People must be educated and informed about the proper disposal of wastes and its far-reaching harmful effects.

5. An effective Environmental Management System (EMS) is necessary to identify the causes of environmental problems and then eliminating them.

6. To advance the linkages between disaster risk reduction and climate change adaptation there is a necessity of scientific data, climate information and socio-economic data to understand the climate risks at the community level and design climate-proof sustainable development interventions.

#### References:

- [1] Awan. A.G, (2013), Relationship Between Environment and Development and Sustainable Economic Development: A Theoretical Approach to environmental Problems, in International Journal of Asian Science, 3(3):741-761
- [2] Dash S K, Jenamani, R K, Kalsi, S R and Panda, S K. 2007. 'Some Evidence of Climate Change in Twentieth Century India'. *Climatic Change*, 85:299–321
- [3] Gore. P.G. & Chavan A.P., (2013), Probabilities of Wet Spells over North Eastern India leading to flood condition, in *Mausam*, Indian Meteorological Department, 64, 475-480
- [4] Mirza, M M Q, Warrick, R A, Ericksen, N J and Kenny, G J, 1998. 'Trends and Persistence in Precipitation in the Ganges, Brahmaputra and Meghna River Basins'. *Hydrological Sciences-Journal-des Hydrologiques*, 43(6):845-858
- [5] National Ambient Air Quality Status & Trends in India -2010, (2012) in Central Pollution Control Board, MOEF
- [6] North Eastern Space Application Centre (NESAC). 2009. Weekly agricultural drought monitoring based on rainfall data (from IMD site, ISRO-AWS sites and TRMM multi-sensor data), June 11 to July 22, 2009
- [7] Shukla S.P. Commission (1997), *Report of the High Level Commission, Transforming the North-East-Tackling Backlogs in Basic Minimum Services and Infrastructural Needs, Part I*, Planning Commission, Government of India.