International Journal of Advanced Research in Engineering Technology & Science ISSN: 2349-2819
Email: editor@ijarets.org Volume-9, Issue-1 January- 2022 www.ijarets.org

# THE IMPACT OF CLIMATE CHANGE ON HUMAN WELL-BEING IN ASSAM

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## ABSTRACT

This paper provides one of the first attempts to evaluate the impacts of climate change on human well-being by assessing altered forest ecosystems and their ability to provide ecosystem services to humans. The well-known methodology is rooted in the valuation exercise, which facilitates the detailed quantification of ecosystem services offered by forest ecosystems and forms the solid ground. This study focuses on a European scale, and the possible impacts of climate change on welfare are evaluated across latitudes in Europe and reported in terms of four future storylines produced for each country by the Intergovernmental Panel on Climate Change (IPCC). Our findings show that welfare effects caused by climate change differ across latitudes depending on the quality of the resources of the forest ecosystem and the storyline in which we stand. The economic effect of climate change on forest ecosystems will lead to a deeper understanding of possible losses in welfare across regions and to identifying winners and losers as a result of future climate change. This will have significant political consequences for the reallocation of resources between European countries in order to cope with continuing climate change.

Potential major threats to global biodiversity have been created by climate change. It is expected that the different components of climate change will influence all pillars of biodiversity, from genes to species to the level of biomes. Tipping points where reaching ecosystem thresholds could lead to irreversible ecosystem shifts and their functioning are of particular concern. Since biodiversity underlies all ecological goods and services that are vital to human survival and well-being, this paper addresses the possible impacts of climate change on biodiversity, its probable impacts on human society, and the climate of global crisis management. Climate change-affected species can react in three ways: change, move, or die. Local species extinctions or a rapidly affected environment as a whole could shift towards their particular tipping point, likely depriving human society of its services and resulting in a global crisis. There is a need to take urgent and effective actions within the different scenarios of the effect of climate change on biodiversity, especially in tropical regions. To address the challenges of the effects of climate change on

biodiversity, a multi-sectoral approach to biodiversity issues with wider policies, strict strategies and programs at international, national, and local levels is important.

**Keywords**: European Forest Evaluation, Products and Services for Ecosystems (EGS), effects of climate change, IPCC scenarios

## INTRODUCTION

The atmosphere is a complex phenomenon that constantly changes. It is clear from historical documents that changes in climate have affected the human economy, infrastructure, and land use with the advent of human civilization. Recent climate changes however are too drastic to be considered 'natural'. This is closely connected to changes in the composition of carbon dioxide (CO2) ambient concentrations and other greenhouse gases such as nitrous oxide (NO2), chloroform carbon (CFC), etc. It has now been scientifically proven that with elevated global average air and ocean temperatures causing widespread melting of snow and ice and increasing global average sea level, substantial warming occurs. Back in 1987, the Brundtland Study described climate change as one of the three issues affecting our survival (World Commission on Environment and Development, 1987). In the recent past, there has been an abnormal change in the composition of carbon dioxide (CO2) and other greenhouse gases in the atmospheric concentration. It has now been identified that global warming is primarily due to manmade pollution. Over the last century, ambient carbon dioxide (CO2) concentrations have increased from a pre-industrial value of 278 parts per million (ppm) to 379 parts per million in 2005, and global average temperatures have increased by 0.74 degrees Celsius. Therefore, climate change and related global issues dominate the international environmental agenda.

The type, frequency, and severity of severe events, such as tropical cyclones, floods, droughts, and heavy rainfall events, are expected to increase because of global warming. Such developments in various parts of the world have already been observed. Effect evidence has been 'solid and most thorough' and many processes and economic sectors that sustain life are at high risk due to climate change (Patra, 2014). Environmental and socioeconomic and related sectors such as agriculture, forestry, human health, biodiversity, snow cover, water management, food security, economic activities, and physical infrastructure are affected by climate change and variability. These sectors are already under stress as a result of socioeconomic pressures. It is possible that climate change will intensify resource depletion and socioeconomic pressures.

In an attempt to grasp the full picture of the consequences of climate change, all industries impacted by climate change need to be investigated. Although many sectors were analysed, none received more attention than agriculture. The impacts on human-related to climate change have gained tremendous attention because an overwhelming majority of people around the world have

a strong connection to food security and poverty status. Changes in climate factors such as temperature, precipitation, regular drought, extreme floods in agricultural crops have mixed types of effects with changes in crop growing seasons. There are fears that factors such as the depletion of much of the soil in the world due to deforestation and less access to water would appear to decrease the potential for increased agricultural production in the future. Three factors are especially significant, according to Houghton, when considering the effects of climate change on agriculture and food production. The first is the vulnerability in the supply of water that contributes to a decline in food production. Therefore, arid, and semi-arid areas are at greater risk. The boost to growth caused by increased $CO_2$ is the second factor that appears to increase demand due to climate change. The third element is the influence of temperature fluctuations, with high temperatures continuing to decrease crop yields in particular. However, studies typically show that the impact of extreme heat and drought on crop yield cannot always be offset by the gain of increased $CO_2$ concentration. The direct and indirect effects of climate change on agriculture are both very troubling around the world. The climate is an important part of ecosystems and species have adapted over time to their regional climate. In various world regions, climate change is already having an effect on ecosystems and biodiversity, especially on high-altitude and high-latitude ecosystems. Projections indicate that climate change will become an increasingly more important threat to the environment if global average temperatures reach 2-3 ° C during this century by altering the distribution of habitats, population sizes, timing of reproduction or migration events, as well as rising the frequency of pest and disease outbreaks. Since human communities rely on ecosystems for the natural cultural, moral, recreational, and aesthetic services they provide the distortion of ecosystems caused by climate change can eventually affect human well-being by reducing the sum or quality of total ecosystem benefits, which can, in turn, be converted into significant social costs for human society. Policy steps are also required to avoid climate change and to maintain the supply of resources to the ecosystems. However, it is important to remember that certain habitats, such as forest ecosystems, often produce feedback effects by sequestrating CO2 emissions into the atmosphere to maintain climate conditions. In the design of sustainable forest management (SFM) strategies, these are essential ecological benefits to be considered, with a possible effect on future changes in land use. In this regard, the present paper, which seeks to recognize cost and benefits shifts because of the effect of climate change on ecosystems, would have practical significance for the implementation of national and international coping strategies to tackle climate change and to conserve biodiversity and ecosystems.

## IMPORTANCE OF AGRICULTURE IN ASSAM ECONOMY

Agriculture and its related activities play an important role in Assam's socio-economic growth as it provides a large proportion of the population with livelihoods and is a major contributor to the state economy. During 2011-12, the State of Assam's Gross State Domestic Product (GSDP) was 12.52 percent higher than that of 2010-11. This reflects a growth rate of 5.01 percent in the agricultural sector, 13.87 percent in the manufacturing sector, and 15.82 percent in the service sector. Assam changed from an annual average GSDP growth rate of 5.33 percent in the 10th plan (2002-2007) to 6.41 percent in the 11th plan (2007-2012). By achieving a growth of 3.86 percent in the 11th Plan, agriculture has achieved a strong improvement among all sectors. In recent years the government has launched region-specific schemes with more investment in this primary sector, which are being strengthened.

## LAND USED PATTERN IN ASSAM

According to 2010-2011 land-use figures, the net sown area is 28.11 lakh hectares, which is 35.80% of the total geographical area, and the land not available for cultivation is 26.26 lakh hectares (33.45 percent). Again, the forest area is 23.61 percent, while the fallow land is 1.63 percent.

## AGRICULTURAL HOLDING

Operating holdings in Assam occupy an area of 27.2 lakh hectares with an operating area of 29.99 lakh hectares. The same amount was 27.1 lakh hectares and 27.1 lakh hectares in 2001-02 31.1 hectares of lakh resp. The soil erosion of the ever-expanding Brahmaputra River, the expansion of roadways, the rise in urbanization, and the conversion of agricultural land to a homestead may be among various other reasons for the decrease in the area worked. Furthermore, the disaggregated data reveals that marginal holdings out of total holdings rose from 63.7 percent in 2000-01 to 67.3 percent in 2010-11. The table also indicates that the smallholdings shared 18.25 percent where only 0.15 percent of the total holdings were shared as large holdings in 2010-11, and both class shares have decreased in the last decade.

## CLIMATIC CHARACTERISTICS OF ASSAM

### Weather and Rainfall

Due to its peculiar geographical location and varying physiographic characteristics, Assam has a variety of climatic conditions. Due to its varying terrain conditions, major variations in the climate pattern are also seen throughout the province. Assam's climate is characterized by warm

and humid summers and winters that are cool and dry. The average temperature in the state varies from 80 Celsius (winter) to 360 Celsius (winter) (summer). Assam is located in a high precipitation region with an average annual precipitation of 2297.4 mm. In the winter season (January-February), the state receives around 2 percent precipitation, 25 percent in the summer season (March-May), 65 percent in the monsoon season (June-September), and 7 percent in the post-monsoon (October-December). Assam is located in a high precipitation region with an average annual precipitation of 25847.4 mm.

## CLIMATE EXTREMES AND AGRICULTURE IN ASSAM

One of the state's natural hazards is flooding. The state's flood-prone area is 31,500.00 Sq Km, which is around 39.58 percent of Assam's total land area. This is around 9.40 percent of the entire country's overall flood-prone area. The flood-affected average annual area is 9.31 lakh hectares. The severity of the flood issue in Assam has been further exacerbated by the erosion of the banks and tributaries of the Brahmaputra River. Study shows that since 1950, the rivers have eroded an area of 4.27 lakh hectares of the state, which is about 7.40 percent of the state's total area. The estimated annual erosion rate is 8,000 hectares. 17 Since 1953, a brief overview of flooding and its damage in Assam. Due to floods during the peak Kharif season, there was an adverse effect on the region and the development of Kharif crops in Assam. According to the World Bank Report, in terms of area, flood damage in Assam was a maximum of 3,820 million hectares in any one year from 1953 to 2004. In 1987 and 1988, the proportion of total flooded cropped areas was highest (approximately 35 to 40 percent), as was the proportion of total flooded areas.

## CLIMATE CHANGE IMPACTS ON BIODIVERSITY

As modelled by numerous climate forecasts, widespread dieback of humid tropical forests such as the Amazon will result in a major reduction in precipitation. Combined with increasing temperatures, this will lead to a major reduction in the abundance of species in this area, as foreseen in previous global assessments of biodiversity. Extensive fires and forest dieback may also lead to a massive deterioration of ecosystem service maintenance and control. For example, the release of carbon in plants and soils will be large enough to affect atmospheric $CO_2$ concentrations and the global environment significantly. There is confusion regarding Amazon. However, if extensive dieback of the Amazon Forest were to occur over the next few decades, a potential outcome would be a negative feedback loop on biodiversity, regional and global climate change. With drastic implications for human well-being, West Africa's tipping point for land loss has already been reached many times. Unregulated use of natural resources is encouraged by

social and political uncertainty and induces human migration to areas already under environmental stress, frequently causing more social and political disruption. Several studies have shown that reducing the resources of biodiversity damages the functioning and services of ecosystems. Short-term adaptability is a decisive feature of species diversity to a large degree. The ability to mitigate the impact of climate change is, therefore, a vital service for species-rich habitats, such as Sudan's savannahs and forests. This and other ecosystem services, such as pollination, seed dispersal, control of natural pests, are the foundation for the continued restoration of natural biodiversity, enabling local people to continue using many essential natural products and services. This also refers to the Guinean Forest, which is distinguished by high endemic levels. Land loss is one of the key factors for this region's semi-arid regions, as is the great challenge of restoring land after it has been degraded because of soil compaction, erosion, and salinization. As one of the largest remaining near-intact habitats in the area, the miombo woodland belt, a moist savanna formation, extends south of the Congo rainforests from Angola to Tanzania. Land-use change (which may be an indirect consequence of local climate change) is expected to cause high rates of extinction of vertebrates and vascular plants instead of direct impacts of climate change, thereby altering the composition of the species and thus the characteristics of this woodland by more than 20 percent by 2050.

## CLIMATE CHANGE-INDUCED SPECIES LOSS AND ALTERED ECOSYSTEM FUNCTIONING

Global projections expect significant biodiversity declines due to global climate change, which are generally higher than current loss rates and therefore much higher than the fossil records of species extinctions. One of the first global studies reported that 15-37 percent of species are committed to intermediate climate warming extinction by 2050. In 2006, Malcom and colleagues estimated that under worst-case scenarios, the extinction rate of endemic species could reach up to 39-43 percent, reflecting a possible loss of 56,000 endemic plant species and 3,700 endemic vertebrate species. Conservation goals are especially vulnerable to biodiversity hotspots since they are marked not just by their endangerment but also by their high degree of endemism. Most of these hotspots are located within tropical regions. There is a clear awareness that biodiversity depends on the combined, interrelated activities of its species i.e. the forms and rates at which ecological processes are carried out in the biogeochemical functioning of an ecosystem (e.g., respiration, $CO_2$ fixation, nitrification, litter decomposition). Ecosystem functions are affected, including impacts on goods and services provided by ecosystems to human benefit and prosperity, if such processes are disrupted by the loss of species and therefore by the loss of vital links within

the system. Therefore the issue of climate-induced loss of biodiversity is of major concern, especially in the environment of vulnerable development.

## PERCEPTIONS RELATED TO CLIMATE CHANGE AMONG FARMERS

We have explored climate change as a perception of farmers over the last 20 years in various aspects of temperature and rainfall in this section. Farmers have been asked questions related to changes in temperature and rainfall patterns over the last 20 years, as well as other threats associated with agricultural production over the last 5 years, to capture their views of climate change.

## PERCEIVED RAINFALL CHANGES AMONG FARMERS

The outcome suggests that most farmers have correctly detected rainfall shifts. Approximately 59% of farmers thought that the number of rainy days was declining. Again, 58% perceived that precipitation was declining. Among farmers, the understanding of both the volume of rainfall and the onset of rainfall varies. For example, rainfall is growing, according to 50 percent of farmers in Dhubri, whereas 36 percent perceive that rainfall is decreasing. In Dhubri, this can be interpreted as more rainfall variability. In certain years, the distribution of rainfall is even where the rest is unequal. The rainfall timing also varies from year to year. Most farmers also say that for days now, rainfall is unpredictable. The farmer's expectations often vary from one another because of the greater variability in the distribution of rainfall.

The winter rainfall shows a significant increasing trend in Dhubri, where a decreasing but insignificant trend is seen as rainfall in all other seasons -summer, monsoon, and post-monsoon. In either of the seasons, Lakhimpur and Darrang are also not showing any major trend in rainfall. The variability in rainfall in all these stations however has been noted. The perception of farmers on early and late onset as well as erratic rainfall trend thus concurs with this observed real variability.

## PERCEIVED CHANGES IN TEMPERATURE AMONG FARMERS

Compared with greater variability in forecasts of rainfall, expectations of temperature fluctuations are more evident in the three districts under study. Around 75 percent of farmers see a rise in the number of hot days and 81 percent see a decline in the number of cold days. Around 83 percent of farmers experience an increase in excessive cold and 57 percent of farmers say that excessive hot is growing at the same time. A rise in annual and seasonal maximum and minimum temperatures in Lakhimpur and Darrang is seen in the projected trend temperature analysis. On the other hand,

Dhubri shows a decrease in maximum temperature during the winter and summer seasons and no noticeable minimum temperature pattern. Thus, our estimates contradict farmers 'perceptions especially about excessive hot in summer in Dhubri. There may be two probabilities: firstly, they may overrate the change based on their understanding of climate change, and secondly, there may be some setbacks in Dhubri's climate results. It is identical with projected forecasts about all farmers' expectations of temperature shifts.

## INFORMATION ABOUT CLIMATE CHANGE

In addition to capturing the views of farmers linked to different aspects of climate change, farmers were also asked if they had heard of the word climate change. In addition, only 26.96% of the farmers reported having heard of climate change and the majority of the farmers had no idea as to what climate change is. Lack of education, poor exposure to mass media, and lack of agricultural extension services may perhaps be the causes. While they do not know the word climate change, they have undertaken various adaptation practices based on their understanding of changes in rainfall and temperature. During the survey, one point noted was that farmers who learned about climate change were mainly big farmers and had more exposure to mass media.

When asked if they saw climate change-related hoarding/banners and attended some climate change meeting or training, farmers essentially talked about agricultural loan ads, organic manures, government schemes/programs, etc which are not directly related to climate change but help to raise awareness among farmers about recent changes in climate change. Just 3.04 percent are farmers who have observed hoardings. A few respondents (12.17 percent agreed that they had attended a conference on different agricultural practices in relation to the climate change meeting. When farm officers distribute new seeds of variety, organic fertilizer, or any new seeds of crops they gathered in their field. With the initiative of NGO "Nagorik Adhikar Moncho" under the project "Bringing Green Revolution to Eastern India (BGREI)" in Dhubri, a few have also attended a training program on winter paddy variety and summer paddy variety. Sukuliburia ADO conducted training on' Banana and Lemon Plantation methods' under the National Food Security Mission in Lakhimpur. Only 15 percent of farmers attended such training programs.

## RISKS AFFECTING AGRICULTURAL PRODUCTION AS PERCEIVED BY FARMERS

Due to multiple factors, farmers are faced with agricultural threats. In recent years, due to climate change, the frequency of climate events such as floods and droughts has increased. The rise in crop pest and disease occurrence, livestock diseases, etc is also regarded as consequences of climate change. All such risks associated with their crops were requested by farmers to point out.

Both climatic and non-climate threats were included in the options. As floods or heavy rainfall, drought or less rainfall, erosion, livestock, as well as crop pests and diseases are the most common climate risks listed. Among the non-climate factors, limited land holdings, labor shortages, low crop prices, and market distances were mostly found by farmers. Labour is again the top-rated danger in Darrang. Deficiency (42.3%), followed by drought (22.4 percent). Significant numbers of farmers opt for non-farm operations, including migration, resulting in a shortage of labor in Darrang. The top listed risk is flooding in Dhubri and Lakhimpur. In both districts, this is consistent with the real occurrence of these incidents. Small landholdings (17.7 percent) are also another risk listed in Dhubri by respondents. Small landholdings have different restrictions. Owing to the small size of the holdings, farmers are unable to get the benefits of any new techniques. Low crop prices and erosion have also been ranked as important threats to agricultural production in Lakhimpur. The main threats of all the districts faced by farmers are flooding, followed by market distance and low crop prices.

## CONCLUSION

To the scientific community alone, climate change is no longer a matter of curiosity. Awareness and information on current temperatures and changes in rainfall in a given area is important if anything is to be considered about future climate change. This study not only stresses the need to study climate change and its effects on agriculture but also discusses the methods needed to enhance farmers' ability to adapt. While the temperature does not rise forever, during the winter and monsoon, the minimum temperature rises. With less rainfall during the winter, monsoon, and post-monsoon season, this will generate more chances of drought in the coming years. The lack of monsoon rainfall contributes more to the rise in warm days (along with increasing minimum temperature). In addition, early rainfall reduces the maximum temperature during the season. This is a notable outcome of our studies. Due to temperature rises, most of the crops under study have shown a negative effect. The redistribution of the region for crops with minimal impact is important. With the assistance of irrigation facilities, early planting of summer rice will help improve productivity. This could also result in a rise in irrigation demand. Again the introduction of a more heat-resistant winter rice variety would help to solve future crises.

Unanimous consensus was reached on changes in rainfall and temperatures and farmers' expectations of climate change are in agreement with the climate variables observed. Farmers were less aware, however, that changes represented what is referred to as 'climate change.' In agriculture, adaptation choices differ at various levels. Farmers are investing in new crop varieties, as well as hybrids, to improve water resistance, heat stress, and other adverse conditions. In

agriculture, farmers are introducing more innovative techniques such as crop variety modification and crop switching. Moreover, they mix crops and livestock in order to mitigate economic risks. And farm irrigation practices have been getting better to address drought risk. In addition, the timing of farm activities is also being modified to accommodate seasonal and related changes in both temperature and rainfall.

In our study, a high prevalence of unplanned adaptation is found. The lack of sufficient expertise and understanding underestimates reasonable approximations for adaptation. This also poses major difficulties in assessing the costs and benefits of choices for adaptation. The need for the hour is for proper adaptation to be facilitated. Factors that have a positive effect on adaptation, such as income, farming experience, literacy, interaction with extension, should be taken into consideration when coping with future mitigation policies.

## REFERENCES


- Adams, R., Rosenzweig, C., Pearl, R.et al. (2018),"Global Climate Change and U.S. Farming", Nature, Vol. 345, pp 219-223.
- Aberra, K. (2018), "The Impact of Climate Variability on Crop Production in Ethiopia: Which Crop is more Vulnerable to Rainfall Variability?" paper introduced at the ninth International Conference of EEA/EEPRY Addis Ababa, Ethiopia, July 2018. Accessible on the web: www.efdinitiative.org, evaluated on 20 June 2018.
- Adger, W. N.; Khan, S. R.; and Brooks, N. (2017), "Estimating and Enhancing Adaptive Capacity", UNDP Adaptation Policy Framework, Technical Paper 7, New York.
- African Development Bank Report (2015), "Sex, Poverty and Environmental Indicators on African Countries" Economic and Social Statistics Division, Statistics Department, African Development Bank
- Agarwal, P.K. (2016), "Effect of Climate Change on Indian Agriculture", Journal of plant Biology", Vol. 30, pp 189-198
- Agrawal A. (2015), "Atmosphere Adaptation, Local Institutions, and Rural Livelihoods", International Forestry Resource and Institution Program (IFRI) Working Paper, W08I-6
- Ahmed, F.E., Hall, A.E. also, DeMason, D.A. (2015), "Warmth injury during flower advancement in cowpea (Vigna unguiculata)", American Journal of Botany, 79: 784-791.
- Amemiya, T. (1981), "Subjective reaction models: An overview", Journal of Economic Literature, Vol. 19, No. 4, pp. 1483-1536.

- Anley, Y., Bogale, A. also, Haile-Gabriel, A. (2007), "Appropriation choice and use power of soil and water preservation measures by smallholder means ranchers in Dedo region, Western Ethiopia", Land Degradation and Development, Vol.18, 289–302.
- Assam Science Technology and Environmental Council (2011), "Proposals for Assam State of Assam 's Strategy and Action Plan on Climate Change", Draft paper of workshop, Government of Assam.
- Bahinipati, C.S., Venkatachalam, L. (2015), "What drives ranchers to embrace ranch level variation practices to atmosphere limits: Empirical proof from Odisha India", International Journal of Disaster Risk Reduction, http://dx.doi.org/10.1016/j.ijdrr.2015. 08.010i
- Belliveau, S., Bradshaw, B., Smit, B., Ramsey, D. et al. (2006), "Homestead level transformation to different dangers: Climate change and different concerns", Occasional Paper No. 27. Guelph, Ontario, Canada: University of Guelph, Department of Geography
- Bhandari, G. (2013), "Impact of Precipitation and Temperature Variation on the Yield of Major Cereals in Dadeldhura District of far Western Development Region, Nepal", "Global Journal of Plant, Animal and Environmental Sciences",Vol.3, No.1, Jan-deface