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ROLE OF WETLANDS IN COMBATING CLIMATE CHANGE: AN ANALYTICAL STUDY IN MUZAFFARPUR DISTRICT (BIHAR)

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Abstract: Climate change is a harsh reality that the planet earth is bound to experience sooner or later. Increased human activities are multiplying the effect of climatic change. Apart from that, pressure on natural resources is increasing which is leading to problems like water scarcity, food shortage etc. Wetlands are a unique natural resource which can be crucial in terms of maintaining the hydrological cycle, recharge of ground water, flood control, acting as pollution filters, providing for irrigation and supporting multiple agro based activities. The wetlands are all the more significant for the study area where they are found in abundance because of its geographical setting, population is dense and natural resources are not managed properly. Their role in combating effects of climate change is important therefore they should be appropriately managed in order to harness their full potential and boost ecological and economic health of the region.

Index Terms **- Wetlands, Climate change, Aquaculture, Resource management.**

I. INTRODUCTION

Human population over the years has exerted unprecedented pressure on natural resources leading to their overexploitation, pollution and even extinction of some of them. Among various natural resources, wetlands are unique in nature and their role in balancing the human environment interaction is still underestimated. Muzaffarpur district of Bihar is a region where pressure of population growth on natural resources is felt severely because of lack of proper utilization of resources. The study area is located in the northern part of the Northern Gangetic plains of Bihar. It is part of the Eastern Gangetic alluvial plains which is drained by several perennial rivers. The region receives an adequate amount of rainfall as well, since it is situated close to the terai region of the Himalayas. The area has quite a few natural wetlands in the form of oxbow lakes or mauns along the river meanders and waterlogged depressions known as chaurs formed due to tectonic activities during the different phases of tertiary progeny. These wetlands have a huge ecological and economical role to play for the sustainability of the region. These wetlands are not just huge reservoirs of freshwater, but they act as pollution filters, recharge groundwater and provide for many economic activities as well. They can be developed as scenic tourist attractions also. The role of these natural wetlands is all the more enhanced in recent times when global warming is reflecting in the decreasing water resources or drying up of water bodies. Changing weather patterns are affecting agriculture which is the basis of livelihood for a major part of the population. Therefore, conserving these water bodies is important to ensure economic and ecological prosperity of the region.

II. OBJECTIVES

The present study is aimed at: -

- ❖ Identifying the effects of climate change in the study area.
- ❖ Identifying the role of wetlands in combating the effects of climate change in the study area.

III. STUDY AREA

Muzaffarpur district is a part of Tirhut division which is an important administrative as well as a geographical unit of Bihar. It is located between 25°54'N - 26°23'N latitudes and 84°45'E - 85°45'E longitudes. It has an area of 3123 km^2.

IV. SIGNIFICANCE OF STUDY

The role of wetlands largely needs to be evaluated in these crucial times of climate change. The growth in human population in the past couple of centuries has resulted in overuse of natural resources and large scale emission of greenhouse gasses. This has caused global temperatures to rise considerably. Global warming has well known effects especially in regions of high population with poor resource management policies. The study area is one such region in which recent changes in climatic patterns are going to leave long-run impacts. If the importance of wetlands is realized, then they will be managed accordingly and that will be fruitful for the region.

V. DATA & METHODOLOGY

The present study is primarily empirical in nature. Wetlands have vast geographical extent and they are quite a few in number in the study area. Therefore, it was not practical to visit each and every site physically. But efforts have been made to do some amount of field survey taking a few wetlands as samples to find the relation between them and the population living around it. The data related to the study is procured from related literature and some authentic sources as well.

VI. DISCUSSION

Climate change has been a phenomena throughout the earth's geological history, but nowadays, its impact is affecting a large population that is why it is profoundly discussed. As in the case of India, which is home to almost 150 million people, the impact of climate change will be more threatening as resource development in this region is not to the optimum level and a huge amount of resources are still untapped or get wasted in the absence of sufficient technological development.

The study area i.e. the Muzaffarpur district is situated in one of the most densely populated regions of the country. Geographically it is situated in the northern part of the state. It is drained by many rivers like Baghmati, Gandak, Burhi Gandak and many of their tributaries such as Lakhandei, Manushmara, Baya etc. These rivers have their origin either in the glaciers of the Himalayas, the Shiwaliks or their foothills. But climate change is leading to the melting of glaciers at a much faster rate. It can be assumed that such occurrence will cause the flooding of the rivers initially, but drying of them later, as there will be shortage of snow on higher altitudes to recharge the glaciers due to rising global temperatures. Such effects of climate change may not be visible right now, but a region like the northern plains of Bihar where the study area lies is susceptible to severe damage to environment and economy.

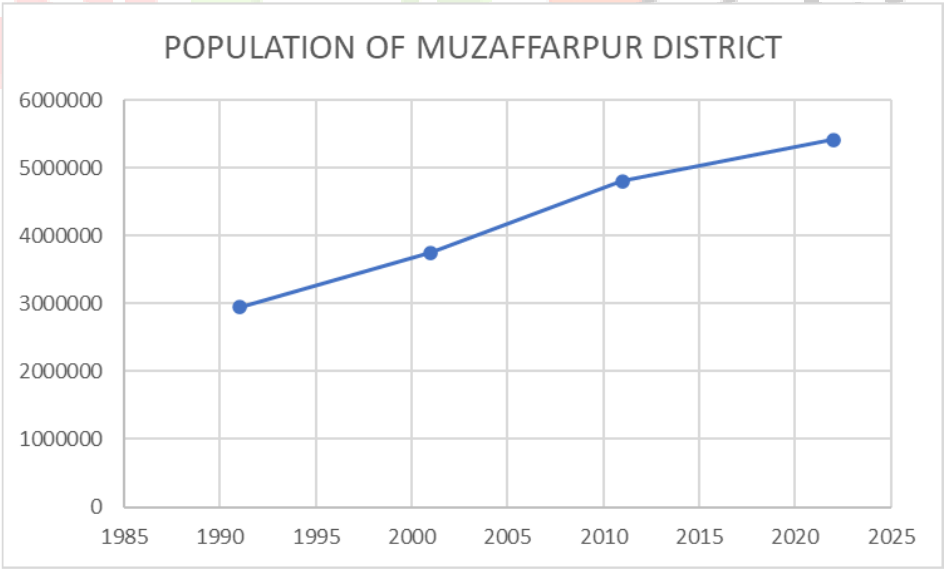
Effects of climate change on the study area:-

As mentioned above, the changing weather patterns have an inevitable effect on humankind everywhere on the globe and the study area is not an exception. According to IMD Patna, the state of Bihar recorded surplus rainfall in June 2020 and 2021 which was the highest received in the last decade. Muzaffarpur was one of those districts which received the highest rainfall. The changing rainfall patterns might be attributed to the changing climate, which proved to be beneficial for agriculture in some parts but in low lying areas it resulted in flooding.

Same as rainfall, there are marked fluctuations in temperature regime as well during the past few years. Winters have delayed or shortened significantly affecting the cropping patterns. The farmers of Muzaffarpur, which is globally known for its litchi production, have suffered the most because for the past few years fluctuating temperatures and increased humidity in the months of March and April have affected the fruits' growth significantly. There are 11000 hectares of litchi orchards which produce around 1.5 lakh tonnes of fruit annually. There are approximately 45000 litchi farmers here. Effects of climate change is evident on litchi production as it has dropped from 70% of the country's total produce to 62% in the past couple of years. Though there is lack of sufficient scientific data to adhere to this fact, weather scientists are of the view that changing weather patterns have something to do with lowered quality of the most popular fruit of this region. Not just litchi, production of other fruits like mango also has suffered due to lower temperature in the early summers and abrupt rise in the month of May and early June.

Alongwith temperature fluctuations, climate change is causing the glaciers to recede on the high mountains leading to reduction of waterflow in the rivers streaming out of them. Muzaffarpur district has an agricultural economy and agriculture is mostly monsoon dependent. The gross sown area in Muzaffarpur district is around 299.6 thousand hectares, of which only 60.86% is irrigated by tube wells, pynes (canals) etc., the rest relies on rain waters only. Insufficient measures of irrigation put agricultural production at risk at times of uncertain and irregular rainfall. Muzaffarpur district is the pivot of development for north Bihar but unfortunately development of allied activities is not sufficient to compensate for the loss caused because of failed agricultural practices either due to flooding or drought like situations.

Another impact of climate change that is probable to affect the study area is recession of underground water levels in the coming future. Population has grown rapidly in the past few years.



Source:- www.census2011.co.in

Muzaffarpur district has experienced a growth of 12.77% in its population in the last decade. It had a population of 4,801,062 in 2011 which is estimated to be 5,418,433 in 2022. This trend accentuates the probable impact of climate change on the region.

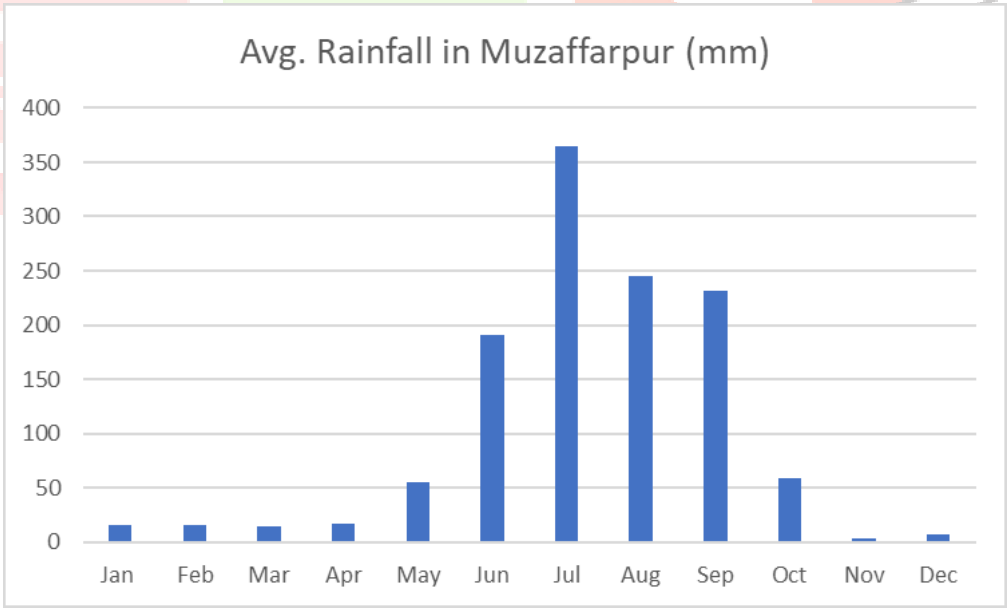
Increasing population demands for more resources and for water resources it is primarily dependent on underground water reserves. Despite being a region of adequate rainfall from the south western monsoons and several rivers draining the area, there is no need to be complacent regarding water supply as

changing weather patterns can have adverse effects on the regularity and amount of rainfall and this will adversely impact the groundwater level.

Climate change and the role of wetlands: -

Wetlands are permanently or temporarily submerged areas of land which are a prominent feature of the geographic landscape of the study area. Meandering of rivers is a common feature of the rivers flowing in the region which can be attributed to the local topography. The cut off courses of river meanders, especially of river Burhi Gandak, have developed into ox-bow lakes known as 'Mauns' locally. Apart from that geological activities during the tertiary orogeny has formed some depressions in the region, which have got filled up with water later on forming wetlands known as "Chaurs." These are the more common natural wetlands that are widely found in the study area. Some well known wetlands of the region are Manika maun, Brahmapura maun, Maidapur chaur etc.

Wetlands as a part of the natural environment have great significance. They are one of the most sensitive ecosystems and when climate change is posing a threat to the very existence of humankind itself, these wetlands can prove to be of great value for the ecology and economy at the same time. As they are huge reservoirs of water, not only do they provide water for irrigation and other necessities for the human population, they are a major source for groundwater recharge. If the geographical location of Muzaffarpur district is taken into account, it is clear that the region has an abundance of water with scores of channels flowing through the region to supply water to it all the year round. Besides, it is located in the eastern part of the country experiencing substantial amounts of rainfall from the south-western monsoons. Therefore it appears to be an area of water saturation, but that does not make the wetlands unimportant. Overexploitation of resources mainly forests and increase in carbon emissions has raised global temperatures and weather patterns have changed globally with the study area being no exception. The average annual rainfall is around 1271 mm. The chart below shows the mean monthly distribution of rainfall.



Source:- www.climate-data.org

But the changing weather patterns have disrupted rains every two or three years. In recent years it has been observed that most of the rains have shifted to the later half of the monsoon season i.e. August and September, which results in drier June and July affecting agricultural practices and ground water levels. Along with it the excessive exploitation of underground water by the growing population has also increased the value of wetlands for replenishment of lost ground water. Wetlands are nature's mechanism for flood control as well. As Muzaffarpur district is located in the northern plains of Bihar with many of the perennial rivers finding their course through the plains with least relief, there is frequent occurrence of flooding of

these rivers during the times of heavy rains. As most of the wetlands are cut off branches of their parent rivers, some of them are connected to them through narrow channels. This linkage distributes the waters in them, controlling the excess of flood waters from inundating the nearby areas. At times of climate change when floods have become more frequent and way too severe in the study area, this contribution of the wetlands is enormous. Wetlands are often laden with wild growth of vegetation and as it is universally known that both the vegetation and the water bodies are capable of absorbing carbon dioxide and wetlands being a combination of both of them act as effective pollution filters. The ecological importance of wetlands makes them an important asset for the study area as it is strewn with all the environmental issues of groundwater scarcity, pollution, floods etc. and wetlands have an determining role in controlling each one of them.

Climate change is bound to affect agricultural practices and since Muzaffarpur district has a predominantly agricultural economy, there must be a preparedness regarding these challenges. And wetlands can play an important role in supporting agriculture by providing water for irrigation, supporting various allied activities such as aquaculture that includes fishing, production of aquatic animals such as snails, crabs, shrimps etc. and vegetation like fox nuts or makhana, water chestnut etc. Resource management comes into play here. If the wetlands are managed properly and utilized to their full potential they can easily provide an alternate option to the economy of the region. Apart from this, many of these wetlands are scenic places and attract migratory birds from far off regions and provide them breeding ground. This attribute of the wetlands can be harnessed by developing them as tourist spots for bird watching, boating etc. Such development will certainly generate alternate employment opportunities in this area. In Muzaffarpur city which is the headquarters of the district as well as the Tirhut division, one such project is being developed around the Brahmapura maun.

But an important thing to remember is that wetlands are a vulnerable component of the environment. Like other natural resources, proper management alone can conserve them to be utilized for sustainable development. Their existence is also at risk when the climate is going through transition globally. Rising temperatures will not just affect the glaciers and the river streaming out of them, but these water bodies are also under threat. Unfortunately, they are facing the challenge of getting neglected, encroached and being used as dumping grounds by the population residing nearby. It is important that their importance is realized at the earliest. These wetlands can prove to be ecologically and economically beneficial only if they are managed sincerely.

VII. CONCLUSION

Lately Climate change is affecting the study area in various forms such as rise in summer temperature, increase humidity in early summer, decreasing groundwater levels due to deficit in rainfall, severe rain in some recent years causing heavy floods etc. And all this is affecting agriculture which is the pillar of the region's economy. To sustain the large population which the study area is home to, preparedness to tackle these challenges is of utmost importance. Muuzaffarpur district has a number of natural wetlands which can play a vital role in supporting the regional economy in such crucial times.

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