



Climate Change and Uttar Pradesh: Issues, Challenges and way forward

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Abstract-

Earth is considered to come in existence around 4.6 billion years ago and since then it is facing cyclical fluctuations of temperature, varying from warm to cold weather conditions. It has been found that approximately about 65 thousand years back northern hemisphere faced extreme impact of ice age. Presently world is in a phase of inter-glacial era and cyclical variation in temperature has adversely affected the water resources and in turn it has also put impact on socio-economic activities of the society. The demand for the adoption of sustainable development approach has got evolved worldwide and for the future cause/security and protection of environment every nation of the world is willing to go with the sustainable development approach. It is well known to every nation of the world that climate is changing but the rate at which it will change is not yet clear. It is also well known that the development of culture and civilization it takes place gradually and it has the impact and influence of prevailing climatic/environmental conditions. It is also clear that any change in climatic/environmental conditions will definitely influence and put its impact on the culture and civilization of the society as, culture and civilization is also governed by the economic perspective and economic perspective is affected by climate change. This article does highlights/reveals the adverse impact of climate change on epidemic, water quality, pollution, agricultural activities, flood, draught, depletion of ground water level and also emphasizes on the way forward to overcome these issues and how to retain/regain/improve the welfare of the society by ensuring sustainable development process in large populous state like Uttar Pradesh. This study is based on the secondary data furnished by various research institutes, academic bodies and government institutions/sources.

Keywords- Ice age, Drought, Sustainable Development, Culture, Civilization, Flooding.

Introduction-

Climate change is the serious issue for world and in turn for India and Uttar Pradesh also. Adverse impact of climate change can be seen on primary activity like agriculture, food grain production and food security, on availability of water resources, on small and marginal farmers and on existing ecosystem and in turn on the livelihood of rural/common people of the society. As, the adverse impact of climate change can be seen mainly on the small and marginal farmers of the rural region who solely depend on better monsoon and climatic conditions for higher rate of crop productivity and they are the mainly affected groups of the society. In general it can be seen that climate change causes loss of crop, loss of bovine population and loss of forest produce. It is the need of the hour that Indian planners must include climate change measures into the national level policy strategy formulations. It is also needed that certain mechanism is to be promoted so that effectiveness of planning and management related to climate change can also be raised. In this regard Niti Aayog insists on the effective implementation of such measures so that SDG 13 can be attained. One of the largest states in India is Uttar Pradesh and is located in the Ganga Plain. Ganga Plain is one type of physiographic subdivisions in India.

Uttar Pradesh has 243000km² area and also one of the most populous states with 199 million populations (2011 census). The large portion of this population is engaged in agricultural and allied activities and they contribute approximately 42% of state economy. Uttar Pradesh has tropical monsoon climate with high temperature in summer, high or low rainfall level and cooler winters; these climatic conditions put impact on natural resources, agriculture and human being. It has been seen that adversely affected group in Uttar Pradesh is small and marginal group of farmers, what else can be noted that rural area population who are living in a devastative environment has to face unfavorable impact of climate change in the form of drought, failure of crop, livestock loss and loss of forest produce. Uttar Pradesh covers up 7.3% of land area and approximately 17% of India's population resides in Uttar Pradesh. Pressure of population is continuously increasing on land. Continuous increasing population and expansion of urban area has put large scale pressure on land and on water resources. One more major issue has come up in the form of change in demand for

land and in urban areas and in rural areas. In urban areas land use pattern has been changed and there is rise in demand of land for construction of houses, offices, recreational activity centers, shopping malls, roads, bridges, underground transport system, drainage system, schools and colleges. The encroachment by man in the natural cycle of river has polluted the water, disturbed the ecosystem and increased the sediment load of the river. The encroachment by man has caused problem of polluted water drained out directly in river, sediment load has increased and climate has controlled the slope gradient which determines the energy of the rivers. Narrow channel with the wide valley is the characteristic of the rivers of Uttar Pradesh.

It is clear by this time that with the increase in the quantity of anthropogenic gases in the environment the alarming issue of climate change it aggravates. The alarming phase of climate change in turn hampers the growth of the economy, like productivity of crop goes down, which may cause scarcity of food and threat for subsistence living in less developed countries like India. India is agrarian economy where approximately 53% of its population is engaged in agricultural activities and agriculture also contributes approximately 15% in India's GDP. The concern is that though there is the rise in agricultural productivity but availability of consumable food and nutritional input is still a major challenge for the government to deal with. Now question arises why Indian agriculture faces adverse impact of climate change then the answer is- that agriculture in India is mainly monsoon based and average size of holding in India is approximately below one hectare so, landless agricultural workers, small and marginal farmers because of paucity of funds cannot take remedial adaptive measures.

Critical Issues related to Climate change in Uttar Pradesh

Uttar Pradesh has the high density of rivers, fertile soil, favorable climatic conditions and landscape which is also smooth and all these parameters lead it to become one of the populous region of the world and it is facing aftereffects of climate change and ignorance of natural & scientific facts in the form of drought, flood, problem of potable water, challenge of epidemic spread out, issue of rising pollution, downfall of agricultural productivity and affected rivers.

Effect on agricultural productivity-

Uttar Pradesh is a large state with 9 distinct agro climatic zones and along with this if data is being analyzed then it is revealed that per capita availability of cereals, vegetables, fruits is more than the demand which exceeds the dietary provision suggested by Indian council of medical research whereas per capita availability of nutritious food items like protein rich pulses, and milk is less than the demand. It is being revealed that out of total area of food grains crop (19.8 million Hectare) about 6.6 million hectare is taken out of farming and approximately production loss of 14 million tons of food grains. That is the reason there is the need to develop food security strategies to avoid hunger and mal nutrition in the populous state like Uttar Pradesh and more over Uttar Pradesh is the agrarian state and also has the highest cropped area of 25,785,000 hectare.

Zone	Region	Region/Districts	Soil Type	Rainfall (mm)
Zone1	Tarai	Saharanpur, Bahraich, Bareilly	Alluvial and Clayey	1150
Zone2	Western plain	Bijnore, Bdaun, Rampur	Sandy and Clayey	700-1000
Zone3	Central Western	Saharanpur, Meerut, Baghpat etc	Alluvial and Sandy	600-965
Zone4	South Western	Agra, Firozabad, Etawah, Aligarh	Sandy, Alluvial and clayey	750
Zone5	Central Plain	Lucknow, Unnao, Kanpur, Allahabad	Alluvial and clayey	850-900
Zone6	Bundelkhand	Jhansi, Hamirpur, Chitrakoot	Rocky	800-1000
Zone7	North Eastern Plain	Gonda, Bahraich, Gorakhpur	Sandy, Alluvial and clayey	1000-1200
Zone8	Eastern Plain	Barabanki, Faizabad, Sultanpur, Varanasi	Alluvial, Sodic and clayey	1000-1200
Zone9	Vindhyachal	Mirzapur, sonbhadra and Allahabad	Rocky, Black and Red alluvial soil	1100

Department of Agriculture Uttar Pradesh (Agro climatic zones of Uttar Pradesh)

The major crops grown in Uttar Pradesh are paddy, wheat, sugarcane, potato, mustard, gram, pea, groundnut and lentil. Uttar Pradesh also exports potatoes, rice, mangoes and vegetables to other nations. Uttar Pradesh has 485 fruits and vegetable processing units. There is rise in the production of food grain in Uttar Pradesh in 2001, and was 43 million ton, which was increased to 47 million ton in 2011, increased to 49 million ton in 2016-17, increased to 51 million ton in 2017-18 and increased to the level of 601 lac MT (or 60 million ton) in 2020-21.

Cereals are grown on an area of 178.34 lac hectare and results in the production of 598.11 lac mt during 2021-22, along with this coarse cereals were grown on 20.25 lac hectare and there is the production of 47.03 lac mt, pulses production in 2017-18 was 2,208.0 thousand ton and presently was grown on 24.1 lac hectare of land and there is the production of 26.22 lac mt; Uttar Pradesh is largest producer of vegetables in India and in 2018-19 produced 1002.64 thousand mt., cultivation of crop specially production per hectare is affected majorly by the weather fluctuations and mainly global issue like climate change will have confirm impact on crop yield and productivity. When normalized yield difference method is considered for prediction analysis of crop yield on seasonal basis, observation shows that rise in temperature to higher level may cause downfall in yield of paddy crop in eastern Uttar Pradesh by 1.0 to 1.1% per hectare by 2020. In the similar way, downfall of temperature to minimum level may decrease the yield of rice by 1.5 to 1.9% per hectare in eastern Uttar Pradesh. If we consider future scenario of rainfall then observation shows that south-west monsoonal rainfall would be the major factor which controls the yield of rice.

Drought-

Bundelkhand region of Uttar Pradesh comprises of 48 Blocks which fall under the jurisdiction of 7 districts. Bundelkhand region of Uttar Pradesh has the geographical area of 2.94 million hectare which is approximately 12.21% area of the state. When economic aspects and development of infrastructural facilities is considered then, the outcome is that the Bundelkhand region of Uttar Pradesh is the poorest region when compared with eastern, central and western region of the state. In this region of Bundelkhand 4.96% of state's population resides.

Area	Hamirpur	Jhansi	Banda
Average Annual Rainfall (mm)	621.59	831.34	889.64
Drought Years	1986,1988,1991,1993,1994,1995,2001,2002	1979,1986,1996,1998,2005,2006	1979,1981,1984,1998,2007,2009

Metrological drought years observed from 1975 to 2010 at Uttar Pradesh- Bundelkhand Region

The long lasting dry and warm season months lead to the drought like conditions, and also turn fertile land areas to the barren land holdings. The adverse impact of climate change and almost nil rain falls is as such that Gangetic plain region of Uttar Pradesh and the fertile regions of the Maharashtra, Madhya Pradesh, Haryana and Punjab has also turned into the barren dry patches. World Bank has warned India by means of its report (India's water Economy: Bracing for a turbulent future) that in upcoming next 2 decades because of inadequate water supplies and improper management of ground water resources there is the possibility for the arise of water crisis which, may lead to a drought like conditions. In Uttar Pradesh Bundelkhand region is perennially drought prone region, where there is the low rainfall than the required rate.

Flooding-

Flood has become the common natural hazard which adversely affects the physical environment, causes loss of life and damage to the property and in turn loss to the society. Though flood cases less loss to property, life in comparison to other natural disasters like earthquakes, cyclone and drought but is responsible for causing damage to the cultivated cop, high incidence of injuries and also causes homelessness. Along with Bihar, West Bengal, Assam and Orissa Uttar Pradesh is one of the most flooded states in India and Uttar Pradesh has faced massive flooding in 1998, 2000 and 2008. It is estimated that about 30 districts of this state are flood prone districts and frequent affected area is eastern Uttar Pradesh, which is occupied by rivers like kuwana, great gandak, Ghaghara, chhoti gandak and rapti. Higher rate of snow melt, mass movement in upper reaches and poor drainage, blockade, high rainfall in catchment areas, dam/levee failure. The river valley has been narrowed because of construction of artificial levees so that land can be provided for the settlement of rising population. When discharge of water exceeds the capacity of the channels then flooding occurs in the adjoining areas and becomes devastative and destructive in its act. Eastern districts of Uttar Pradesh are main flood affected regions than the districts of western and central regions. Annually about 27 lac hectare land affected by floods and approximately 432 cr rupees is an estimated annual economic loss because of floods.

Water quality degradation and downfall in water level

In Uttar Pradesh Rivers are the main source of fresh water and because of perennial nature these are the important water resources. In this state because of the high population growth and continuous rise in environmental pollution, the quality of river water is deteriorating at the higher rate. It has been proved that the socio-economic development of an area depends on the hydrological resources available in the region. Main constituent of the potable water is the ground water as it has the perennial availability. In Uttar Pradesh because of rapid rate of growth of population and rising environmental pollution in has deteriorated the aquifer to a major extent during the last two to three decades of time.

Deterioration of the quality of aquifer clearly hints that sewage and industrial effluent plants were not fully developed and made functional in Uttar Pradesh and the aftereffect is that the quality of river water has gone down drastically which in turn becomes devastative for the ecosystem of the water body and also increases the social cost of the residents who make use of this polluted water. This is the need of the hour that Uttar Pradesh Government should establish governmental organizations/Institutions/agency's which can solely deal with the aspect of supply of domestic water to rural as well as urban region and monitoring as well as maintenance of the quality of water. At India level Uttar Pradesh is the densely populated state with 628 municipalities. Water management and conservation as well as protection of water bodies are the need of hour for Uttar Pradesh. Uttar Pradesh Government may take the expert help from International water management institute (IWMI) in this regard.

It has been found that water is not only essential for the life of living creatures but also critically needed for primary activities like agriculture, secondary activity like Industry and for household requirements. Now, it is clear by this time that future availability of the clean water in Uttar Pradesh depends primarily on the appropriate waste management. Sustainable development goal no.6 on clean water and sanitations of United Nations insists on the aim of improving water quality by reducing pollution. SDG6 has fixed the time frame of year 2030 to make an improvement in the quality of water by reducing pollution level, eliminating waste disposal method of dumping and regulating/minimizing the release of contagious/hazardous materials/chemicals in the water resources and

enhancing the recycling/safe reuse of waste water globally. Main focus of United Nations is on developing support and strengthening the participation of local communities in improving water and sanitation management effectively.

Generation of Industrial Waste-

Expansion of industries in Uttar Pradesh has increased the rate of generation of waste water from industries and because of lack of effluent treatment plants, improper disposal as well as management practices and presence of toxic material in industrial waste water has affected surrounding ecosystem severely. In Uttar Pradesh this practice of disposal of industrial waste has affected agro-ecological conditions in a devastating way; and agricultural crop gets contaminated which adversely affects the health of the human beings who consume it. Another negative dimension which is attached with industrial water waste is that when it is disposed of in the water bodies directly then it destroys the ecosystem of the water body in an adverse manner.

Emission of air pollutants-

Expansion of Industrial activities and thermal power plants along with transport sector in Uttar Pradesh has caused higher rate of emission of air pollutants like sulphur dioxide, nitrogen dioxide, ozone and suspended particulate matter. Such a large scale of emission of air pollutants has damaged the quality of ambient air present in the surrounding, which is above the standards set by central pollution control board of India. Air pollution level rise has caused significant loss to the agricultural productivity however; intensity of losses depends upon the concentration of the pollutant, duration of exposure, climatic factors and species of plants. These pollutants cause visible and invisible damages to the plants like down fall in the crop productivity.

E-Waste generation-

E-waste generation in India has become one of the major challenges and India is one of the largest producers of e-waste in the world. As per global e-waste monitor 2020 report, world dumped 53.6 million tons of e-waste last year. Out of these 53.6 million tones only 17.4% was recycled. China with 10.1 million tones, was the biggest contributor to e-waste, United States was second with 6.9 million tons of e-waste where as India stands at third place with 3.2 million tons of e-waste. In a combined way these three countries account for approximately 38% of the world's e-waste in the past year. It is revealed that government has not revealed data on e-waste generation in a country. Moradabad city of Uttar Pradesh was on a limelight recently when National Green Tribunal (NGT) imposed fine on district magistrate and state pollution control board for improper and non environmental disposal of black powder waste dumped on the banks of Ramganga River.

Spread of Epidemics-

In Uttar Pradesh Epidemic spread outs are very common and during the month of July to November (Especially during rain) spread out of epidemics can be seen. Main epidemic spread out diseases are dengue, malaria, cholera, Japanese encephalitis, flourosis and a hepatitis B. adverse impact of epidemic spread out can be seen mainly in faizabad, sidharth nagar, maharajgaj, azamgarh and Gorakhpur districts of eastern region of Uttar Pradesh. There are various reasons for this epidemic spread out in Eastern region i.e. rapid rate of growth of population, less developed medical and health facilities, change in agricultural practices and land use pattern, change in social and human demographics, public health schemes failure, natural calamities, adverse impact of climate change on biodiversity of the region. In Uttar Pradesh, there were 47,507 reported cases of acute encephalitis syndrome (AES) from 2005 to 2018, with yearly fluctuations, average case fatality rate of AES was 17.49% with highest in 2005 (24.76%) and lowest in 2018 (8%). Among the AES patients there were 9.98% JE cases. Eastern districts of Uttar Pradesh like Deoria, Gorakhpur, Pilibhit, Azamgarh, and Ballia along with kheri are adversely affected by Japanese encephalitis; state government needs to strengthen the capacity for the provision of secondary and tertiary care services in district level hospitals and medical colleges of public health system along with private sector.

Emerging Options ahead in Uttar Pradesh-

To overcome the challenges arisen because of climate change Uttar Pradesh government needs to take the necessary steps like- **a) green house gases to be reduced-** Co₂ of the air can be reduced by means of a forestation drive in Uttar Pradesh. At international level agreement (Kyoto protocol) was signed by developed and developing nations to reduce the carbon dioxide emissions and also to curtail the presence of green house gases in the atmosphere. Countries which abide by the Kyoto protocol were assigned upper limit of carbon emission levels and agreed to come forward for the carbon credit trading. Kyoto protocol also imposes penalty on the

violators in the form of a lower emission limit in the upcoming span of time. **b) Sustainable Development mechanism to be adopted in Drought prone districts-** In Uttar Pradesh for making assessment of rainfall deficit year and drought year observation is made on the total rainfall poured down in Bundelkhand region. On the basis of observations it has been found that the mean of annual average rainfall for 36 years in Bundelkhand region is found to be 8908.25mm. Rainfall deficit for the year is decided on the basis of deviation from this calculated mean. Assessment of meteorological drought year is done on the basis of comparison if, the rainfall deficit is less than 75% of the mean then it is considered as drought year. In UP years 2000, 2002, 2004, 2005, 2006, 2007, 2009 and 2010 are considered as the rainfall deficit years. In 7 districts of Bundelkhand for 2-4 years moderate to severe agricultural drought occurs in last 10 years.

Remedial measures can be adopted for overcoming drought-

a) By Recharging aquifers- Under this process excess surface water is lead to the ground by three methods – (i) by surface spread, (ii) by means of recharge wells, (iii) to replenish an aquifer making changes in natural conditions for more penetration. This is a method to store surplus water in an underground level and making use of that during shortage of water. Uttar Pradesh government has announced policy for ground water management, harvesting of rain water and recharge of ground water. the prime objective of this policy is to regulate ground water exploitation and to promote optimum use of ground water on sustainable basis.

b) Harvesting of Rainwater- it is a method used for the collection and storage of rainwater drops into natural water bodies, reservoirs or tanks, in other words it is the infiltration of surface water into the sub surface aquifers. Roof top harvesting is the one type of rain water harvesting. Rain water pouring down on roof top is intercepted and allowed to run into the pit and it recharges the underground water and that stored water can also be used for drinking purposes, gardening, livestock rearing, irrigation of agricultural lands etc. with the large scale efforts of rain water harvesting method is implemented effectively then local water bodies can be recharged, flooding of urban areas can be controlled and problem of water scarcity of dry regions can also be solved. In Uttar Pradesh dry regions of Bundelkhand and Vindhya face problem of water scarcity because of low ground water availability. Approximately 63 blocks of the region are drought prone. The problem of ground water contamination and pollution is very common in Uttar Pradesh. Quality wise and quantity wise ground water level in Uttar Pradesh is under critical state. It is the need of the hour that Uttar Pradesh government should formulate area specific guidelines, technical specifications and practice suitable for the area so that rain water harvesting can be promoted in drought prone regions and ground water level can be recharged.

(C) Flood District Management- in India along with Bihar, West Bengal, Assam and Orissa Uttar Pradesh is one of the flood states. In the recent past Uttar Pradesh has faced large scale flooding in the year 1998, 2000, 2001 and 2008, and about 30 districts in Uttar Pradesh are prone to flood. Eastern region of Uttar Pradesh faces frequent challenge of flood and it is the outcome of spilling of rivers like kuwana, chhoti Gandak, rapti, great Gandak and Ghaghara. Geomorphology sedimentology and flood characteristics are found in Ganga Plain Rivers like Ganga, Sarda and Gandak. In the upper catchment of flood prone rivers UP Government must focus on structural conservation of soil and afforestation measures. For the development of these areas emphasis should be on utmost utilization of water resources available and suitable cropping patterns are introduced. To regulate devastative and destructive strength of flashing floods number of small flood retention reservoirs of appropriate capacity should be build on or near each river. Severity of flood destruction increases with the population rise as natural route of the river is encroached by houses, factories and other constructions as well as enhanced human activities in the river basin and river valley has become major challenge. The river system has been changed/altered because of rapid rise in the density of population and rise in human intervention.

(D) Efforts to be made to maintain quality of water- underground water is the primary source of potable water and irrigation that's why it is needed that water is kept free from various chemical ions like Ca^{2+} , Mg^{2+} , Na^+ , K^+ , HCO_3^- , SO_4^{2-} , NO_3^- , NO_2^- , Cl^- , F^- and trace metals like Fe, Cu, Mn, Zn, Cd, and Pb. Spatial variation of water quality is affected by anthropogenic activities. Hydrological network of the region has influential impact on the economic and social development of the area.

Way forward for the Uttar Pradesh government-

Uttar Pradesh government may take preventive measures to reduce the impact of climate change on the sustainable development of the state. Well developed/managed government organization will be able to observe/find early warning signals of upcoming natural disasters and will help the government to initiate effective safety measure on time. Issues like climate change are to be considered seriously and there is the need to deal these issues judiciously. There is the need for implementing environmental policies and measures in such a way that further deterioration of environmental assets/valuable resources can be controlled and further uncontrolled exploration of environmental resources can be regulated. Government of Uttar Pradesh needs to develop structural platform for the ascertained adoption/maintenance of sustainable development goal objectives; which are essential for the fulfillment of present needs without compromising with the capacity to meet out future needs. These measures can be taken by the

government to overcome flood in Uttar Pradesh- a) repair work of barrage gates and embankment is urgently needed, b) renovation of drainage system is needed, c) river erosion needs to be dealt efficiently and river banks to be protected, d) available water bodies to be deepened, e) awareness among the local/regional people is to be spread out, f) priority to be given for the construction of soil and water conservation structures, g) flood control rooms to be formed/established at district head quarter, h) proper analysis of frequent flood occurrences is to be done, i) surplus flood water to be taken away towards water scarce regions, j) Drought Management Institute are to be opened, k) studies of natural resources, their proper monitoring and forecasting is to be done, l) rain water harvesting structures, roof top rainwater harvesting provisions are to be established compulsorily, m) proper crop monitoring and forecasting of weather provisions are to be established, n) improvised communication mechanism is to be established and made functional, o) schemes for rural development, land resources, drinking water and generation of employment opportunities are to be emphasized, p) Urban development provisions are to be carried out with strict guidelines for construction of buildings, q) sewage treatment infrastructure to be developed and made operational, r) steps are to be taken to improve quality of water by pollution reduction, elimination of process of dumping and by reducing release of hazardous chemical and materials, s) government has to emphasize on how to protect, restore water-related ecosystems, including mountains, forest covered areas, wetlands, rivers, aquifers and lakes.

Best Practices that can be considered and adopted by the government of Uttar Pradesh for overcoming issues of climate change-

i) Government of Uttar Pradesh need to promote and provoke afforestation and reforestation drive for the conservation of biodiversity. Ganga River has been freed and need to go with the plantation drive on this land area. Union ministry of water resources has started afforestation drive by planting saplings on the banks of Ganga River. Here, the need of the hour is to enhance afforestation drive along with the conservation and sustainable management of tree resources. ii) Government of Uttar Pradesh also needs to increase the participation of local people in the drive of growing trees and planting of these trees. At India level environment must be a development agenda. iii) Along with ensuring food and nutritional security, water and livelihood security must be a part of vision document of national soil and land use policy. iv) Construction of artificial levee and embankment are considered as most popular method to control the flood; whereas on practical basis it has been found that artificial levee and embankment cannot control flood fully and for that very purpose remote sensing technique can be used for the identification of flood affected area and small flood retention reservoirs of suitable capacity need to be constructed in nearby region of river so that devastative impact of floods downstream can be regulated. v) Dry land farming is to be promoted in dry land regions where cool wet season is followed by warm dry season. These are also can be linked to arid conditions or drought prone areas or areas where there is scarcity of water resources. If government of Uttar Pradesh insists on promoting dry land farming then definitely it will improve economic condition of agriculturists of the region as well as will reduce the poverty in that region. Positive dimension which can be linked to dry land farming is that it will promote cultivation of crops like jowar, bajra and ragi and will also improve nutrient consumption level of our Uttar Pradesh and in turn of our nation. Along with that semi-arid regions of Uttar Pradesh can also be utilized for the cultivation of crops like oilseeds, cotton and pulses which require less irrigation and in turn will improve production of food grain at state level. vi) when basic idea of sustainable development is considered then it becomes clear that it has the goal that to ensure availability and sustainable management of water and sanitation for all. It takes into account efficient water use, proper management of water resource, ecosystem of the water bodies as well as to ensure that safe drinking water, proper sanitation and hygiene is accessible to all without failure.

Some Innovative Actionable ideas-

It is known that nature has provided natural resources free of cost and in its pure form where as human being to fulfill his greed and lust has made them hazardous and chemically contaminated. It is well known that there is no certified idea to prevent flood and lateral erosion but only possibility is to reduce rate of damage. Now, it is revealed that foolproof solution to this problem is protection not prevention. Government of Uttar Pradesh need to reduce loss/damage by means of preparedness, mitigation and framed recovery program. In this regard to reduce flooding and lateral erosion impact structural and non-structural control measures can be taken. **Measures meant for structural control** can be indicated as, propagation of vegetation, embankment construction, to control direction of river lateral dams to be constructed, cement & sand bags and boulders can be dumped on the banks, by planting trees by the side of rivers stream can be stabilized and reduced; menace of flood can be overcome by imposing checks on deforestation, denudation and soil erosion. **Measures meant for non-structural control** are developing forecasting measures, developing warning system, implementing emergency in this regard, security of river bodies, efforts to be taken to delimit flood and lateral erosion zone and land use planning to be implemented. There is the need for the formulation of the policy so that no one can encroach with permanent settlement in the peril zone of the river. In general at world level GIS and Remote sensing techniques are used as non structural mitigation measures. In Uttar Pradesh in recent time severe drought has affected some part of the different regions in the year like 2002, 2004, 2006 and 2007. In the southern districts of state including Bundelkhand and Vindhyan regions rain deficiency of the year 2006 and 2007 has caused calamity condition. To improve the capacity of the Uttar Pradesh state to

mitigate the effects of natural disasters, to make an assessment of disaster management capacity of the state, establishing and making fully functional early warning system there is the need for refinement of the objectives of Disaster management in UP State. Presently rapid rate of growth of population along with continuous expansion of urban area in river Ganga basin has become a major severe issue before the planners of the Uttar Pradesh; and Ganga basin is the home for nearly 450 million people and has increased stress on water resources and in turn lead to water shortage on seasonal basis as well as rise in water pollution. When data of untreated wastewater at India level is considered then estimates show that about 78% of water remains untreated and about 8,000 million liters of untreated waste water is released daily into the holy river Ganga. This untreated water deteriorates the quality of river water adversely and also puts devastating impact on surrounding environment of river and on people who make use of that water. Government of Uttar Pradesh is continuously working on developing via media to overcome after effect of recurrent droughts on agriculture and livelihoods of common people, impounded by climate change in Bundelkhand region of western UP. Government need to develop coordination among nongovernmental organizations, local authorities and charity donors so that effective steps can be taken. Government need to promote dry farming techniques in these rain scarce regions. Uttar Pradesh government also need to develop their primary health centres, community health centers and district level hospitals to control epidemic outbreaks of Japanese encephalitis, malaria, hepatitis B, flourosis, dengue during the months of July to November every year.

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