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HISTORY OF LAND USE IN THE INDO GANGETIC PLAINS, INDIA AND ITS IMPACT ON POPULATION: A REVIEW

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ABSTRACT

Indo-Gangetic Basin, one of the most populated in the world, has been a complex mosaic of human-native relations, suffering and development, challenges and opportunities in the past 40 years. Fast growth in the use of agricultural water is a popular trend. For the livelihoods of rural people, interactions and access to water are important. The Indo-Gangetic plain is an environmentally sustainable, socially aware plain Indian important and economically competitive area of climate and anthropogenic stress affecting terrain, hydrology and fertility. In the future, the main risk would be the intermittent supply of water. In the event of a larger flow of water, flooding and sedimentation affects the Piedmont region and the river bottoms, while salination, desertification and drying of aquifers jeopardise the top surface of the piedmont district. The Indo-Gangetic Plains (IGP) are in the prime location and host the ideal conditions for agricultural practices and provide a solution to a problem of poverty and food insecurity in India. However, this area faces many issues such as seismic changes in the earth, soil fertility and excess rainfall as a result of rising global temperatures. Looking at historical information, there are two main problems that may arise in this area: increased water supplies or decreased water supplies. The biggest issue this area faces is predicting the level of rainfall falling the monsoon season as the primary problems in this area arise from or are worsened by water scarcity or excess flooding.

***Keywords*:** Indo Gangetic Plains, Climate Change, Population, geographical variations

Introduction

India has rich natural resources and climatic variations that allow it to cultivate many plant species, typically cultivated in tropical, subtropical and temperate regions. Despite its abundance of energy, it is difficult to maintain a balance of food production due to the increasing population. The country's biggest problem is self-sufficiency in grains. Agrarian livelihoods are important to natural resources and, thus, it is crucial for national food security to sustainably utilise the natural resources available. Natural resources are seen in India as a tool for development, job creation, poverty reduction and various livelihood options for millions of individuals. Provided that the national economy has multiple concurring land use structures, a multitude of federal and state laws regulate their implementation in the nation's government framework. The Indo Gangetic Plains (IGP) are well known to provide nearly 50 % of the total food consumption to feed 40 percent of the country's population (Pal *et al*., 2009).Of the 610 Indian administrative districts, the IGP contains 185. The IGP is distributed in a total area of approximately 52.01 m hectare and contains 8 agro ecological regions (AER) and 14 agro-ecological sub regions (AESR). The IGP 's territory covers almost 13% of the country's overall geographic region and has a population of over 280 million rural people. The region comprises middle-income countries and states that rank among the poorest countries (Erenstein, 2009).

About 10,000 years ago, the population of the Earth was approximately 5 million (50 lakhs). It was at this time that human beings started agricultural practices more extensively. As a result, after 8,000 years at 1 A.D., the global population rose to approximately 200 million (20 crores). Due to this increase in agriculture, the human population rose to about 40 times its previous value. Despite this dramatic increase as a result of agriculture, in the present day, humans seem to have forgotten the importance of agriculture. They have poisoned soils and the air with toxic chemicals and gases. Additionally, buildings are being constructed on fertile and prime agricultural lands. If this trend of harming agricultural practices continues, the global population will soon again be reduced to the number which existed before humans turned to agriculture. The climate has

a significant impact on the quality and quantity of agriculture that can be produced. This is especially damaging as in recent years; global temperatures have seen a great increase and therefore are adversely affecting global weather patterns. This consequently affects agriculture in areas such as the Indo-Gangetic Plains.

Agriculture is extremely important as it not only provides food and a sense of livelihood to many people in India, but also is a source of employment for many. Being a relatively poorer in certain parts of India, the jobs created as a result of agriculture contribute majorly to people's incomes and livelihoods. As a result, agricultural industries greatly add to the Gross Domestic Product of India and consequently lead to benefits to the economy such as an increased multiplier effect (Sehgal *et al*., 2013). Previously, this impact of the climate was not felt to such great extents as mentioned above, the population of the earth was much less. However, due to recent manmade changes, the climate has been changing rapidly and has therefore impacted agriculture. In order to reduce these impacts, we must prevent further growth of the levels of carbon dioxide within our atmosphere and create prevention and adaption measures to ensure that we can continue to live on our planet safely (Saini, 2008). Historically, the civilizations established on fertile lands with assure supply of water for livelihood as well as for crops and animals. In India too Indo Gangetic plains bestowed with fertile land as well as adequate supply and availability of water for humans and animals; and irrigation purposes. Therefore, as expected in past history the population density also more in these regions due to favourable soils and water availability.

Moreover, the world population has grown by about five billion since the beginning of the Green Revolution and many believe that, without the Revolution, there would have been greater famine and malnutrition. Population movements increase urban populations and reduce rural populations. This reduces labor productivity in agricultural areas and causes these areas to remain inactive and increases the pressure of urban development on these areas.Keeping above in view the present review article on," History of Land Use in the Indo Gangetic Plains, India and its impact on population" has been attempted with the following objectives.

Study area

The region of Indo-Gangetic Plains is known to be one of the most densely populated regions of the world. The three main rivers, the Ganges, Indus and Brahmaputra, and their tributaries have produced the fertile alluvium found in the Indo-Gangetic region. The Indian portion of this plain is centered on the River Ganges and extends from north-central India up to the Thar Desert in the west and eastward up to Assam in the north and down to the Bay of Bengal in the south. The study area in this work covers most of this great plain region and includes eight Indian states – Punjab, Haryana, Uttarakhand, Uttar Pradesh, Jharkhand, Bihar, West Bengal and Delhi – and the union territory of Chandigarh. The study area accounts for about 653 211 km2 (Census of India 2001) which is about 19.87% of the total land area of India and is inhabited by 41.32% of the total Indian population (Census of India 2001). In order to accommodate this increasing population, the urban areas in the study area are undergoing a rapid expansion. As a consequence, most of the rich agricultural land is being converted to built-up areas, which is not only affecting the agricultural productivity, but also the ecological and hydrological cycles in the study area.

Current status of natural resources in IGP

The Central Research Institute for Dry Agriculture (CRIDA) prepared the NRI (Natural Resource Index) map of country to the National Rainfed Region Authority (NRAA) for Seven factors i.e. rainfall, status of groundwater, irrigation intensity, rainfed area, drought, available water content of the soil, degraded land area and waste lands. Two thirds of the allocated size are accounted for by the NRI; rainfall and drought represent the biggest share of the NRI as the consequence of rainfed agriculture is calculated. The map shows that the eastern part of the country is resource-rich, middle part (split vertically) is medium-rich and the western part is relatively poor (Patil *et al*., 2014).Almost all the democratic regions (west and south India) like Kerala, Karnataka, Goa and Gujarat have medium to poor NRI. Most poor districts / regions found by the numerous committees formed over the last 30 years by the government of India include virtually the entire middle and lower IGP, which is also the high NRI state. High NRI and poverty appear to be mutually compatible. One of the main reasons for poverty in these area is unabated population growth (more than 20% in the last decade), high population density (> 1000 people / km^2) and rely on agriculture as sole source of livelihood. The IGP can be split into four distinct areas i.e. The Indo-Gangetic plains (TIGP), upper Indo- Gangetic plains (UIGP), middle Indo-Gangetic plains (MIGP) and lower Indo-Gangetic plains (LIGP) (Gupta and Yadav, 2014).

This is the large unit in the Great Plain of India, occupying an area of approximately 3.75 lakh sq km, from Delhi to Kolkata in Uttar Pradesh, Bihar and West Bengal. The Ganga is the major river because of this the plain name is named as IGP. The Ganga and its huge number of affluent in the Himalayas-the Yamuna, Gomati, Ghaghara, Gandak, Kosi, etc. carried from the mountains massive volumes of alluvium and dumped it there in order to create this vast plain. Also contributing to the development of this plain were the peninsula 's banks such as Chambal, Betwa, Ken, Son, etc. The general slope of the entire plain is to the east and south east. This plain can be further divided into the following three sections based on its geographical variations:

(a) The Upper Ganga Plain.

(b) The Middle Ganga Plain.

(c) The Lower Ganga Plain.

(a) The Upper Ganga Plain: This plain occupies the upper part of the Ganga Plain and is bound in the north by the 300m Shivaliks, and in the south by the Peninsula, and in the west by the Yamuna River. The eastern boundary is very mysterious, and among geographers it has become a controversial theme. The plain is approximately 550 km east-west and approximately 380 km North-South covering an area of approximately 1.49 lakh sq km in length. Its height ranges from 100 to 300 m above sea level. The Ganga and as well as the Yamuna, Ram Ganga, Sarda, Gomati and Ghaghara are flooding the plains. Nearly all of the rivers flow through NW-SE with the lie of the land. The land is around 25 cm per km on average. In the northern portion, the gradient is comparatively steep. If the elevation rises, the rivers rise steadily throughout the plain. his flat and unusual plain is occupied by the submontane of Tarai-Bhabar and the

bluffs of the river, river meanders and oxbow lakes, levees, abandoned river courses, sandy stretches (Bhurs) and the river canals themselves. This flat and unusual plain is rendered monotonous. The west portion of the plane consists of Ganga-Yamuna Doab which is moderately higher. The low-lying Rohilkhand plains unite to the east of the doab into the Avadh plains. The Avadh plains largest river is Ghaghara. The khadar of this river's is very high, as the river is passing through this area. It often changes its direction regularly.

(b) The Middle Ganga Plain: To the east of the Upper Ganga plain is Middle Ganga plain occupying eastern part of Uttar Pradesh and Bihar. It spans roughly 600 km east-west and approximately 330 km north-south, creating a combined area of approximately 1.44 lakh sq km. Its northern and southern boundaries are well defined by the Himalayan foothills and the Peninsular edge respectively. Its western and eastern frontiers were very unclear, and both sides of the Ganga plain had a large area, which gave it the character of the eastern-west continuum. There is no physical limit worthy of this name, and the plain opens up from the upper Ganga plain to the west imperceptibly and dies almost invisibly into the lower Ganga plain to the east. As such, the Ganga Valley represents a transformation area par excellence. However, there are many attempts to demarcate these intermediate zones of western and eastern boundaries. These boundaries are more widely accepted by 100 m in the west, 75 m in the north-east, and 30 m in the south-east. This is clearly a very low plain, not more than 150 m in elevation.

The Ghaghara, the Gandak, the Kosi and all the Ganga tributaries that come from the Himalayas drain this plain. These rivers fill the alluvial deposits at the foot of the Nepal Himalayas with 2.000 m deep troughs. They steadily pass across this flat land which has marked the region with local landmarks like levees, bluffs, oxbow reservoirs, marshlands, valleys, ravines and so on. The composition of the Kankar is relatively limited because of the khadar supremacy. Nearly every river continues to travel its routes and this region is vulnerable to regular flooding. In this sense, the Kosi River is very popular. In 1736, it flowed in the vicinity of Purnea, and now it is roughly 110 km west. Occasionally, in 24 hours the water level has raised by 10 metres. The 'Sorrow of Bihar' has long been renamed. This river is being tame by intense efforts both by India and Nepal. Ganga-Ghaghara doab, Ghaghara-GandakDoab and Gandak-Kosi Doab (the plain of Mithila) are the most important elements in this plain. The Son is the most important, with some rivers joining the Ganga from the south. . Here, in the east of Uttar Pradesh, the gradient is steeper than the 9-10 cm per km and in the Mithila plain just 6 cm per km. The Magadh Plain is to the east of Son River.

(c) The Lower Ganga Plain: The Purnea district of Bihar, the whole West of Bengal (excluding Purulia District and Darjeeling Mountain Parts) and much of Bangladesh are located in this area. It is approximately 580 kilometres away in the north from Darjeeling Himalaya to Bay of Bengal in the south, and approximately 200 kilometres from the Chotanagpur mountains on the western frontier to Bangladesh in the East. This plain consists of about 81,000 sq km of total area. His width varies considerably, and it is just 16 km from Bangladesh to Rajmahal Hills. The outline of 50 m is nearly the western edge. The sediment deposited by Tista, Jaldhaka and Torsa formed the northern part of this plain. In addition, the Duars (Darjeeling Tarai) and the plain of Barindcharacterise this region, the ancient alluvium tract between the Kosi-Mahananda corridor in the west and the Sankosh river in the east. About two thirds of the plain are in the shape of the Delta. It is the world's greatest delta. In the delta zone, the Ganga River breaks into many channels. The slope of land is just 2 cm per km. The surface area is 2/3 below the normal sea level of 30 m. If the sea level raised by just seven feet, the entire land up to Kolkata will be fully submerged. A broad variety of estuaries, mud flats, mangrove wetlands, sandbanks, beaches and forelands lies down against the seafront of the delta. The coastal delta is protected in a large part by massive, impenetrable tidal forests. The Sunderbans are named because here the Sundri tree is prevalent.

History of Indo Gangetic Plains

Indo-Gangetic Plain, also known as the North Indus Plain, stretches to the west (including) from the Brahmaputra River Valley and Ganges (Ganga), to the Indus River Valley, from the North Indian Plain, a large north-central portion of the Indian subsoil region. The region includes affluent and most populated regions of the subcontinent. Most of the plain is comprised of alluvial soil formed by the three major rivers and their tributaries. Weak rainfall or drought in winter arise in the eastern portion of the region, but in the summer rainfall are so extreme that large areas become swamps or freshwater lakes. The plain eventually dries to the west where the Thar (Great Indian) incorporated.

The Indo-Gangetic Plains are found in the states of Punjab, Haryana, Uttar Pradesh, Bihar and West Bengal and consist of two major drainage basins: the drainage basin Punjab and Haryana, and the drainage basin Ganges-Brahmaputra. The entire Plain is between 400-800 km wide and is now a sinking basin due to seismic changes in the earth. The land is highly fertile due to the nature of the Indo-Gangetic Plains, and is thus suitable for farming activities. Delhi, Lucknow and Chandigarh are some notable cities situated here. These regions are considered among the most extensively farmed in the whole world, consisting mostly of wheat and rice cultivation. Some other traditional crops are also found in these regions, however, such as cotton, corn, and sugarcane. The region has an incredibly high population density as a result of this expanded cultivation and almost 1 billion people actually live here. Dividing the entire area into 5 separate sub-regions. Regions 1 and 2 are spread around Pakistan, Haryana and Punjab, Regions 3 and 4 inhabit Uttar Pradesh, Bihar and Nepal and lastly West Bengal and Bangladesh constitutes of Region 5. The Indo-Gangetic Plains prime area means that the temperature varies from dry to mild climates. This means the city is having mild, humid, rainy summers and cold, dry winters. Monsoon rains which occur in this region most directly affect the climate.

Indus-Ganga Plains are large floodplains of the Indus, Ganga and Brahmaputra River System and are also known as the "Great Plains" (Meade, 2007). They pass from Jammu and Kashmir and Khyber Pakhtunkhwa, in the west and Assam in the east, paralleling the Himalayas and draining almost all of north and east India. The plains occupy an area of 700,000 km^2 and vary from several hundred kilometres wide in their range. The Ganges and the Indus rivers are the main rivers in this system and their affluent rivers includes Beas, Yamuna, Gomti, Ravi, Khambale, Sutlej and

Chenab.The Indus-Ganga belt is the largest contiguous alluvial expanse in the world created by the silt deposits of many rivers. The plains are level and largely treeless, and can be irrigated by canals. The region is also rich in supplies of freshwater. The plains are the most heavily agricultural regions in the country. The major crops planted are rice and wheat which grown in rotation. The corn, sugarcane and cotton are also some of them. With a population estimate reaching 400 million, the Indo-Gangetic plains are among the most heavily inhabited regions of the planet.

Population density in IGP

The preservation of the Indo-Gangetic Plains is crucial due to the extremely high population density in this area. The impacts of climate change will vary from region to region due to the structure of the population in each area. The areas that have a higher population density are more easily impacted by changes that occur as a result of climate change. Out of all the regions, Uttar Pradesh has the most cities with very high population density. These levels of high population density can also be seen in West Bihar and West Bengal (Roy Chowdhury *et al*., 2012).

The Indo-Gangetic Plains are amongst some of the most heavily populated areas and agricultural areas in the whole world. This must be taken into consideration when making decisions to solve the problems caused by climate change in these areas. It also makes it more difficult to identify the areas which need the maximum support.In the end, the most populated areas of Bihar, Uttar Pradesh and West Bengal were found to be the most susceptible to damage and the most vulnerable to climate change (Roy Chowdhury *et al*., 2012).

Correlation of population with soils, climate and water availability in IGP

The geography of the Indo-Gangetic Plains is heavily associated with tectonic activity that occurs in the Himalayas. As well as that, the climate of the Himalayas also has an impact on the fertility of the soil, water patterns and therefore harvest quantity and quality at the Indo-Gangetic Plains. Research done in this area indicates that there will be increased rates of evaporation and an increase in humidity due to the warming of the planet. Onetheory put forwards is that the heat in the air means water will be retained for longer periods of time which as a result will decrease precipitation. Alternatively, some research suggests that this is not the case and climate change will lead to an increase in precipitation. Additionally, it is thought that the increase in temperatures will result in the melting of existing glaciers in the Himalayas – this will inevitably lead to an increase in precipitation. As these glaciers melt, the ice will turn from snow to water and fall as precipitation. Another issue faced by the population of this area is the salinity of the soils, especially in Uttar Pradesh, Haryana and Punjab (Patil *et al*., 2014). A rise in temperatures is likely to exacerbate this salinity and cause it to spread to surrounding areas as well. Moreover, the carbon content within the soil must be considered. The higher the levels of carbon in the soil, the better the physical properties of the soil – it helps the soil by binding various particles within it. This factor is inversely related to vulnerability.

Overall, there was quite some variation in the maximum and minimum temperatures in this area. In one particular study, the rate of change of maximum temperatures was higher in the South of Uttar Pradesh and the rate of minimum temperatures was higher in the Northern part of Uttar Pradesh. This variation in temperatures is likely to have a great impact on the level of agriculture in these areas (Saini, 2008).

Sustainability of population in IGP in future

Unfortunately, climate change is not the only threat to the survival of the Indo-Gangetic Plains in the future. This area also experiences increased stress on resources due to heavy usage of resources found here- these include water, land and agricultural resources. As a result, the Indo-Gangetic Plains face many threats: both from climate change in addition to overdependence on resources from a growing population.

There are 2 main situations in which the future of the Indo-Gangetic Plains is most likely to follow. Firstly, a situation where the water supply increases and another where the water supply will diminish. In the first situation, this increase of water may lead to the erosion of landforms around the Himalayas. In this case, preventive measures may need to be taken in order to combat this increased erosion. On the other hand, the approach may involve buildings dams or reservoirs to collect water and store it for future use. Another factor to consider is the productivity of agriculture (grains and other crops). The productivity of crops is calculated by considering the mean volume of crops produced once in a crop season in the year. It has been researched that the relationship between vulnerability and productivity is inverse (Gornall *et al*., 2010). Therefore, as vulnerability of the Indo-Gangetic Plains increases, the productivity of crops is likely to fall. This will result in a less sustainable future for this region. Looking at the study, productivity was the highest in the East of the Indo-Gangetic Plains and decreases as you travel West.

Adapting after studying the impacts of climate change can severely reduce the negative impacts on the population and can lead to a more sustainable future. The Indo-Gangetic Plains are particularly vulnerable due to their location in India, which is a relatively poor country and has limited resources to solve these problems.

Climate Change and Associated Hazards

One of the main concerns about climate change is whether precipitation in a given region will decrease or increase. This will determine if the potential risks are caused by excessive water availability or water scarcity. The traditional model indicates that heating will lead to an increase in evaporation and humidity. But the warm air maintains that water will delay and slow the precipitation for a long time. On the contrary, recent studies have shown that global warming can increase the precipitation by around 20% (Wentz and Schabel, 2000, Wentz *et al*., 2007). If precipitation and temperature change, both the IGP which can be nucleated in the Himalayas and the IGP can be anticipated to be quick as well as slow hazards. The increased precipitation is likely to be accompanied by rapid hazards such as flooding and erosion as well as the decreased flow in rivers will result in slow risks such as soils salinisation, Desertification, ground water subsidence, shrinkage of water bodies and diminished flow in rivers and drought. The bounds of the terrestrial forms, land water and vegetation may both change. The main concern is about how

and when these variations will occur in the land and water systems in IGP. Research has shown that short-term and long-term climate driven shifts can be expected on vegetation and river systems (Mol *et al*., 2000; Veldkamp and Tebbans, 2001; Boggart *et al*., 2003). Within the structure of IGP, certain shifts in the last interglacial phase (i.e. 25 ka) must be investigated so as to decide how the soil, ecosystem and hydrological processes were impacted by a decline in and a rise in the water flow to IGP. At first, the warming may lead to glaciers and snow melting in the Himalayas and a shift in precipitation mode from snowfall to rainfall. The supply of water would increase the degradation of the Himalayan land and the creation of waste that will increase the valley's sediment content. The hypsithermal occurrence of the Holocene is about 8-6 ka BP, was an example to demonstrate this condition in the past, when flood erosion filled regoliths up to 80 m in valleys, which were then eventually transported downstream (Pratt *et al*., 2002). However, to complete the loop takes a few hundred years unless there is an answer time to adapt to the current conditions for landscape components and geological organisations. The IGP and its river valleys can adjust to changing sediment load, river flow speed and discharge conditions. The social and agricultural needs, water management and extraction practises are typically suited to the current monsoonal climate and suited to river flow and sub-surface aquifers' seasonal behaviour. After having debuted the alluvial plain, due to its inclining topography and loose lithology the Piedmont zone would be the first target of river erosion. The gully erosion, which is potentially increased at the rapid flood rate contributing to the prolongation of badlands and depletion of the forest land has already affected it. Further downstream, deposition of fresh sediment layers can occur in the lowlands in the central alluvial plain, where slopes are milder. Indeed, during the earlier wet interstadial cycles in the Late Quaternary, the highest degree of sedimentary development existed as mega-fans along the Himalayan front and as deposits in rivers and inland waterways. On either side of the Himalayan mountain-fed rivers, the lowlands are several hundred metres to more than 10 kilometres long (Shukla *et al*., 2001, Kar *et al*., 1997). Over fine textured soils, the proximity to the seasonal source of water as well as the fresh consistency in shallow ground waters, however, these areas are favoured for agriculture.

They are stable surfaces, through the course of centuries of practise the culture pattern has evolved. Fresh sedimentation because of changes in the river's hydrodynamics will shift the land in this aspect and potentially impact the cultivation type. The western portion of the IGP is reduced in the second example, as precipitation is limited.

In the second level, the western portion of IGP is diminished as precipitation is reduced. Haryana-Punjab, adjacent to the Thar desert, is now the most vulnerable sector because it is a poor place with a history of drought and desertification. The desertification process of the Delhi region has been roughly 16 ka BP with the formation of broad dunes (Glennie *et al*., 2002), and numerous damp and semi-arid bursts (Enzel*et al*., 1998; Saini *et al*., 2005). These plains are susceptible to climate changes much less and respond even faster than the middle of the desert. The rainfall at the eastern side of Thar in the latitude of Delhi is about 300 mm and 600 mm. If we believe the rainfall reduces by 300 mm, the average decrease will be 50 percent, which will turn the region into a dry zone. The climate zones of Ganga plain, east of Delhi, with precipitation ranging from 600-1400 mm, will not be affected by a 300 mm drop in rain and will have negligible consequences. In the light of past incidents, the Haryana-Punjab plain is becoming crucial. This was formerly part of the popular Indus culture, when Ghagghar-Hakara the Harappan culture prospered. The fact that a significant population remains in these plains testimony to the hundreds of cultural mounds spread in northwestern Haryana and southeastern Punjab. However, increased aridity, drought, soil salinization, and desertification are listed as possible cause (Mishra 1984; Sahai, 1999). The precise cause of the breakdown of civilization is disputable. The decline is measured at approximately 200BC. In this area, there is a the publicity about the presence of a mighty river called "Vedic Saraswati," which streams from the Himalayas into the Arab Sea and was subsequently lost to climate change and tectonic turbulences (Wilhelmy, 1999; Oldham, 1999; Roy and Jakhar, 2001). While it remains to be defined a full chronology of events and reliable data for the cause of civilisation and the Saraswati River, the region has obviously undergone medium- to large-scale vegetation shifts, and temperature fluctuations, which appear to be one of the major factors. In the event of a future decline in rainfall, the Thar desert will extend across this area, change the landscape and make the land uncultivable.

Even a temperature increase of up to 20^{o}C can result in a 4 to 34 percent drop in farm output (IPCC, 2007). The already prevalent soil salinity in the plains of Haryana, Punjab and western Uttar is expected to spread to the slightly salty regions, thus reducing agricultural land supply. The already diminishing water level would be strained. Soil water extraction will likely be increased, which would contribute to water shortages in the stressed regions. This can lead to a change of the habit of the river from the gainer to the Yamuna River donor in Faridabad, U.P.

Conclusion and Future Prospectives

It is difficult to predict how exactly the warming will affect people in different regions of the globe. In the IGP changing environments have the potential to decrease the productive capabilities. There may be two types of problems we need to deal with: rising water supply and declining water supplies. Modeling IGP behaviour, in abundance and water deficits, is a potential solution. We should search for analogues from past years based on changes in the atmosphere of the last 25Ka Himalayan time frame and IGP and examine past reactions of ground, water and vegetation to these modifications. The aim is to gather, assemble and synthesise basin-specific stratigraphic data, rainfall proxies, and temperatures in order to redefine the dynamics of monsoon changes in time and space. This will aid in developing and evaluating potential landscape models for changes in environmental patterns and in recognising areas as vulnerable to multiple forms of hazards. On the basis of these inputs, water management strategies could be tested and suitable crop pattern adjustments as well as new land use approaches and irrigation techniques created.

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