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REVIEW PAPER

Impact of Climatic Changes and Global Warming on Water Availability

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Abstract: The present study was performed to review the past 20 years literature regarding the impact of global warming and climatic changes on water availability, its quality/quantity/yield and consequent effects on nutrients, freshwater and biota. Water resources are susceptible to changes in climate. The water holding capacity of the atmosphere has increased with the rise of temperature. Global warming will cause increased sea levels due to the spreading of oceans and melting of glaciers. The flow of affected freshwater into the oceans will cause variations in stratification, nutrient availability, salinity, and turbidity, which will affect tourism, agriculture, and industry. The total amount of organic carbon availability varies from winter to warming, and there are also changes in enzymes' activities. There is a vast shift in rainfall due to climate changes. The intense precipitation, runoff, erosion, and transfer of a vast number of pollutants into the groundwater affect drinking water quality. Many organisms such as animals and plants spread to other regions, so the biological composition of natural ecosystem agriculture is modified. We cannot measure these complicated processes precisely, yet we roughly estimate these processes through the extinction of species and variation in productivity. The temperature has a pronounced effect on the distribution of various species in different geographical regions. Warming shows an impact on interspecific and intraspecific interaction. It also has an impact growth period and yield of crops. The use of future climate models enables us to understand the environmental issues and future climate changes thoroughly.
Keywords: Temperature; Water resources; Ecosystem; Pollution

1. Introduction

Water is a necessary element of life. Resources of water are directly related to climate and are greatly sensitive to climate change (Döll, 2009). Impact of human activities causes the exacerbation of the effects of climate change phenomenon, variations trend intensity and changing the period of climate changes sequence (Sameenezhad et al., 2014). The changes in climatic events, mostly precipitation and evaporation handled by the atmosphere's processes, cause changes in water resources' hydrological properties (Nováky). A sufficient water supply is required for all living organisms' survival; for that reason, our planet is called a blue planet. It is well known that most of the parts of our earth are occupied by water. About 2.5% is fresh water present in deep groundwater and glaciers, and only a minute amount of water is readily available (Chen and Xu, 2005). Freshwater is required for irrigation, recreation, drinking, industry, transportation, and fisheries (Fataei et al., 2010; Fataei et al., 2011). Marine and terrestrial biodiversity were reduced at a slow rate compared to freshwater biodiversity, according to investigations carried about 30 years ago, which impart negative feedback in the future (Zabel, 2016).

In recent decades, climate change, dam constructions, unsustainable industrial development and excessive exploitation of groundwater for agriculture have been the main cause of drying of Lake Urmia. It has been proven that in the case of lakes drying up, this change has an effect on the global climate (Valiallahi et al., 2019).

By keeping in view the importance of water for life, the present review focuses the water availability and its direct link with global warming; the effects of global climate change on water availability in different biota. The purpose of this review is to gather research from all over the world in the past twenty years about the effects of climate change and global warming on water availability. This review will help to understand the dire need for steps that must be taken about global warming.

2. Materials and Methods

Current studies are focused on reviewing the literature regarding the impact of global warming on water availability. The reported studies were consulted to discuss and evaluate water and climate, climate change and hydrological cycle, and global warming effects on water quality/quantity/yield, nutrients, freshwater, and biota. The studies also demonstrate the effects of water availability on an ecosystem and climatic changes on water availability.

The impacts of climate change and socio-economic driving factors (derived from the IPCC's A2 and B2 scenarios) on potential global water stress are studied using a global water model (Alcamo et al., 2007). Bates et al., in their book, have linked data from different works published about climate change with water availability and water stress (Bates et al., 2008). Along with digitized river networks, numerical studies integrating climate model outputs, water budgets, and socioeconomic data are being conducted (Vörösmarty et al., 2000). Richardson and their fellows collected lake thermal profile data from various sources, including provincial and state agencies throughout the temperate deciduous forest region of northeastern North America (Richardson et al., 2017).

3. Results and Discussions

Water and Climate

Water is found on earth in many different forms, such as groundwater, lakes, rivers, and soil moisture (Walther et al., 2002). Water availability is essential for economic activity, human health, geophysical processes, and the ecosystem's working. Climate change causes the most significant changes invaluable and excess water availability and has threatening effects (Shiklomanov, 1990). The essential climatic parameter is retaining the time period of water in the ocean and atmosphere (Milly et al., 2005). Hydrological retaining time period undergoes dramatic short-term water level changes mainly in the freshwater system (high surface to volume ratio) (Alcamo et al., 2007). The water holding capacity of the atmosphere is increased with the rise of temperature; approximately 4 % of water is increased with the rise in 10ºF temperature (Bates et al., 2008). Various physiographic situations occur in the coniferous forest and elevated rangeland (Arnell, 2004). Affected fresh water is poured into oceans causing variations in different parameters such as stratification, nutrient availability, salinity, and turbidity (Vörösmarty et al., 2000). Hypoxia frequency rises when the Mississippi river discharge increases. When the inflow of water is reduced in little lakes, the dissolved organic carbon concentration is reduced. Water becomes transparent, resulting in more solar radiation absorption and an increase in thermoclines. More transparent lakes have higher near-surface warming and more significant increases in thermal stratification strength than the less transparent lakes. Figure 1 represents the lake thermal profile data from different sources (e.g., research stations, state and provincial agencies) throughout the temperate deciduous forest region of northeastern North America, from Maine to Pennsylvania, USA, and southern Ontario, CA (Richardson et al., 2017).

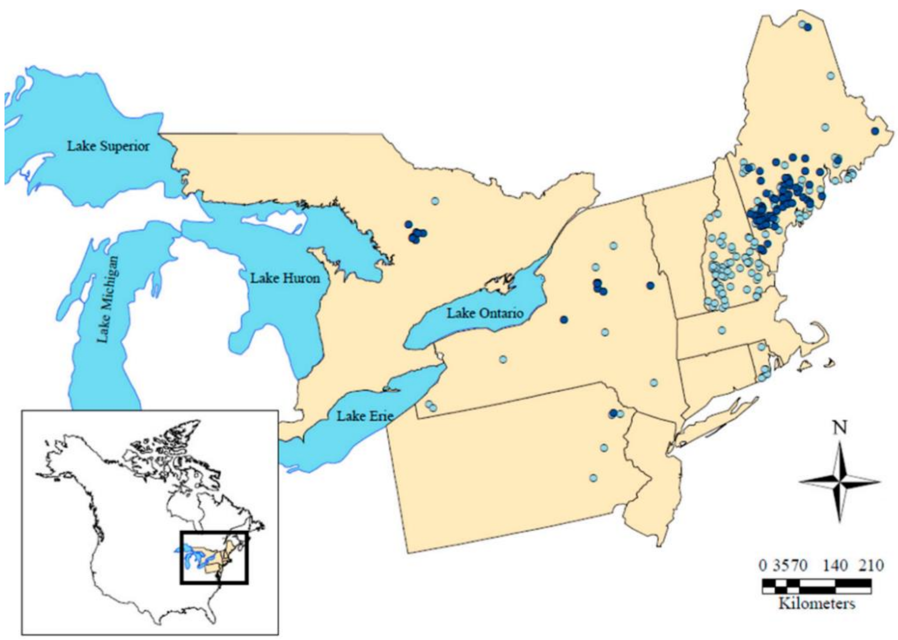

Figure 1: Location of study lakes for the northeastern North America (NENA) study. 1975 and 1985 cohort of lakes are represented as dark blue (n = 85) and light blue (n = 226) circles, respectively (Richardson et al., 2017)

The drinking water rate becomes high due to the diseases caused by pathogens in the environment (Lake, 2003). There are very few control and management systems to ensure the availability of drinking water. Global warming enhances changes in both regime seasonal runoff and variability inter-annual runoff; these are essential for water availability as variability occurs in average annual runoff (Vörösmarty et al., 2000).

Lakes are critically essential sentinels of climate change. However, the lake features, through the regions, e.g., trophic status, geography, geomorphology, mixing regime and transparency, etc., help in moderating the magnitude of the signal through climate change. Temperatures at the lake water surface are continuously being increased worldwide, highlighting the concerns about the lake ecosystem's future integrity. Homogeneous warming of lake waters is most significant in polymictic lakes, where frequent mixing distributes heat throughout water bodies (Richardson et al., 2017). There must be the use of various models in order to study and predict the concentration of greenhouse gases in the atmosphere. The use of various future climate models enables us to provide a complete understanding of these issues and future climate changes (Huntington, 2006).

Availability of water is essential for economic activity, human health, geophysical processes, and an ecosystem's working. Air is saturated with water vapor pressure, which depends on temperature and perturbations of the global water cycle due to an increase in global warming (Carpenter et al., 1992). Regional variables that are changed by global warming cause complications in hydrological cycles (Bates et al., 2008).

Climate change; the changes in the earth climate over long periods of time; mainly occur when the atmosphere's temperature is changed. Water resources and crop production suffer a lot due to climate changes, and it is a burning issue in the 21st century (Ficke et al., 2007). There is a significant relationship between agriculture, water, energy, and climate changes. It can never be denied that climate change has the worst effects on water availability. About 50% of freshwater is received from snowmelt and mountain runoff. Climate change causes threatening changes invaluable and excess water availability and quality (Xenopoulos et al., 2005). Drinking water quality and quantity are declined because of the municipal sewer system; glacier mountains are threatened, and it causes an increase in sea level. Climate warming enhances the melting of ice, converting freshwater into seawater; it has little effect on water supply (Araújo and Luoto, 2007). According to the United Nations Environment Programme, it should be highlighted that increase in population causes more requirements for agriculture.

As a result, a large amount of water is needed for irrigation which in turn increases pollution. Generally, it is estimated that greenhouse gases' rise badly affects the hydrological cycle (T. P. Barnett et al., 2005). The hydrological cycle is also known as the water cycle that tells us about water flow the earth surface. About 97% of water is stored on our planet, and 0.001% in the atmosphere and the rest of the water is stored in ice caps, snow, and underground surfaces. In the hydrological cycle, water is exchanged between continents and the ocean. Because of that, it is termed the global hydrological cycle (Chahine, 1992). Due to the evaporation of oceans, the precipitation level is increased, contributing to the rise in the precipitation over land ratio. As a result, the large amount of water is transferred back as runoff (Oki and Kanae, 2006). Global warming, the elevated temperature of the earth because of increased greenhouse gases in the troposphere, significantly impacts water availability. Human activities release a large amount of CO_2 into the atmosphere. As a result, the temperature is increased from 2.6 ºC to 4.8 ºC (Zhu et al., 2017). The modification in the freshwater ecosystem is related to spatial and temporal scale because this effect is measured. It is known that global warming, which is one of the prime causes of climate change and very harmful for the freshwater organization. It is estimated that the worst adverse effects of global warming will arise in future for example heat stock through which longer drought or flooding will occur. Hydrological retaining time period may undergo dramatic short term changes in water level mostly in fresh water system (high surface to volume ratio) (Schindler, 2001).

Due to the increase of solar radiation and decrease of water level, the temperature is increased. As a result, aquatic life as fishes, phytoplanktons, corals, reefs, and other biota are badly affected by these changes, and tolerance factor becomes low, leading to the change of complete organization freshwater (Winder and Schindler, 2004). Due to the water system's increased temperature, cyanobacteria's unwanted growth will occur, so irrigation and drinking water become toxic, so there must be a planned system for the utilization of water (Wagner et al., 2016).

Climate change and hydrological cycle

Climate is the earth's variation over a long time, mostly when the variation in temperature of the atmosphere has occurred. Anything that causes changes in the incoming and outgoing solar radiation and energy distribution in the atmosphere, land, and oceans will change the climate (Houghton et al., 1992). Increased greenhouse gases in the atmosphere will affect the parameters that contribute to cool and warm biz on the earth's surface. The amounts of each greenhouse gas will cause the climate's direct warming and consequent adverse effects on temperature, density, wind, particle count, and precipitation (Change, 2014).

The hydrological cycle is the water cycle that tells us about the flow of water throughout the earth's surface. The hydrological cycle starts with water evaporation from the ocean surface; when the moist air rises, vapors condense to form clouds (Chahine, 1992). When water comes on the ground, two types of mechanisms occur; one is that a small amount of water is transferred back to the air, and other water is absorbed by the earth's surface and acts as groundwater. To attain equilibrium, the water moves towards lakes and rivers and again moves back to oceans, and the process is repeated several times. When the hydrological cycle performs its work efficiently, the best out is snowfall (Lettenmaier et al., 1999). Conversion of energy in the water cycle leads to a change in temperature. Water absorbs energy from the surrounding during evaporation, and a cooling effect is observed. When water condenses, it gives off much energy. As a result, warming occurs, directly affecting the climate (Ramanathan et al., 2001).

Climate change is the long-term seasonal variation due to an increase in greenhouse gases in the atmosphere. Water flows throughout the planets in different paths; it is a complex mechanism called the water cycle (Vörösmarty et al., 2000). Climate change has many observed effects on the hydrological cycle; these effects include varying the amount, timing, quality, and allocation of accessible water. Water availability affects various activities of the organism (Bala et al., 2008). The water cycle activity is changed as the climate cycle changes, such as climate become warmer when a large amount of water is evaporated from the reservoir. The water holding capacity of the atmosphere is increased when the temperature is raised; approximately 4% of water is increased with the rise in 1ºF temperature. Worldwide observation shows that global warming's adverse effect is increased sea level based on two conditions one is spreading of oceans due to warming; secondly, the water level rises by melting glaciers. An alarming situation for an ecosystem's infrastructure is that salt water is added to freshwater used for an aquifer. To overcome the salinity, we have to use some specified energy techniques (Held and Soden, 2006). Conferring to Intergovernmental Panel on changes in Climate, the rise in the level of greenhouse gases; significantly carbon dioxide increases the temperature of the atmosphere, which produces warming due to this outgoing level of infrared radiation is increased; it also results in the rise of temperature of earth and change in hydrological activity (Trenberth, 1999).

Impact of global warming on water quantity

Due to the dramatic increase in human activities hydrological cycle and climate are badly affected; the availability of resources in the geographical region is reduced, especially in the Mediterranean parts. As a result, severe water availability changes are observed because of the reduction in precipitation and heavy rain patterns. The lack of equilibrium between the water availability and its usage causes drought and may affect water resources' stability (Scanlon et al., 2007). Their outcomes are many folds and directly affect the economic session, including tourism, agriculture, and industry. Due to hydrological imbalance in the chemical composition of water-accessible systems, there is a scarcity effect on river basin(Piao et al., 2010). Water that moves closer to the surface has a greater quantity of nutrients and pollutants; this amount is exceeded because of anthropogenic activity and simply by low diluted water. This is mainly related to several arid and partial arid river organizations (Navarro-Ortega et al., 2012). Figure 2 shows changes in annual surface soil moisture per year over the period 1988 to 2010 based on multisatellite datasets. Surface soil moisture exhibits wetting trends in the Northeast, Florida, upper Midwest, and Northwest, and drying trends almost everywhere else.

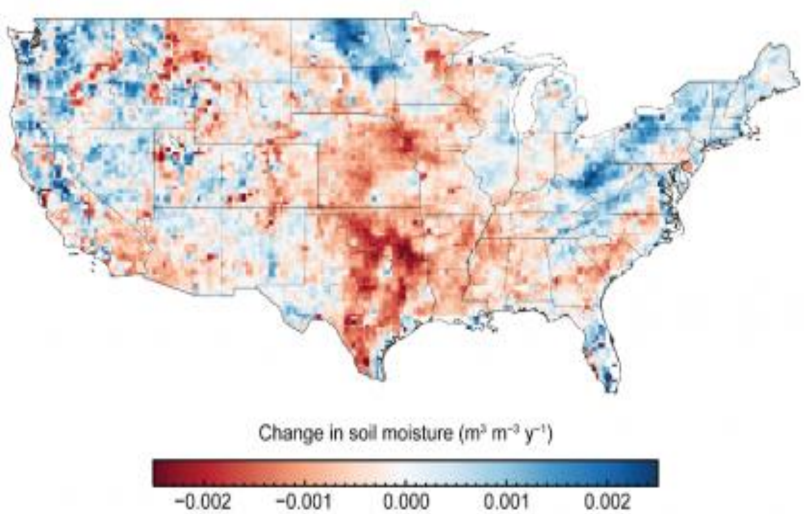

Figure 2: Annual surface soil moisture trends from 1988-2010 (El Sharif et al., 2015)

Effects of global change on water yield

In the next few years, it is indicated that there will be a temperature rise, but precipitation will change from one region to the other. On crop productivity, different climate change effects are related to the water yield and water soil balance (Jha et al., 2006). Various physiographic situations are presented in the coniferous forests and high rangeland. Time series input data and global change scenarios are statistically measured by soil water assessment tools (Middelkoop et al., 2001). The most influential water yield parameter is precipitation and temperature or water flow timing (Adam et al., 2009). Water yield is also slightly affected by carbon dioxide, humidity, and radiation (Stonefelt et al., 2000).

Impact of global warming on water quality

There is a reduction in the tolerance capacity of freshwater as the flow of water is diminished. The water input is essential to evaluate the amount and history of pollutants in rivers and lakes (Schindler, 1997). The recent climatic warming has resulted in marked regime shifts in the biological communities of many Arctic lakes and ponds, and high-latitude regions are particularly sensitive to these threatening effects. Important drivers of these limnological changes include the changes in the deltas, and extent and frequency of spring floods in rivers and lakes, and the duration and amount of ice and snow cover. Other alterations include the disturbances in evaporation and precipitation ratios, significant changes in the quantity and quality of river and lake water because of increased inflows of glacier melting from permafrost, and decreased percentage of precipitation as snow. UV radiations prove damaging as they deplete stratospheric ozone over the north and reduce many Arctic lakes' turbidity.

Likewise, transport of pollutants occurs at a long range, and biomagnification in food chains leads to prominent concentrations of many persistent pollutants, either organic (e.g., insecticides) or metallic (e.g., mercury) in nature. Rapid industrialization, increased human population, metallurgical activities (mining of diamonds, metals, etc.), constructions of roads, seaports, and hydroelectric dams stress the northern aquatic ecosystems. Cumulative effects from these stresses are more severe than the changing climate only (Schindler and Smol, 2006). When the water movement is decreased in little lakes due to anthropogenic activities, then the absorption of solar radiation increases, which results in rising thermoclines. Precipitation of chemicals and pathogenic activity rises because of more excellent retention time and solar radiation. When thermoclines, warmer water, and ice-free periods rise, heat capacity will be increased (Schindler, 2001).

Effects on the quality of drinking water

As the population dramatically rises, the water flow becomes reduced, which minimizes the quality of drinking water. When urbanization changes, then it changes the quality of water (Wood et al., 2004). The inflow of industrial effluents to oceans is increased on a large scale, where they impart worse effects on the drinking water. Large quantities of fertilizers are used in the agricultural field for the treatment of erosion and wetlands. In the past, virulence pathogens (e.g., *Escherichia*) were a significant issue in all the fields, including meals and water (Delpla et al., 2009). Elevated pathogens level has led to several species' death because it has more significant potential to cause disease. Many people think that that this problem is dealt with by using chlorination technique more for the availability of better drinking water, but that is not true; the side product that is produced with the protein have various drastic health effects such as mental disturbances, cancer of the bladder (Cantor, 1997)and developed stress (Delpla et al., 2009; LeChevallier et al., 1981). Gastrointestinal diseases are produced on a global level by *Cryptosporidium parvum* (Maass et al., 1962). The rate of drinking water becomes high due to these diseases caused pathogens in the environment diseases. There are the least control and management systems for the availability of drinking water (Schindler, 2001).

Effect on nutrient Cycle

With the increase of global warming, the soil composition is also changed due to the rise of mean average temperature. The total amount of organic carbon availability varies from winter through summers, although drought changes soil activity leads to the change in activities of the enzyme. The process of nitrification well handles a temperature rise. Warming drastically affects the variability of water availability (Qin et al., 2010). There are seasonal changes in the quality of water which in turn affect the nutrient cycle. A maximum mineralization quantity is achieved by elevated temperature and the amount of nitrogen, phosphorus, and organic matter. Due to the intense precipitation runoff, erosion, and many pollutants transfer into the groundwater, and drinking water availability becomes affected (Delpla et al., 2009).

Impact of global warming on groundwater

The distributions of groundwaters are dramatically changed by global warming. In dry conditions, the groundwater sources become reduced (Eckhardt and Ulbrich, 2003). Mainly reduction in the alkalinity is observed, which leads to a rise in acidic levels through precipitation in lakes. Its effects are dramatically increased in contrast downstream lake; it increases the sources of chemicals because drought enables groundwater to remain in contact with sediments. The direction and magnitude of water chemistry are evaluated by path flow chemistry substrate, and critical model processes are used (Taylor et al., 2013). However, groundwater comprises a smaller percentage of total earth water, and it is the primary source of water for over 1.5 billion people worldwide. The extinction of groundwater may be an alarming threat to agriculture irrigation, enhancing the buildup the salt in soil (Green et al., 2011). Figure 3 shows the impact of climate change on renewable groundwater resources by the 2050s, for a low emissions scenario. The map also shows the human vulnerability index, which is only defined for areas where the groundwater recharge is projected to decrease by at least 10% relative to 1961-1990.

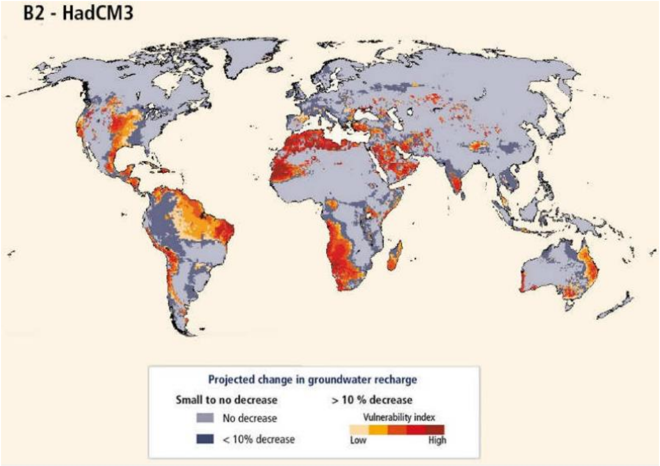

Figure 3: Impact of climate change on groundwater resources by the 2050s (Change, 2014)

Impact of global warming on freshwater

There are many effects of climate change, but fluctuation in the freshwater ecosystem's composition is more pronounced (Woodward et al., 2010). Some effects are that river, and lakes' level surface temperature reaches an elevated point at a higher altitude. At a sizeable intense lake, the hypolimnetic temperature will rise, ice cover on the lake will decrease. Glaciers melt and cause change regime discharge and downfall of pollutants and solute concentration into the water surface (Ficke et al., 2007). Trends will be preceded similarly, and it is predictable that; there is variability in regime flow of rivers concerning changes in intensity, quantity, seasonality, and allocation of precipitation, it caused an increase in the flow of sediments, pollutants and nutrients downfall to the coastal region, variation in evaporation, dynamic flooding and rainfall; it leads to the changes in composition, functions, structure, distribution and water retention time in wetlands (Schindler, 1997). Little lakes in a high global warming period may be diminished, but streams' movement becomes interlinked with lakes and even saline. Climate change has a profound outcome of restoring rivers, wetlands, streams, and lakes regarding its effects on nutrient cycle, temperature, and hydrology (Collins et al., 2010).

Impact of global warming on biota

Humans are directly related to the biosphere for the sake of survival. The impact of climate change has a significant influence on the ecosystem. Many organisms such as animals and plants migrated to other regions to attain a favorable environment because of global warming. As a result, natural ecosystem agriculture's biological composition is modified, and range variation and effect on pathogenic organisms (Araújo and Luoto, 2007). We cannot correctly measure these complicated processes, but we roughly estimated these processes by the extinction of species and variation in productivity. However, these changes will be secured if rapid measures are adopted. Another biota affected by climate change is a hardly worse condition due to a reduction in habitats (Minville et al., 2010). The temperature has a known effect on the allocation of various species in the different geographical regions and the rates of growth and nutrient competition (Kareiva et al., 1993). Warmer water causes the toxicity of organisms and rises in the out brakes of algal bloom. The above discussion on the global warming scenario is not well investigated, but warming modifies the aquatic organization and its impacts on interspecific and intraspecific interaction (Pearson and Dawson, 2003).

Climate change and water availability

Global warming plays a vital role in modifying the hydrological cycle in various parts of the world through weather shift in water movement without any consumption of water holding capacity; these modifications will cause water shortages (T. P. Barnett et al., 2005). So it is observed that that reduction of runoff and the resources of water availability is predictable mainly in the parts that at current climate have little resources and most of the time affected from shortage problem; there organization of precipitation in recent time in many parts of the biosphere causes the decrease of water flow near to the land in warm conditions and increases during cold conditions and perhaps to rise of severe peak discharge in most of the regions of the biosphere the soil moisture will be minimized in warm conditions which would cause to greater frequency of droughts (Urama and Ozor, 2010).

High temperature and increase of variability of rainfall would lead to raising irrigation demand for water availability. The effect of climate change on the ideal growth period and the maximum yield of water is utilized. Global warming enhances changes in both regime seasonal runoff and variability inter-annual runoff. These are essential for water availability as variability occurs in average annual runoff (Christensen et al., 2004). Global change emphasizes the water management committee's critical challenge by taking the initiative in future hydrological properties. Water managers should need to adopt a scenario-based technique that can be easily practiced in all biosphere regions (Arnell, 1999). There is a need to focus on a change assessment and evaluation initiative concerning the policy framework for the effective development of global hydrologic cycle adaptation. This study emphasizes global climate action on river basins to integrate the global researcher's idea to demonstrate a peculiar adaptation technique(Change, 2014).

Humans are an interactive part of the biota ecosystem; they respond to change in the fresh water reservoir, causing dramatic change. The positive feedback of climate change on water availability is only attained when human-induced greenhouse gases concentration should be declined (Grafton et al., 2013). Figure 4 compares the expected percent change in water demand in the US from 2005 to 2060 with and without climate change. ‘With climate change’ indicates a scenario where current greenhouse gas emission trends continue and ‘without climate change’ indicates a scenario where greenhouse gas emissions are reduced.

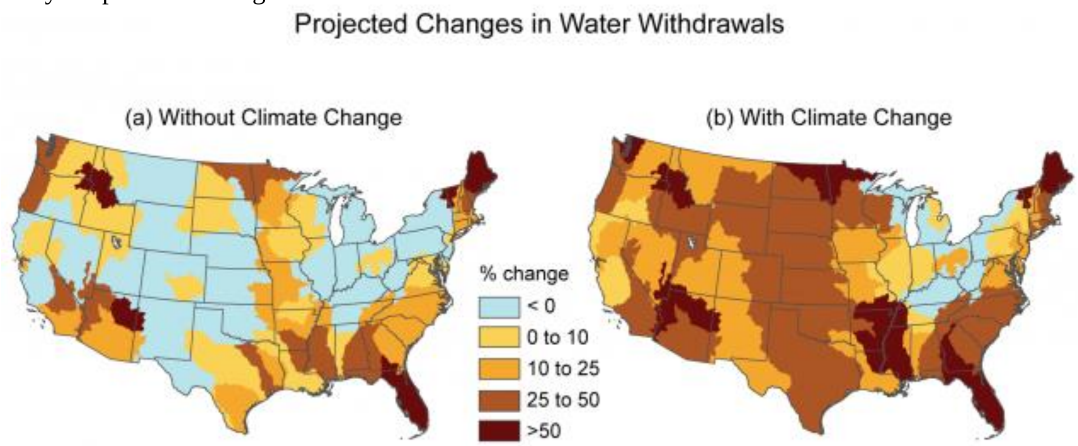

Figure 4: Projected water demand from 2005 to 2060 (Pryor et al., 2014)

Water availability and its effects on an ecosystem

Changes in the rate of evaporation affect the availability of water. Elevated temperature accompanied by appreciable variation in precipitation results in a more significant requirement of irrigation water. The precipitation rate would be the same in the whole season, and then there is a greater concentration of atmospheric carbon dioxide (Change, 2001). At the global level, no such tool was utilized that quantify the change of climate concerning water irrigation; the influence of climate change on optimum period of growth and yield of irrigation water has only been assumed (Stakhiv, 1998).

Among all the ecosystems of the world, the freshwater ecosystem occupies larger distribution of organisms. It is an alarming situation for the entire organisms to be extinct due to change in the climate. The cold or snow-dominated river basin and freshwater ecosystem are affected due to fluctuations occurring in water flow (J. Barnett and Adger, 2007). Affected freshwater moves into oceans; it will cause variation in different parameters such as stratification, nutrient availability, salinity, and turbidity. Hypoxia frequency rises when the Mississippi river discharge increases. River discharge reduces due to reforestation and climate change, but there is a vast rainfall shift due to climate changes (Morton, 2007). Freshwaters in different regions demonstrate many differences and similarities in their responses to climatic warming. Comparison is based on reports from regional committees and long-term records for several sites where climate warming has been observed during the past two decades.

Additionally, other human adaptations to freshwaters also simulate some of the expected results of climatic warming. Palaeoecological studies of freshwaters may also be considered under climatic warming, and differences in communities were also of interest under different climatic regimes. Physical, chemical, and biological variations in lakes occur majorly. It is essential to consider land-water interactions and a link between climatic warming and human stresses to predict climate change lakes' effects (Schindler, 1997).

Future Aspects

Greenhouse gases concentration in the atmosphere will rise continuously from the billions of tones by anthropogenic emission (Leavesley, 1994). These concentrations are increased due to rise in earth surface temperature, influence the amount of precipitation, snow cover reduction (permafrost), increased sea level increase in acidity of oceans, alteration in ecosystem properties, and alarming threats to human health (Bellard et al., 2012). There should be environmental, water, and reserve promotion to confirm the receiving quality, quantity, and timing to strengthen their ecological working and their services to society (Waggoner, 1990). In order to study and predict the greenhouse gasses concentration in the atmosphere, we must use models. The use of various future climate models enables us to provide a complete understanding of these issues and future climate changes (Jackson et al., 2001).

Conclusions

Regional variables that are changed by global warming cause complications in hydrological cycles. Global warming is one of the major causes of climate change and very harmful for freshwater organizations. It is estimated that the worst adverse effects of global warming will arise in the future, for example, heat stock through which longer drought or flooding may occur. The activity of the water cycle is changed as the climate cycle changes. Global warming's adverse effect is the elevation in sea level due to the spreading of oceans and melting glaciers by warming. The quality and quantity of fresh water in different regions demonstrate many differences and similarities in their climatic warming responses. Many of the fluctuations in lakes and streams are due to climatic warming on terrestrial water bodies. The distributions of groundwaters are dramatically changed by global warming. The more pronounced effect of climate change is the fluctuation in the composition of the freshwater ecosystem. Humans are directly related to the biosphere for their survival. The impact of climate change has a great influence on the ecosystem. Many organisms such as animals and plants migrated to other regions to attain a favorable environment because of global warming. As a result, the biological composition of natural ecosystem agriculture is modified. The temperature has a known effect on the allocation of various species in the different geographical regions and the rates of growth and nutrient competition. Warmer water causes the toxicity of organisms and rises in the out brakes of algal bloom. Climate change also affects the ideal growth period and maximum yield. Water managers should need to adopt a scenario-based technique that can be easily practiced in all biosphere regions. The use of various future climate models enables us to understand these issues and future climate changes.

Conflict of interest

The authors declare that they have no conflict of interest.

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