Assessing the Impacts of Environmental Change and its Management in Forest Plants and Agricultural Crops

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ARTICLE INFO

Assessing the impacts of climate change will be a vital task in developed as well as in developing countries because of many interdependent physical, biological and chemical processes are ongoing in earth and human systems. These processes can be affected by change in climate, causing an effect on natural resources (water resources, forest products, etc.), on biodiversity, ecosystem services and on plants in general, some positive and on others negative effects, such as, altering biophysical relationship, shrinking of habitats, desertification and general shift in natural world. Warming directly affects rate of plant respiration, photosynthesis, and other biogeochemical processes. For instance, enhanced CO₂ concentration can increase photosynthetic rate especially for plants growing under warm and dry condition such as C₃ plants. Naturally, plants have their own mechanism to tolerate a certain level of increased temperature. As soil temperature increase, the decomposition rate of organic matter will increase, and then nutrient mineralization and availability for plants uptake become increased at presence of sufficient water if other conditions are unchanged. Thus, the interaction and different combination effect of rise CO₂ concentration and temperature is determined by soil properties, water, mineral and nutrient availability etc, as a result the expected response of plants in different environments and climate variability can be either positively or negatively affected.

Keywords: Climate changes, ecosystem, environment, plant growth

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INTRODUCTION:
The ecosystem, and balance between different dominating species and abiotic factors can be highly affected by climate change. Tree cover provides a habitat for numerous herbaceous plants, fungi, and lichens, small and large animals. Thus, loss of tree cover will affect virtually all species that make up a complex forest ecosystem. In order to increase the function of component of some terrestrial species we need to conserve and manage agro ecosystems. Forests provide many services to human being and natural systems such as provision of food, medicine, regulation of hydrologic cycle, recreational use and aesthetic value etc. In addition, forest regulates the atmospheric exchange of light energy, carbon dioxide and water.[1] Even though plants have their own natural mechanisms to tolerate some level of adverse conditions, physiological responses of forest (plants) under climate change condition are highly determined by the limiting factors of a particular site of forest growth. For example, increasing temperature may also increase vapor pressure deficit (VPD) of the air, and thereby increase transpiration rates that may result in adverse effects, especially on dryer sites.[2] Following growth of human population and industrialization, there is a resource competition among humans over land use change, deforestation or over-harvesting, expansion of farmland and pastureland, which causes a negative impact on biodiversity of different habitats, forest cover, forest growth, and ecosystem services. Following these pressures, the continuous rise in temperature, enhancement of concentration of CO2, sea level rise, and stress of nutrient and water availability can have additional negative effects as well as positive impacts on different processes in earth and human systems. For these and many other reasons, we need to protect our benefits through practicing adaptation measures.

Effects of CO2
CO2 concentrations have been steadily rising for more than two centuries. Increases in atmospheric CO2 concentration affect how plants photosynthesis, resulting in increases in plant water use efficiency, enhanced photosynthetic capacity and increased growth. Increased CO2 has been implicated in ‘vegetation thickening’ which affects plant community structure and function. Depending on environment, there are differential responses to elevated atmospheric CO2 between major ‘functional types’ of plant, such as C3 and C4 plants, or more or less woody species; which has the potential among other things to alter competition between these groups. Increased CO2 can also lead to increased Carbon: Nitrogen ratios in the leaves of plants or in other aspects of leaf chemistry, possibly changing herbivore nutrition. Plants are grouped in to ‘C3’, ‘C4’ and ‘CAM’ plants according to their photosynthetic metabolic pathways. Around 95 % of the world plant biomass grouped in ‘C3’ plant species (e.g. wheat, rice, fruits & vegetables), C4 (e.g. maize or corn, sugarcane & sorghum) and CAM (e.g. Pineapple). These divisions into groups largely based on the enzymes involved in photosynthetic fixation of CO2, namely Rubisco, PEP carboxylase and to some extent carbonic anhydrase, which are significantly different in their response to CO2 enrichment. CO2 together with other minerals can activate Rubisco by binding at a non-catalytic site on the enzyme protein. The process of photorespiration rate is high in C3 plants and the relative proportion of CO2 and O2 inside the leaf determines the rate of photorespiration. In contrast, PEP carboxylase in C4 plants not inhibited by O2 and thus photorespiration is negligible. PEP carboxylase also has a higher effective affinity for CO2 than Rubisco in the absence of O2. Therefore, we would expect higher atmospheric CO2 concentrations to increased photosynthesis and growth of C3 plants but not to the same extent, if any, in C4 plants.[3] The result from experiments done on wild grass species shows that under elevated CO2 condition both C3 and C4 species show increase in the total plant biomass of 44% and 33% respectively, the increased in C3 species was greater in tiller formation whereas in C4 was greater in leaf area. Net CO2 assimilation rates (A), that means (flux of CO2 between leaf and atmosphere through photosynthesis) increased in both C3 and C4 species with 33% and 25% respectively, while, stomatal conductance (Gs)(the ability of CO2 entering, or water vapor exiting through the stomata) decreased for C3 and C4 species by 24% and 29%, respectively.[4] Many simulation results showed that
increased biomass production were observed in both C3 and C4 plants under elevated [CO2]; although the enhancement of shoot production by elevated CO2 varied with temperature and precipitation. In C3 species, the response of NPP to increased temperatures was negative under dry and ambient CO2 condition, but was positive under wet and doubled CO2 condition; whereas, the responses of NPP of C4 species to elevated CO2 was positive under all temperature and precipitation levels particularly at high precipitation level. Plant growth in elevated atmospheric CO2 has shown to be less vulnerable to drought, maintaining higher growth rate on drought condition than plants under lower CO2. Elevated CO2 also enhances plant resistance to heat, frost stresses, likely reflecting greater concentrations of membrane stabilizing sugars in the tissues and it induces greater nutrient deficiency, and as observed in several studies it leads to accumulation, of secondary carbon rich chemicals such as tannins. Elevated [CO2] leads plants to produce a larger number of mesophyll cell, chloroplasts, longer stems and extended length, diameter and number of large roots, forming good lateral root production with different branching patterns; in some agricultural food crops, resulting in increasing root to shoot ratios under elevated [CO2]. The potential of crop productivity increased under an increased in local average temperature range of 1-3°C, but it decreased above this range, probably the reason could be low vernalization, shortened phenological phases decrease in photosynthesis rate, and increased transpiration. Elevated CO2 have a positive effect on some annual C3 field crops, such as soybean, peanut, and rice cultivars, etc. Growth and development accelerated throughout the vegetative phase, and before flowering stage started seven days earlier, which contributed to the higher grain yield and change in the chemical composition of the rice grain. Some studies also show that a reduction in maize (C4 species) yield occurred under elevated [CO2] condition due to shortened growing period and a yield reduction also recorded in some experiment on winter wheat (C3 species) due to an effect on vernalization period. Whereas an increase in the yield of spring wheat with 8-10% was observed when water was no limiting; similarly, a cotton crop exposed to free-air CO2 enrichment (FACE) was stimulated and show increased about 48% of harvestable yield and 37% of biomass under elevated (550 ppm) [CO2] level. The difference in responses in different ecosystems to elevated CO2 might be due to difference in water, soil, nutrient availability and temperature variation.

**Effects of temperature**

Increases in temperature raise the rate of many physiological processes such as photosynthesis in plants, to an upper limit, depending on the type of plant. These increases in photosynthesis and other physiological processes are driven by increased rates of chemical reactions and roughly a doubling of enzymatic product conversion rates for every 10°C increase in temperature. Extreme temperatures can be harmful when beyond the physiological limits of a plant which will eventually lead to higher desiccation rates. One common hypothesis among scientists is that the warmer and area is, the higher the plant diversity. This hypothesis can be observed in nature, where higher plant biodiversity is often located at certain latitudes (which often correlate with a specific climate/temperature).

Respiration can be highly affected by temperature, and its rate is determined by status of carbohydrate and supply of adenylate (enzyme catalyzing the conversion processes). The sucrose content of the tissue can govern the capacity of mitochondrial respiration, and mitochondrial respiration plays a great role in growth and survival of plants. One would expect at least a short period increases in respiration rate from parts of plants those show increased growth and assimilation due to elevated [CO2], that is source leaves, individual sink tissue (fruit, seed, steam, root etc.) and total sink tissue. Nevertheless, a few reports concluded that long-term treatment with increased concentration of CO2 resulted in declined whole-plant respiration. Whereas, result of a few other experiments show that a short-term increase in temperature on plants growing in cold climate areas such as Arctic have resulted in greater potential impact on plant respiration than in plants growing in warmer areas (tropics). One of the reasons might be that tropical plants more acclimate to higher temperatures than the Arctic cold area plants. Respiration is...
necessary for many processes in living organisms; for instance, it is crucial for maintenance of photosynthesis activity, mainly because of the energy demands of sucrose synthesis. Moreover, it plays a role in determining the carbon budget of individual plants and the concentration of CO$_2$ in the atmosphere; it contributes up to 65% of the total CO$_2$ released to the atmosphere.$^{[12]}$ However, the responses of photosynthesis and respiration differ. For example the light saturated photosynthesis reaction rate of C3 crops such as rice and wheat is at maximum at a temperature range of about 20-32°C, while crop respiration increase over a temperature range of 15-40°C followed by a decline. The response of plant respiration to long-term change in temperature is dependent on the level of effects of temperature on plant development, and on other direct and interactive effects of temperature and abiotic factors (e.g. Irradiance, nutrient availability and drought). Evidence shows that the response of respiration to temperature is dynamic, with plant respiration often acclimating to long-term changes in temperature. In addition, both degree of acclimation and value of Q10 (proportional change in respiration with a 10°C increase in temperature) vary in response to the surrounding environment and/or the metabolic condition of the plants. There is variability in Q10 as day and night time temperature varies (e.g. nights are increasing to a higher extent than daytime). The Q10 of leaf R is often not always reduced in the light compared with the Q10 of leaf R in dark, and Q10 values are often lower in water-stressed plants than in the fully-watered counterparts, root and leaves also differ in their Q10 values as upper and lower canopy leaves. Q10 of both root and leaf R dark generally decreased as temperature increased. Rise in [CO$_2$] does not show a predictable, systematic effect on Q10 of dark R of stems root or leaves. Different studies show a variation in the effect of rise atmospheric [CO$_2$] on Q10 value of R above ground plant parts in dark condition, but the overall result indicate that elevated [CO$_2$] has little impact on the average Q10 values.$^{[12]}$ However, Q10 dark R is greater in some plants grown under elevated [CO$_2$] for e.g. According to study of Shapiro et al., (2004)$^{[13]}$ both Q10 light and Q10 dark increased in leaves R of Xanthium strumarium. It shows Q10 value of Pinus sylvestris increased in late stage of needle expansion.$^{[16]}$ Nevertheless, found that; ‘there is no a statically significant variation in the value of Q10 for stem respiration under different conditions (in elevated [CO$_2$], elevated temperature, or the combination of elevated [CO$_2$] and temperature relative to the ambient treatment.$^{[17]}$ Indicating that all treatments did not significantly alter the respiratory responses of the stem of Scots pine to stem temperature’ and in his all treatments Q10 value were much lower in the growing season than in the non-growing season. However, there has been a variation in different literatures results; Overall,$^{[12]}$ Atkin et al (2005) suggests that higher [CO$_2$] does not on average alter the temperature sensitivity of dark R in roots, leaves or shoots. In most plants as temperature increase with optimal range, the rate of respiration as well as the rate of metabolism increased, because increased respiration results with higher energy available, that means as long as nutrients are available the metabolism processes within the plant will also increase. Following increased temperature to a certain level, the rate of photosynthesis is also increases but not as much as respiration. That indicates the amount of CO$_2$ produced from increased respiration is faster than the amount of O$_2$ released from increased photosynthesis. Temperature affect photosynthesis through altering the activities of enzymes, electron transport and leaf temperature (leaf-to air vapor pressure difference) can influence the stomatal conductance. As evaporation increases, stomata tends to close to reduce water loss through transpiration, following this stomata closure reduction in CO$_2$ assimilation rate occur due to less rate of CO$_2$ supply to chloroplast, this is indirect temperature response. Temperature also affects photosynthetic metabolism directly showing a change in the activity of ribulose-1,5- carboxylase oxygenase (Rubisco) processes associated with the regeneration of Rubisco’s substrate, rubulose-1,5- bisphosphate (RuBP) through the Calvin cycle.$^{[18]}$ Climatic variability affects crop development and yield via linear and non-linear response to weather variables and exceeding of well-defined crop thresholds, particularly, temperature.$^{[19]}$ In the processes of plant growth, leaf litter fall to soil ground
then under different temperature condition various processes under going inside as well as outside the soil surface and many processes and reactions directly affected by rising temperature, decomposition, weathering and mass flow diffusion etc. may hasten in the soil under optimum soil moisture condition. At low temperatures, the reaction processes become slower, temperature can indirectly affect plant morphology, growth, roots turn over etc., if it is both beyond and under the optimum level for the plants. In addition, soil moisture, availability of nutrient and minerals together with other processes will play an important role in plant growth and development.

Effects of water
As water supply is critical for plant growth, it plays a key role in determining the distribution of plants. Changes in precipitation are predicted to be less consistent than for temperature and more variable between regions, with predictions for some areas to become much wetter, and some much drier. A change in water availability would show a direct correlation to the growth rates and persistences of plant species in that region.

With less consistent, more intense rainfall events the water availability will have a direct impact on the soil moisture in an area. A decrease in soil moisture will have negative impacts on plant's growth, changing the dynamics of the ecosystem as a whole. Plants rely not only on the total rainfall during the growing season, but also the intensity and magnitude of each rainfall event.

The effects of climate change have become obvious in the natural environment over the last 30 years, together with other threats like habitat destruction, fragmentation, disturbance and loss in biodiversity.[20]

For instance, land use change (the most important impact) in tropical forest can cause loss of biodiversity. Hence, overexploitation of natural resources, use of hardwood timber and forest clearing causes high loss in the amount and availability of habitats, and to extinction of species, especially which are endangered, and restricted in range. Although it is difficult to make a causal link between changes of climate in relation to change in species richness, due to many other variables are also involved,[21] species can interact both directly and indirectly and in most cases, indirect interaction is unpredictable.[22,23]

Climate change affects species indirectly by reducing the amount and availability of habitats and by eliminating species that are essential to the species in question. As a result, the loss of one species can result in decrease, increase or extinction of other apparently unconnected species; however, human activities are causing secondary extinction at higher level than expected from random species losses. When species are lost from an ecosystem, it is not the only species that is lost, but the interaction and the general ecological functions, which we expect from these interactions, will be also lost.[21] Climate change impacts classified into two broad categories; 1) Biophysical impacts: indicates the physical impacts caused by climate change directly in physical environment; example, drought and flooding, causes an effect on physical environment such as a) effects on quality and quantity of crops, pasture, forest and livestock. b) Change in natural resources quality and quantity of soil, land and water resources. c) Increased weed and insect pest challenges due to climate change. d) Shift in spatial and temporal distribution of impacts, (sea level rise, change in ocean salinity, and sea temperature rise causing fish to inhabit different ranges). 2) Socio economic impacts: following the first biophysical impacts on environment there will be a secondary effect on socio economic systems. E.g. decline in yield and production, reduced marginal GDP from agriculture sector, fluctuation of world market price, change in geographical distribution of trade regimes, due to shortage of food in quality and quantity the number of people in hunger and risk increased, and cause migration.[24,25]

Causes for climate change
Due to increasing world population and industrial development there is an increased emission of GHGs. Use of fossil fuels, deforestation, burning and decay of biomass, etc., leads to higher atmospheric CO$_2$ concentration, which currently is around 388 ppm and predicted to increase to approximately 470 – 570 ppm until year 2050.[8] The level of absorption, scattering and emission of radiation with in the atmosphere, ocean and at the earth surface highly affected by the amount of concentration of atmospheric GHGs,
aerosols, soli type and moisture, vegetation and land cover, solar radiation etc.
In addition to other factors, the concentration and lifetime of greenhouse gases (GHGs) in the atmosphere depends on the rate of chemical reactions in the atmosphere (faster or slower). For instance, CH4 primarily removed by reacting with hydroxyl radicals to form water and CO2 within its lifetime of 12 years. The global warming potential of CH4 is 72 times higher than CO2 over a period of 20 years and 25 times higher over a period of 100 years. However, since the current concentration of CH4 in the atmosphere is much lower, compared to the level of CO2 the total warming effect of CO2 is higher. According to the Inter Governmental Panel on Climate Change synthesis report, the level of main anthropogenic GHGs emissions at global scale. From the total anthropogenic GHGs emission in 2004, (The amount of CO2 emitted due to use of fossil fuel 56.6%, from biomass burning and deforestation 17.3%, CO2 from others 2.8%) from total anthropogenic GHGs emission CO2 represented to a sum of about 77%, CH4 (methane) 14.3 % produced from livestock, wet rice paddy field, different fermentation processes or (agriculture) energy and waste. From total anthropogenic emission in 2004, 7.9 % of N2O (nitrous oxide) produced due to human activities in agriculture (use of ammonia based fertilizer), due to combustion of hydrocarbon fuel, and from the total anthropogenic GHGs emission in 2004, 1.1 % of F-gases (includes hydrofluorocarbon, sulphurhexafluoride, perfluorocarbon, etc.) Produced from industrial activities, use of old air conditioners and refrigerators.

**Effects of climate change on ecosystems**

An ecosystem is a dynamic complex system of plant, animal, and microorganism communities and the non-living environment interacting with each other as a functional unit. Ecosystem services are the benefits that people get from ecosystems, like food, forest products, water quality and quantity, soil conservation, biodiversity, recreation, and other cultural values. In order to get good ecosystem services for human wellbeing there should be a mechanism, which maintain the nutrient cycles, production, soil formation, etc. in a good state, furthermore enhancing sustainability and conservation of natural as well as human made ecosystems is important. Any disruption or loss of natural ecosystems leads to breakdown of ecosystem functioning and causes loss of ecosystem services. Because of climate change (increased extreme events, e.g. drought and forest fire) large proportion of species are at risk of distinction. Here we can include the water purification by wetlands, provided by forest, the protection of coastal areas from storm surges by mangroves and coral reefs, the regulation of pests and diseases and the recycling of waste nutrients, the removal of carbon from the atmosphere. A fundamental difference between global ecosystems of the past and in the future is the dominating influence of human activity and intervention in natural environment, in addition, deforestation, agriculture and over grazing can fasten the processes of desertification especially in sub tropics and semiarid lands. [3] If we observe the function of natural ecosystems and take few example in USA, at least half of the medicines used today derive from natural source. Between 1998 and 2002, one hundred sixteen out of 158 new medicine drugs licensed obtained from natural origin and only one percent of known plants analyzed for their potential of use in medicine. [26] Ecosystems and ecosystem services affected by global climate change, both directly and indirectly. Many studies particularly on agricultural crops and forest shows that the enhanced atmospheric CO2 directly increase productivity, because higher ambient CO2 concentration stimulates net photosynthetic activity which have been called ‘CO2-fertilization’ effect. Transpiration decreases through a partial stomatal closure resulting in increased water use efficiency of plants at least at a leaf scale; nevertheless, there are considerable differences between different species regarding their response. Some species in terrestrial ecosystems may in the long-term indirectly react negatively, perhaps fatal, to increased CO2 concentration. The indirect responses of ecosystems are due to the effect of elevated CO2 concentration is through effect on climate, such as change in temperature or radiation, humidity, precipitation or other climate variables. In most cases, this situation (the change in climate variables) can cause an impact
on ecosystems. As environmental exploitations by humans are increased, the global environmental change (GEC) (increasing atmospheric CO\textsubscript{2} levels and associated climate changes fragmentation and loss of natural habitats) will also increase, which leads to rapid change on ecosystems in the world. Despite the large body of research showing effects of GEC on population abundances, community composition, and organismal physiology, GEC may cause less obvious alterations to the networks of interactions among species. Yet complex networks of biotic interactions such as predation, parasitism and pollination play an important role in the maintenance of biodiversity, mediation of ecosystem responses to GEC, and the stability (resistance or resilience) of those ecosystem services on which human well-being is dependent. The uptake of minerals, nutrient and water, canopy exchange of plants, absorption of light energy for the formation of carbohydrate through photosynthesis reactions as well as the breakdown and burning processes of carbohydrate for growth and development of the plant (respiration) is highly dependent on the amount of atmospheric CO\textsubscript{2} concentration and ambient temperature. The processes of transpiration (affected by the opening and closure of stomata), and evaporation from surface of plants determined by the level of temperature and CO\textsubscript{2}. Soil biotic processes e.g. decomposition, mineralization, immobilization, and soil abiotic processes such as solute transport, weathering, cation exchange, etc. in the soil affected by climate change. As a result, it causes a change in net primary production, species composition and resource competition; consequently, the general services, which we get from forest ecosystem; such as forest products, biodiversity, species composition, soil and water resources and recreation are affected. Field crops response to climate change Elevated [CO\textsubscript{2}] leads plants to produce a larger number of mesophyll cell, chloroplasts, longer stems and extended length, diameter and number of large roots, forming good lateral root production with different branching patterns; in some agricultural food crops, resulting in increasing root to shoot ratios under elevated [CO\textsubscript{2}]. The potential of crop productivity increased under an increased in local average temperature range of 1-3°C, but it decreased above this range; probably the reason could be low vernalization, shortened phenological phases decreases in photosynthesis rate, and increased transpiration. Elevated CO\textsubscript{2} have a positive effect on some annual C\textsubscript{3} field crops, such as soybean, peanut, and rice cultivars, etc. Growth and development accelerated throughout the vegetative phase, and before flowering stage started seven days earlier, which contributed to the higher grain yield and change in the chemical composition of the rice grain. Some studies also show that a reduction in maize (C\textsubscript{4} species) yield occurred under elevated [CO\textsubscript{2}] condition due to shortened growing period and a yield reduction also recorded in some experiment on winter wheat (C\textsubscript{3} species) due to an effect on vernalization period. Whereas an increase in the yield of spring wheat with 8-10% was observed when water was no limiting; similarly, a cotton crop exposed to free–air CO\textsubscript{2} enrichment (FACE) was stimulated and show increased about 48 % of harvestable yield and 37 % of biomass under elevated (550 ppm) [CO\textsubscript{2}] level. The difference in responses in different ecosystems to elevated CO\textsubscript{2} might be due to difference in water, soil, nutrient availability and temperature variation. Responses of forest trees to climate change Different processes in plants or forest ecosystems and their interaction with climate variability is complex, due to different response of physical, biological, and chemical processes. An increase in the ambient CO\textsubscript{2} concentration could reduce the opening of stomata required to allow a given amount of CO\textsubscript{2} to enter in the plant that might reduce transpiration of the trees. These could increase the efficiency of water use by forest plants and increase productivity to some extent. Trees are capable of adjusting to a warmer climate, although the response expected from species are different and the effect on photo inhibition and photorespiration are more difficult to generalize. As forest trees are characterized by the C\textsubscript{3} photosynthetic path way their productivity and demand for nutrient is highly affected by atmospheric CO\textsubscript{2} concentration and temperature. The total productivity expected from trees (especially from trees with indeterminate growth) growing under elevated CO\textsubscript{2} is larger than estimated in crops. Estimated increased production
from trees is higher than crops only achieved especially if the combination of absorption and increased nutrient use efficiency is attained.[26] However, the long-term response of forest to rising level of [CO$_2$] is still uncertain. The current over all response of trees is positive and results from a review of 49 papers on effects of elevated CO$_2$ on different tree species shows that net primary production (NPP, photosynthesis minus plant respiration) on average increased with 23 % at an elevated CO$_2$ concentration of 550 ppm as compared with 370 ppm.[30] Whereas, enhanced in temperatures can lead to heat and more water logging stress in bogs and cause more severe heat, drought and photo-inhibition stress periods in temperate bog and forest ecosystems.[6]

**Temperature versus [CO$_2$] interaction on plants**

There are many processes in plant growth, affected by interaction of both enhanced temperature and carbon dioxide, in processes that determine carbon balance in the shorter term, from the long time scales of development and growth, which together lead to accumulation of biomass and yield. The two main reasons to expect progressively increasing CO$_2$ responsiveness of plant carbon balance at higher temperatures are 1) the decreased ratio of photosynthesis to photorespiration and 2) the increased ratio of gross photosynthesis to dark respiration in warmer conditions.[31] The effect of elevated CO$_2$ on photosynthetic reactions are more pronounced in high temperature, e.g. around 20$^\circ$C than at 10$^\circ$C. Some predictions indicate that future increase in temperature may increase root mortality more in N-rich soils in temperate forests than in N-poor soils in boreal forests areas with important implications for the cycling between plant and soil.[29] Some (unpublished) studies found that changes in activation state and catalytic constant occur due to both CO$_2$ and temperature, and there were an interaction, which affected the photosynthetic rate demonstrating the underlying complexity of the photosynthetic regulation mechanisms.[31] To sum up, environmental change has an impact on growth rate of individual trees and have a cumulative effect on different interactions and processes inside the forest and has the ability to change the amount of living materials in the forest ecosystem as a whole.[29]

Temperature is one of the decisive factors in forming an effect on growth and productivity by accelerating the bud burst (BB), flowering, and stems elongation during spring and then extend growing season, and it is one of the major factors controlling species distribution. For instance, the predicted warming of 2-6$^\circ$C by 2100 in north temperate forest regions could have substantial impacts on growth and species composition.[32] Increasing temperatures mostly associate with elevated CO$_2$, vapor pressure deficit (VPD) and drought. Change in temperature will interact with other factors to form an effect; for e.g. nitrogen fixing nodule bacteria, mycorrhizal fungi and many other processes influenced by rising temperature. The long-term responses of climate change under higher CO$_2$ concentration, temperature and precipitation may differ from short-term effects because of the feedbacks involving nutrient cycling. ‘Tree seedlings exposed in elevated [CO$_2$] over time period of less than 1 year resulted in enhanced rate of photosynthesis, decreased in respiration and increased growth, with little increased in leaf area and small variation in carbon allocation. Exposure of woody species in elevated CO$_2$ over long time-period may result with higher rates of photosynthesis, but net carbon accumulation may not necessarily increase if CO$_2$ release from soil respiration increases’.[33] Environmental shift affects the extent of plant diseases and insect pests both the presently occurrence and infestation, introduced of the new species. Following these changes, a number of diseases, pests and weeds, preventing actions needed to reduce the effects on human health and ecosystems.[34] Different chemical, biological and physical processes in earth systems need various temperature ranges; usually moderate and optimal temperature (for each processes) are essential for normal activities within the systems, a certain rise or lower from moderate temperature will affect many activities within the processes.

**Abbreviations**

[CO$_2$] – Carbon dioxide concentration
FACE – Free-air CO2 Enrichment
FAO – Food and Agricultural Organization
GEF – Global Environmental Facility
GHG – Greenhouse Gas
(Gs) – Stomatal conductance
IPCC – Inter Governmental Panel on Climate Change
NPP – Net Primary Production
ppb – Parts Per billion
ppm – Parts Per million
ppt – Parts Per trillion
Q 10 – Proportional change in respiration with a 10°C increase in temperature
R – Respiration
REDD – Reduced Emissions from Deforestation and Forest Degradation
Rubisco – Ribulose-1, 5-bisphosphate carboxylase/oxygenase

CONCLUSION
Population growth, urbanization and industrialization will result in a higher demand of renewable and non-renewable natural resources. Even though, currently there is a gap between availability (supply) and demand of increased population interests, there is a need to consider a more careful utilization of natural resources. Activities of filling the gap must be by reducing emission and protecting the coming generation, and make them beneficial. As climate change have contrasting effect in different part of the world, it mainly affect the developing world, causing variability in precipitation, solar radiation, temperature, [CO₂] humidity etc, it leads to increased infestation of disease, insect, pest and dispersal of weed, which may affect food production and productivity. When the ambient factors affecting growth will become beyond the tolerance of the plant species, it will have a negative effect on their reproduction, life cycle and eventually extinct of the species from natural ecosystem. There has to be great consideration of increasing environmental benefits from forest ecosystem by afforestation, reforestation, for carbon sequestration, and storage of carbon as a biomass. Moreover, forest ecosystem can serve as a home or habitat for living organisms. Finally, it is crucial to use different effective conservation strategies to maintain species, genetic diversity, and ecosystem services, and to proceed with research on different plant species to investigate their response to climate variability, and to identify which species will be most restricted in range and which will be most endangered and how they can be protected from extinction.

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