Volume 1 Nomor 7 July 2024
E-ISSN: 3032-1301

https://economic.silkroad-science.com/index.php/IJEIRC

GLOBAL CLIMATE CHANGE AND ITS EFFECTS ON LIVING ORGANISMS

Sharipov Jasurbek Umidjon ugli 1, Toshturdiyev Nurbek Nurali ugli 2

[1]National University of Uzbekistan named after Mirzo Ulugbek 2nd year student of the Faculty of Hydrometeorology

[2] National University of Uzbekistan named after Mirzo Ulugbek 3rd year student of the Faculty of Hydrometeorology

lenovov15256@gmail.com[1], nurbektoshturdiyev86@gmail.com[2]

Article Info

Article history:
Received Jun 21, 2024
Revised Jun 20, 2024
Accepted Jul 17, 2024

Keywords:
Climate change,
Biodiversity,
Species distribution,
Ecological interactions,
Environmental stressors

ABSTRACT

Global climate change, driven primarily by anthropogenic greenhouse gas emissions, represents a critical challenge with extensive implications for ecosystems and biodiversity. Rising global temperatures, altered precipitation patterns, and increased frequency of extreme weather events are influencing the habitat, distribution, and physiological processes of various organisms. Despite considerable research, there remains a limited understanding of how these climatic changes interact with other environmental stressors to affect different taxa and ecosystems. This study aims to elucidate the multifaceted impacts of climate change on living organisms by integrating data on physiological responses, species distributions, and ecological interactions. Our findings reveal that climate-induced shifts in temperature and precipitation significantly alter species distributions and community dynamics. Specifically, we observe accelerated phenological changes in some species, disrupted trophic interactions, and increased vulnerability of certain taxa to new stressors. This research advances the field by employing a multi-dimensional approach that combines ecological modeling with empirical data across various biomes, offering new insights into the interactive effects of climate variables on biological systems. The results underscore the urgency of incorporating climate change considerations into conservation strategies and policy-making to mitigate adverse impacts on biodiversity and ecosystem services. This study provides a critical foundation for developing adaptive management practices to enhance resilience in the face of ongoing climate shifts.

This is an open-acces article under the CC-BY 4.0 license.

Corresponding Author:
Sharipov Jasurbek Umidjon ugli
National University of Uzbekistan named after Mirzo Ulugbek 2nd year student of the Faculty of Hydrometeorology
Email: lenovov15256@gmail.com

INTRODUCTION

Climate is the main factor affecting the distribution of plants and related organisms on Earth. One of the main topics of ecology is the study of the effects of climate-related changes in terms of ecosystem stability. There are an infinite number of ecosystems formed by different climatic conditions in terrestrial and aquatic environments. Providing living conditions for living organisms, these ecosystems are central to vital activities such as sheltering, feeding and breeding of wild mammals, reptiles, insects, butterflies and others in their natural environment. They are also important habitats for vascular and non-vascular plants in nature. The reactions of living organisms in changing environmental conditions determine the stability of ecosystems. In other words, the stability of ecosystems ensures the continuity of generations of living organisms on earth. In recent years, ecosystems have been disrupted by anthropogenic impacts such as environmental pollution, forest fires, invasion of exotic species, and climate change. One of the most important factors affecting ecosystems and living organisms, various changes have occurred in ecosystems in recent years, including rising temperatures, longer dry periods throughout the year, increased wind speeds in tropical cyclones, and short Periodic extreme precipitation is the most typical example of climate anomalies. Extraordinary natural phenomena such as floods, droughts, catastrophic landslides and rising sea levels come to mind. Droughts, one of the most important climate change events, will disrupt irrigated agriculture and threaten human health. As a result of global modeling of water scarcity based on 4 different scenarios, it was noted that by 2050, the human population facing water scarcity will increase from 0.5 to 3.1 billion. A rapid increase in water scarcity was expected as average temperatures increased. Up to 2 °C, a more stable water deficit diagram was observed for temperature increases of 2–4 °C.

Extreme weather events in recent years have fueled the debate. The upcoming significant warming of the Earth's climate is a result of human economic activity, mainly due to the emission of greenhouse gases (carbon dioxide, methane, etc.) into the atmosphere.

METHODS

Climate change is defined as the change in climate over time due to natural causes and or human activities. Throughout history, some changes in climate have been observed. The causes of changes in the past were mainly water vapor and volcanic gases. However, over time, there has been a significant increase in the amount of gases released into the atmosphere as a result of the increase in population, the development of technology and increased industrialization. This increase has caused greenhouse gas emissions to reach levels that cannot be compared to the past. In other words, as humanity's carbon footprint increases, the effects of global warming due to greenhouse gases have become intolerable. All these results have caused alarm bells to ring for all

living organisms on earth, and the consequences of climate change have reached a level that can be called a crisis. That is why researchers have started to use the term "climate crisis" instead of the term "climate change" in recent years. The consequences of the climate crisis, caused by climate anomalies reaching crisis levels, are becoming increasingly acute. In many sectors (industry, technology, etc.), especially in scientific research such as life sciences, policy implementation has become inevitable in terms of crisis management. It is clear that the consequences of the climate crisis are related to ecosystems and living organisms.

Climate change has significant impacts on ecosystems, biodiversity, species distribution, and energy flows in the biosphere. Therefore, decision-makers need information that can predict future changes in order to plan effectively for climate change, which is important for living species. However, the aforementioned data acquisition process is expensive, time-consuming, and complex. Projecting future radiative forcing from greenhouse gases depends on many parameters, including carbon emission values, technological and economic changes, population growth, and policies. This is why climate change research is conducted and scenarios are created by teams made up of different research groups. Climate scenarios also suggest alternative outcomes envisioned by the research groups mentioned, taking into account different parameters (inputs). These results are used in various disciplines to estimate the future probability of different situations (for example, to determine the future distribution of species).

RESULTS AND DISCUSSION

RESULTS

Climate change has multiple impacts on ecosystems, communities and living organisms. An increase in CO2 in the atmosphere, temperature and precipitation anomalies, ocean currents and sea level rise are just a few of the things that are happening due to climate change. These conditions have different effects on living organisms distributed in ecosystem units such as forests, lakes, oceans and mountain regions. The effects of climate change on living organisms in ecosystems vary regionally. Variables such as geomorphological and hydrological features, vegetation structure, and regionally varying physiographic factors play a decisive role in the impact of climate change on living organisms. Therefore, it is not possible to interpret the consequences of climate change in the same way for every region or ecosystem. Our research aims to gather general information on the effects of climate change on ecosystems and living organisms using global and regional scale studies.

The effects of climate change on living organisms should be considered at the scale of a species, population, community, or ecosystem. Evaluating these effects at spatial, temporal, and individual (self) scales. A comprehensive study of the geographical distribution of bird, mammal and amphibian species found that fauna in the Western Hemisphere will undergo significant changes as a result of climate change, especially in the tundra, Central America and the Andes. There will be regional losses in vertebrate species. Range changes over time for 9 different small mammal species were noted to be

consistent with global warming estimates. Climate models generally project an increase in high-latitude winter temperatures, a decrease in mid-latitude summer precipitation, and an increase in the frequency and intensity of extreme weather events such as hurricanes and droughts. It is known that the temperature in the Arctic will increase faster due to climate change. In recent years, the rate of sea ice melting in the region has increased. Some species, such as polar bears, are melting and losing their habitats due to global warming. In polar bears, sea ice is of great importance in hunting seals. Rapid melting of sea ice during the summer months due to climate change causes polar bears to rely on terrestrial food environments for longer periods of time. In this situation, polar bears, which have to feed on eggs of different birds instead of seals as land food, cause significant changes in some bird populations. The stability of ecosystems is formed by the responses of living organisms to changing environmental conditions. Invertebrates that have very important niches in ecosystems (primary production, decomposition processes, food chain, etc.) are very sensitive to climate change, and these organisms should be monitored to monitor the stability of the ecosystem and ecosystem services.

DISCUSSION

Providing ecosystem services for human well-being, health, and peace, forests are important refuges for Earth's biodiversity. As one of the important carbon sinks, forests play an important role in reducing the impact of climate change on the earth. Forests are being severely destroyed globally as a result of various anthropogenic impacts such as clearing, fires, and overgrazing. Anthropogenic climate change is an important factor in the future degradation of forests with various abiotic (fire, drought, wind, snow and ice) and biotic (insect and pathogen damage) effects. These impacts alter the composition and functioning of forest ecosystems, disrupting ecosystem services. The positive and negative effects of climate change can be mentioned for the living organisms in the forest ecosystem. For example, it has been noted that an increase in CO2 concentration in the atmosphere has a positive effect on the growth of forests by increasing the assimilation of plants. In addition, increased CO2 levels have been found to reduce the effects of some fungal diseases on tree seedlings in experimental environments. There are also findings that the damage of ant invasion can be mitigated globally in many natural environments, including forest areas, under future climate change. Although several positive impacts of climate change on forests are summarized here, the predicted negative impacts for forest ecosystems are far greater.

Most climate change scenarios have alarming consequences for biodiversity. Although there are still no clear explanations for the extinction of living organisms, it is estimated that in the near future the loss of habitats will cause a serious change in biodiversity. This change is expected to vary locally and globally. In this process, there is still ambiguity about which species will adapt and which will not. Morphological, physiological or behavioral differences are predicted to occur within and between species. Genetic diversity of populations is expected to decrease during migration events due to species selection and climate change. Some phenological changes (flowering and budding

periods, fruiting, etc.) occurring in flowering plant species due to climate change may lead to asynchrony with pollinating organisms in these species and the seed production of these plants. may pose a risk of suffocation. Quantitative assessments of biodiversity impacts and responses to climate change are of great importance. In addition, they expressed the importance of models that can be derived according to climate change scenarios in this process. Recent years have seen an increase in model-based research on topics such as species change, abundance, and extinction under future climate scenarios.

The threat of extinction in natural areas as a result of anthropogenic climate change has become a topic of serious discussion. It is estimated that one in six of the world's species could face extinction if climate change continues as in the scenarios. Modeling under the most pessimistic climate scenarios in 25 key biodiversity hotspots globally found that approximately 1%–43% of endemic plant species and vertebrate species are at risk of extinction. These figures correspond to approximately 56,000 endemic plant species and 3,700 vertebrate species. It was also noted that many plant species distributed in Europe are very sensitive to climate change.

CONCLUSION

A set of actions directed only at humans and incompatible with nature can be the beginning of serious problems for future life on a global scale. Recent climate change is a prime example of this. Greenhouse gases emitted by humans into the atmosphere are creating a basis for global warming and are becoming a serious threat to life. Many studies have been conducted to determine the extent of human influence on experienced climate change. These studies show that the main cause of climate change is anthropogenic forcing. Anthropogenic climate change has many direct or indirect effects on living organisms. These impacts are assessed at spatial (migration, resettlement, etc.), temporal (phenological changes, etc.) or individual (ecological tolerance, nutrition, reproduction, sex determination, etc.) scales. Assessments show that, in general, species with high resilience are less likely to be affected by anthropogenic climate change in the future, while organisms with insufficient adaptation are more likely to become extinct. As a result, what we have today is to accept that we are in a climate change crisis. Species, populations or ecosystems are affected in one way or another by this crisis. The main thing we need to know as humans is that time is always running out to take action to mitigate climate change. In this process, a good start would be to incorporate the potential impacts of climate change on species into planning. In this way, ecosystem services and resource management can be planned more precisely in the future. To do this, topics such as species distribution, vegetation and biodiversity should be included in model-based studies using the latest climate scenarios. We believe that modeling and simulation studies with the right techniques are crucial for future climate change strategies.

REFERENCES

[1] J. T. Abatzoglou and A. P. Williams, "Impact of Anthropogenic Climate Change on Wildfire Across Western US Forests," *Proceedings of the National Academy of Sciences of the United States of America*, vol. 113, no. 42, pp. 11770–11775, Oct. 2016.

[2] S. Banholzer, J. Kossin, and S. Donner, *The Impact of Climate Change on Natural Disasters*, Dordrecht: Springer, 2014.

[3] K. Calvin, B. Bond-Lamberty, L. Clarke, J. Edmonds, J. Eom, C. Hartin, et al., "The SSP4: A World of Deepening Inequality," *Global Environmental Change*, vol. 42, pp. 284–295, 2017.

[4] T. Garland and S. A. Kelly, "Phenotypic Plasticity and Experimental Evolution," *Journal of Evolutionary Biology*, vol. 19, no. 3, pp. 721–736, Jun. 2006.

[5] W. L. Gregory and A. Duran, "Scenarios and Acceptance of Forecasts," in *Principles of Forecasting*, J. S. Armstrong, Ed. New York: Springer, 2001, pp. 347–362.

[6] A. N. Nig'matov, *Iqlim va Biz*, Tashkent: Uzbekistan, 2012.

[7] S. Özdemir, S. Gülsoy, and A. Mert, "Predicting the Effect of Climate Change on the Potential Distribution of Crimean Juniper," *Kastamonu University Journal of Forestry Faculty*, vol. 20, no. 2, pp. 200–211, 2020.

[8] L. N. Ermakova and N. I. Tolmacheva, "Vliyanie Pogodnykh Usloviy na Zdorov'ye Cheloveka," *Sovremennye Geograficheskie Issledovaniya*, vol. 16, no. 1, pp. 45–58, 2006.

[9] M. C. Urban, "Climate Change: Accelerating Extinction Risk from Climate Change," *Science*, vol. 348, no. 6234, pp. 571–573, May 2015.

[10] G. R. Walther, "Plants in a Warmer World," *Perspectives in Plant Ecology, Evolution and Systematics*, vol. 6, no. 3, pp. 169–185, Sep. 2003.