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BIODIVERSITY CONSERVATION IN THE CONTEXT OF CLIMATE CHANGE

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Abstract. *In this article describe of Biodiversity conservation amidst the uncertainty of climate change presents unique challenges that necessitate precise management strategies. The study reported here was aimed at refining understanding of these challenges and to propose specific, actionable management strategies.*

Key words: *biodiversity, conservation, climate change, soil CO2 emissions.*

Аннотация. *В этой статье описывается сохранение биоразнообразия в условиях неопределенности изменения климата представляет собой уникальные проблемы, требующие точных стратегий управления. Исследование, представленное здесь, было направлено на уточнение понимания этих проблем и предложение конкретных, действенных стратегий управления.*

Ключевые слова: *биоразнообразия, сохранение, изменение климата, выбросы CO2 в почву.*

Annotatsiya. *Ushbu maqolada iqlim o‘zgarishi sharoitida biologik xilma-xillikni saqlash aniq boshqaruv strategiyalarini talab qiladigan muammolarni keltirib chiqarishi bayon qilingan. Mazkur tadqiqot ishi ushbu muammolarni bartaraf qilish hamda aniq, samarali boshqaruv strategiyalarini taklif qilishga qaratilgan.*

Kalit so‘zlar: *biologik xilma-xillik, tabiatni muhofaza qilish, iqlim o’zgarishi, tuproqda CO2 emissiyasi.*

Introduction. Biodiversity conservation has emerged as one of the most critical global challenges of the 21st century. The term “biodiversity” refers to the variety and variability of life on Earth, encompassing species diversity, genetic diversity, and ecosystem diversity [8,14]. Biodiversity is fundamental to ecosystem services such as food production, water purification, climate regulation, and cultural value, all vital for human well-being [4,9]. However, biodiversity is under unprecedented pressure from human activity, with habitat destruction, climate change, overexploitation, pollution, and invasive species driving rapid declines in species and ecosystems worldwide [3,12].

As the urgency to protect biodiversity grows, international frameworks such as the Convention on Biological Diversity (CBD) and the United Nations Sustainable Development Goals (SDGs) have established ambitious targets for biodiversity conservation [5]. Despite these efforts, global biodiversity continues to decline, prompting researchers, policymakers, and conservationists to seek more effective strategies for halting biodiversity loss [7]. This has led to an explosion of scientific research aimed at understanding the drivers of biodiversity loss and developing innovative solutions to protect and restore ecosystems [6,11].

Given the vast and rapidly growing body of literature on biodiversity conservation, it has become increasingly important to systematically assess research trends and identify knowledge gaps in this field. Bibliometric analysis, which uses quantitative methods to evaluate patterns in scientific publications, offers a powerful tool for understanding the evolution of research in biodiversity conservation [2,10]. By analyzing large datasets of academic publications, bibliometric studies can provide insights into publication trends, influential authors and institutions, key research areas, and collaboration networks [1,13].

Methodology. The study employs a range of analytical techniques to interpret the collected data:

Statistical Modeling: Used to identify trends and patterns in biodiversity changes and to predict future impacts of climate change on ecosystem composition and function.

Comparative Analysis: Enables the examination of similarities and differences in climate change impacts and adaptive capacities across the three ecosystems, facilitating the identification of universal and ecosystem-specific conservation needs.

Scenario Analysis: Applied to evaluate the potential effectiveness of various conservation strategies under different climate change scenarios, guiding the development of adaptable and resilient management approaches.

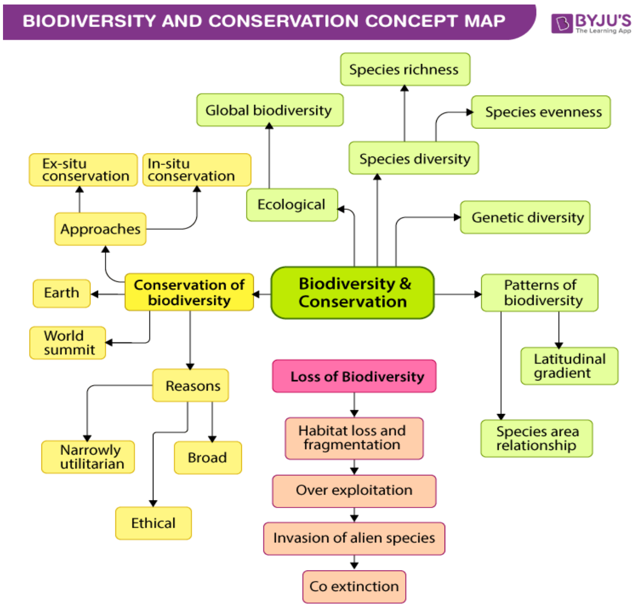
The research design is structured into several phases, each tailored to investigate the unique aspects of the selected ecosystems under study:

Phase 1: Baseline Data Collection involves mapping the current biodiversity status, ecological characteristics, and climatic conditions of each ecosystem. This phase establishes the groundwork for comparative analysis and future impact assessments.

Phase 2: Conservation Strategy Evaluation involves the development and testing of various conservation interventions aimed at mitigating the impacts of climate change. Scenario analysis and modeling techniques are applied to evaluate the effectiveness of these strategies under different climate change projections.

Results and discussion. The extensive research conducted on the impacts of climate change on biodiversity within tropical rainforests, alpine regions, and wetlands yields critical insights with profound implications for conservation strategies worldwide. The findings underscore the urgency of adapting conservation practices to the realities of a warming planet, highlighting the need for innovative, flexible, and resilient approaches to safeguarding biodiversity. This section delves into the conservation implications derived from the study’s findings, proposing a pathway forward for the preservation of unique ecosystems in the face of unprecedented climatic challenges.

The research underscores the necessity of developing conservation strategies that are tailored to the specific needs and vulnerabilities of each ecosystem type. For tropical rainforests, strategies must address the dual challenges of habitat fragmentation and reduced carbon sequestration capacity, emphasizing reforestation, forest connectivity, and the protection of remaining forest tracts. In alpine regions, conservation efforts should focus on protecting critical habitats from encroachment and managing water resources to support both biodiversity and human communities downstream. For wetlands, strategies need to prioritize the maintenance of hydrological regimes, protecting against water extraction and land-use changes that threaten their integrity.



Scheme 1. Biodiversity conservation concept map

The studies showed significant seasonal dynamics of soil carbon dioxide emissions in unique natural ecosystems: an increase in respiration occurs during the period of intensive plant growth and slows down during the flowering period of plants, followed by a surge in soil "respiration" after the death of plants, and in the winter period they decrease to zero, with minimal transition values in the late autumn and early spring periods, especially in meadow ecosystems.

It is believed that an area with higher species abundance has a more stable environment compared to an area with lower species abundance. We can further claim the necessity of biodiversity by considering our degree of dependency on the environment. We depend directly on various species of plants for our various needs. Similarly, we depend on various species of animals and microbes for different reasons.

Biodiversity is being lost due to the loss of habitat, over-exploitation of resources, climatic changes, pollution, invasive exotic species, diseases, hunting, etc. Since it provides us with several economic and ethical benefits and adds aesthetic value, it is very important to conserve biodiversity (Scheme 1).

A study of the daily dynamics of soil CO_2 emissions showed a multiple change in the intensity of soil respiration during the period of active plant growth. As plants develop, they level out, mainly maintaining the localization of periods of maximum resulting respiration in the daytime and minimum - in the early morning. Both daily and seasonal changes in soil CO_2 emissions in the studied agroecosystems are determined by at least 30% of microclimatic environmental factors of soil temperature and moisture. At the same time, the influence of the temperature of the upper soil horizon on CO_2 flows is approximately 2-3 times stronger than that of moisture. The dominant biotic environmental factor regulating the seasonal dynamics of soil CO_2 emissions is the vegetation cover and its diversity in tropical forests, alpine meadows, and wetlands. At the same time, the resulting seasonal respiration of ecosystem soils is generally higher in meadow soils than in forest and marsh plants of these natural ecosystems. An important environmental factor regulating soil CO_2 emissions, in addition to the vegetation of natural ecosystems, is the type and degree of land degradation, especially their susceptibility to erosion. Soil CO_2 emission increases from slightly eroded to moderately and strongly eroded soils, especially in meadow and then forest ecosystems. The conducted studies confirm a stable increase in the diagnosed soil CO_2 emission of the integral biological activity of soils with variation in the range of positive temperatures of the upper part of the soil profile of natural ecosystems. Soil CO_2 emission allows us to refine the quantitative assessment of seasonal organic carbon losses, which varied from 2 to 2.5 t/ha per year, taking into account the pool of the upper horizon of the studied soils (110-130 t/ha).

Conclusion. There is a significant opportunity for research on the effectiveness of community-based conservation and climate adaptation strategies. Such studies would contribute to a deeper understanding of how local knowledge and participation can enhance conservation outcomes and support sustainable livelihoods in the face of climate change.

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ЗАЩИТА РАСТЕНИЙ В ЭПОХУ КЛИМАТИЧЕСКИХ ИЗМЕНЕНИЙ: ВЫЗОВЫ И РЕШЕНИЯ

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Аннотация. *Статья рассматривает влияние изменения климата на защиту растений, подчеркивая возникающие вызовы и возможные решения. Повышение температуры, изменение осадков и частота экстремальных погодных явлений способствуют появлению новых вредителей и болезней, что требует адаптивных методов защиты. Использование математических моделей, таких как дифференциальные уравнения и регрессионный анализ, позволяет прогнозировать вспышки вредителей и заболеваний, а также оптимизировать применение пестицидов. Примеры из Индии, США и Китая показывают, как математические расчеты могут повысить эффективность защиты растений и способствовать устойчивому сельскому хозяйству в условиях климатических изменений.*

Ключевые слова: *защита растений, изменение климата, математические модели, оптимизация применения пестицидов, устойчивое сельское хозяйство.*

Аннотация. *Мақолада иқлим ўзгаришининг ўсимликларни ҳимоя қилишга таъсири, юзага келаётган муаммолар ва уларнинг ечимига оид масалалар кўриб чиқилган. Ҳароратнинг ошиши, ёғингарчилик миқдорининг ўзгариши ва экстремал об-ҳаво ҳодисаларининг тез-тез содир бўлиши янги зараркунандалар ва касалликларнинг пайдо бўлишига сабаб бўлади, бу эса ҳимоя қилишнинг мослашувчан усулларини талаб қилади. Дифференциал тенгламалар ва регрессия таҳлили каби математик моделлардан фойдаланиш зараркунандалар ва касалликлар тарқалишини прогноз қилиш, шунингдек, пестицидларни қўллашни оптималлаштириш имконини беради. Ҳиндистон, АҚШ ва Хитой мисоллари математик ҳисоб-китоблар ўсимликларни ҳимоя қилиш самарадорлигини оширишга ва иқлим ўзгариши шароитида барқарор қишлоқ хўжалигига ҳисса қўшиши мумкинлигини кўрсатади.*

Калит сўзлар: *ўсимликларни ҳимоя қилиш, иқлим ўзгариши, математик моделлар, пестицидларни қўллашни оптималлаштириш, барқарор қишлоқ хўжалиги.*

Abstract. *This article examines the impact of climate change on plant protection, highlighting the emerging challenges and potential solutions. Increasing temperatures, changing precipitation patterns, and the frequency of extreme weather events contribute to the emergence of new pests and diseases, necessitating adaptive protection methods. The use of mathematical models, such as differential equations and regression analysis, enables the forecasting of pest and disease outbreaks, as well as the optimization of pesticide application. Examples from India, the USA, and China illustrate how mathematical calculations can enhance the effectiveness of plant protection and promote sustainable agriculture in the face of climate change.*

Keywords: *plant protection, climate change, mathematical models, optimization of pesticide application, sustainable agriculture.*

Введение. Изменение климата оказывает значительное влияние на сельское хозяйство, создавая новые вызовы для защиты растений. Повышение температур, изменение режима осадков и частота экстремальных погодных явлений способствуют появлению новых вредителей, распространению болезней растений и ухудшению условий роста сельскохозяйственных культур. Эти изменения требуют разработки инновационных подходов к защите растений, которые могут адаптироваться к новым условиям. Одним из таких подходов является использование математических моделей и расчетов для прогнозирования и оптимизации мер защиты растений в изменяющихся климатических условиях.

Цель этой статьи — рассмотреть, как изменение климата влияет на защиту растений, и какие математические методы могут быть использованы для решения возникающих проблем. В статье приводятся примеры математических расчетов, используемых для прогнозирования вспышек болезней, распространения вредителей и оптимизации применения защитных средств.

1. Влияние изменения климата на защиту растений

1.1. Повышение температуры и распространение вредителей

Одним из наиболее очевидных последствий изменения климата является повышение средней температуры. Это