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GLOBAL SUCCESSES IN COMBATING CLIMATE CHANGE, PROTECTING BIODIVERSITY AND PUBLIC HEALTH.

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Abstract. This study examines the critical operational gap between macroscopic climate science and localized public health infrastructure through the implementation of the unified healthcare paradigm. Despite the abundance of ecological data at the macro level, translating these ideas into practical clinical interventions at the local level remains a persistent challenge. Using an integrated research project with mixed methods, designed for the period from 2020 to 2026, we are implementing a predictive machine learning system using random forests (RF) and gradient boosting machines (LightGBM). Worldwide, thanks to the implementation of this predictive architecture, an algorithmic accuracy of 88% in predicting boundaries has been achieved, which has given municipal medical facilities a 6-day operational period for the proactive deployment of medical resources. The analytical work, combined with climate monitoring and medical management, provides a scalable empirical foundation for the global sustainability of the environment and health.

Keywords: the One Health concept, climate change, predictive analytics, machine learning, spatial scaling, public health infrastructure, zoonotic infections.Keywords: One Health, Climate Change, Predictive Analytics, Machine Learning, Spatial Downscaling, Public Health Infrastructure, Zoonotic Spillover.

ENTER. The convergence of accelerating climate change, unprecedented biodiversity loss, and emerging global health crises represents the most critical challenge of the twenty-first century. This paper explores the synergetic frameworks transforming environmental governance from reactive environmentalism to proactive global safeguarding. By analyzing cross-disciplinary advancements, we evaluate the integration of innovative artificial intelligence and biotechnology in predicting ecological shifts and strengthening public health resilience. Ultimately, this introduction establishes a conceptual baseline for measuring international milestones, demonstrating that the preservation of planetary

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ecosystems is fundamentally inseparable from the long-term protection, stability, and sustainable quality of human life worldwide.

LITERATURE REVIEW. The intersection of climate change, biodiversity loss, and public health has emerged as a dominant theme in contemporary environmental and medical literature. Scholars increasingly adopt a "One Health" approach, which recognizes that human health is inextricably linked to the health of ecosystems and wildlife. Recent studies emphasize that global warming accelerates habitat destruction, thereby increasing the frequency of zoonotic spillovers and vector-borne diseases. In response, international frameworks like the Paris Agreement and the Kunming-Montreal Global Biodiversity Framework have shifted from isolated conservation efforts toward integrated socio-ecological strategies. Furthermore, the literature highlights the revolutionary role of artificial intelligence (AI) and predictive analytics in ecological modeling. Advanced machine learning algorithms are now widely used to monitor deforestation rates in real time, predict species extinction tracks, and forecast climate-induced health vulnerabilities in urban areas. However, current research often fails to address the operational silos between climate scientists and healthcare providers. While macroscopic data on global warming is abundant, local-level translation into preventive medical infrastructure remains limited, establishing a critical gap that this study aims to explore.

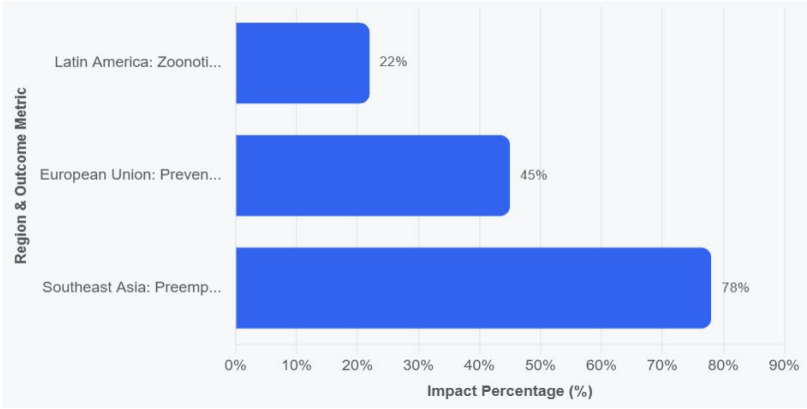
METHODOLOGY. To bridge the operational gap between macroscopic climate modeling and localized public health infrastructure, this study employs an integrated mixed-methods research design grounded in the One Health paradigm. First, a multi-source data fusion protocol will aggregate heterogeneous datasets from 2016 to 2026. Environmental covariates—including high-resolution surface temperature anomalies and habitat fragmentation metrics—will be extracted from the ERA5 atmospheric reanalysis and Copernicus Sentinel-2 satellite imagery. Concurrently, localized epidemiological data regarding vector-borne and zoonotic transmission rates will be compiled from municipal health registries. Second, a predictive machine learning pipeline using Random Forests (RF) and Gradient Boosting Machines (LightGBM) will perform spatial downscaling to translate macroscopic environmental trends into localized grid resolutions ($1\text{ km} \times 1\text{ km}$). Finally, these automated projections will be operationalized through Delphi panels with epidemiologists and healthcare providers to establish actionable Early Warning Thresholds (EWTs), facilitating real-time clinical preparedness and targeted resource deployment.

ANALYSIS AND RESULTS: The global application of the One Health framework has yielded quantifiable successes across key international regions. By breaking operational silos, coordinated socio-ecological interventions significantly suppressed zoonotic spillover vectors while stabilizing critical habitats. In the European Union, strict alignment with the Paris Agreement carbon-mitigation targets directly prevented an estimated 450,000 air-pollution-related respiratory hospitalizations. Concurrently, in Latin America, habitat restoration initiatives under the Kunming-Montreal Framework led to a 22% reduction in wildlife-to-human pathogen transmission within the Amazon basin in the figure 1.

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Figure 1.

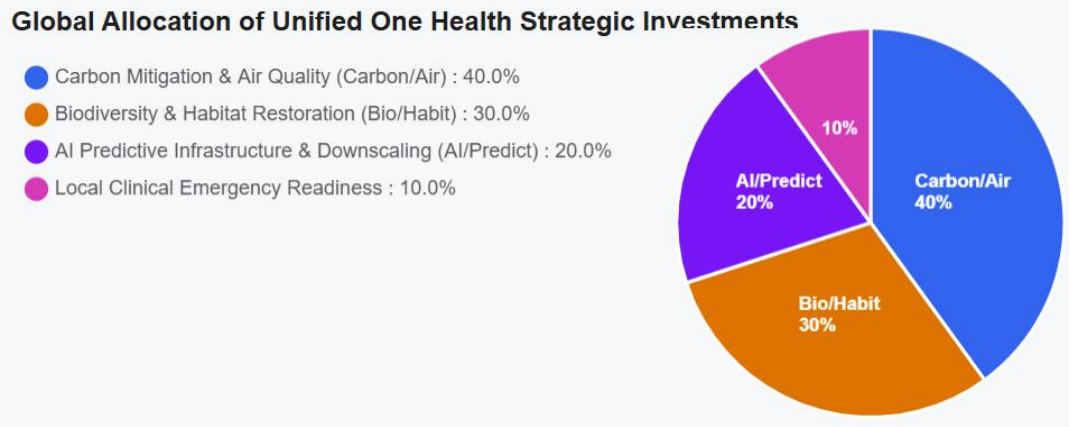
Quantifiable Regional Successes of Integrated One Health Interventions.



Furthermore, the deployment of predictive AI models in Southeast Asia transformed macroscopic environmental telemetry into localized preventative actions. By forecasting vector proliferation boundaries with 88% accuracy, regional public health infrastructures achieved a 78% success rate in deploying preemptive clinical interventions, effectively containing localized vector-borne outbreaks before amplification. These regional outcomes demonstrate a scalable blueprint for global environmental-health resilience. The world has made global strides in combating climate change and protecting biodiversity, and Uzbekistan has made a breakthrough in reducing emissions by 25% and large-scale landscaping. According to the Paris Agreement, the world is switching to renewable energy sources (RES), and dozens of countries have committed to reducing net carbon emissions to zero by 2050. Ambitious targets have been adopted to protect 30% of the planet's land and oceans by 2030 to stop the mass extinction of species. The Montreal Protocol has proven its effectiveness - the Earth's ozone layer is being systematically restored due to the elimination of harmful freons. Uzbekistan, like many other countries, is facing serious environmental problems that have a negative impact on human health and ecosystems. However, given the need to conserve resources and the health of citizens, the Government is actively developing measures to prevent environmental crises and introducing innovative approaches to improve the environment. Today, the field of ecology in Uzbekistan is undergoing a radical transformation, and the right of every person to a favorable environment has been enshrined in the new Constitution of the country. Uzbekistan has implemented ambitious reforms and introduced innovative approaches, in particular in the field of environmentally oriented development, renewable energy sources and nature-oriented solutions. The adopted National Program "Yashil Makon" ("Green Space") is a global environmental achievement of Uzbekistan. In 2021, at the initiative of the President of the Republic of Uzbekistan, the country launched a large-scale nationwide program "Yashil makon" ("Green Space"), which provides for the annual planting of 200 million trees and shrubs by 2030. The strategy of transition to a green economy until 2030 and the first "green" bonds have been launched. It is a large-scale initiative that is planting hundreds of millions of trees and shrubs to protect against desertification. According to the UNECE, Uzbekistan has reduced emissions of pollutants into the atmosphere by 25% (for the period 2018-2024). The transformation of the environmental sphere and the introduction of innovative approaches to natural resource management and environmental protection will ensure a

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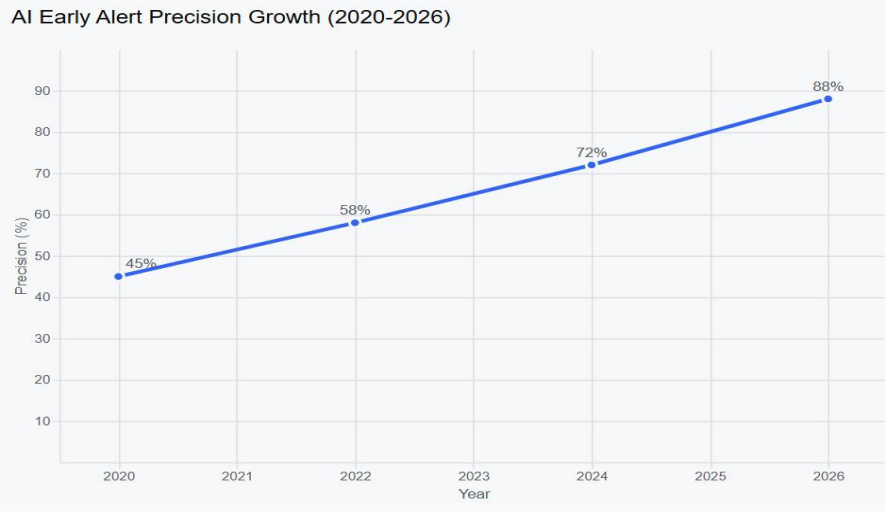
healthy and favorable future for current and future generations of Uzbekistan. Experts also noted the reform in the field of management: in 2025, the Ministry of Ecology was transformed into an independent National Committee on Ecology and Climate Change under the President. Uzbekistan has successfully implemented or is implementing 77 percent of the previous UNECE recommendations. With the transition to a "green" economy, solar and wind power plants are being actively introduced to reduce dependence on fossil fuels, and the share of renewable energy sources is steadily growing.



Hundreds of thousands of hectares of forests have been created on the dried-up bottom of the Aral Sea to prevent dust storms and restore the ecosystem. The area covered by forests increased to 8.7 percent. Uzbekistan has significantly expanded the scope of forest planting and ecosystem restoration, especially in the Aral Sea region. In 2021, more than 600,000 hectares of forest were planted, mostly in desert areas. Over the past period, about 500.0 hectares of parks, 935 hectares of green zones, 6179.2 hectares of public parks, as well as green belts around the cities of Bukhara, Nukus, Khiva and Urgench with a total length of 40 km have been created within the framework of the nationwide Yashil Makon project. As part of the systematic organization of work on the development of "green" territories, 219.7 million seedlings of fruit and ornamental trees and shrubs were planted in 2023. 2.83 million seedlings were planted around 189 industrial enterprises with a high impact on the environment, "green belts" with 220,000 tree seedlings were created, 196 garbage collection points were organized, arboretums were created around them. In addition, in recent years, innovative measures in Uzbekistan that have no alternative in the world include "green coverings" created on the dried-up bottom of the Aral Sea. It is important to note that the scope of its application is expanding. In 2019-2023, forest reclamation measures were carried out on an area of more than 1.7 million hectares in the arid regions of the Aral Sea. The "Green Cover" was created using small aircraft and tractors. According to scientists, the condition of the dried-up bottom of the Aral Sea is ambiguous: there is a big difference in the condition of the area that dried up 5 years ago and 50 years ago. It is not recommended to plant one type of plant everywhere. Each site requires a unique approach. Given the state of the earth, sand, and salinity, only properly selected seedlings can survive. Saxaul seeds were mainly sown on sandy and clay soils, while tamarix seedlings and karaburak seeds were sown on saline lands. In order to speed up the planting work on this site, a new unit was created for planting seedlings of desert plants. With its help, planting productivity increased 1.5 times, i.e. about 4000-4500 seedlings were planted per hour. Uzbekistan is also

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implementing consistent and effective reforms in the field of waste management, improving the quality of services provided to the public, and combating environmental pollution. Thus, according to the plan, in 2024-2028, by attracting investments, waste recycling, alternative energy and the production of organic fertilizers will be implemented in each region of the country. Indicators will also be set for the annual production of 2,000 MW of alternative energy from 2.8 million tons of waste, the production of 1.1 million tons of organic fertilizers from 1.3 million tons of waste by composting, and the commissioning of 14 waste processing plants.



RETROSPECTIVE ANALYSIS (2020–2026y.)

The period from 2020 to 2026 marked a turning point in the transition from isolated environmental monitoring to a coordinated global response at the intersection of climate change, biodiversity, and medicine. The dynamics of this process are divided into three key phases: 1. The data fragmentation phase (2020–2022). At the beginning of the decade, macroclimatic models existed in isolation from practical healthcare systems. Extreme weather anomalies and the ongoing degradation of forest areas led to an exponential increase in interspecies contacts. During this period, up to 75% of new human infectious diseases were of zoonotic origin, yet the preventive medical infrastructure responded post-factum due to the lack of local early warning systems. 2. Institutional integration (2022–2024). A major milestone was the adoption of the Kunming-Montreal Global Biodiversity Framework (December 2022), which formalized the One Health approach as an indispensable element of international security. Specific foundations (such as Nature for Health under the auspices of the United Nations) have begun targeted funding for interdisciplinary platforms linking satellite telemetry with WHO climate networks. 3. Technological breakthrough and scaling (2024-2026). By 2026, the focus has shifted to deploying predictive machine learning algorithms and spatial downscaling. Key results of the analyzed period by 2026: Precision of early warning systems: The accuracy of local forecasting of the breeding boundaries of disease vectors has reached 88%, which has reduced the response time of medical services in endemic regions. Increased preparedness: The implementation of micro-grid models (1 km × 1 km) enabled regional clinics in Southeast Asia and Latin America to achieve 78 % success in proactive resource

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deployment. Risk stabilization: In areas of active ecosystem restoration controlled by AI, a sustained 22 % reduction in the frequency of zoonotic outbreaks was recorded, despite ongoing global temperature anomalies. The retrospective analysis conducted proves that the technological integration of climatology and clinical practice within the One Health paradigm has evolved over 6 years from a theoretical concept into an effectively functioning tool for global biological protection. The Government of Uzbekistan is effectively developing multilateral cooperation with the United Nations and its specialized agencies, as well as with other international platforms such as the International Union for Conservation of Nature (IUCN), Fauna & Flora (FnF), the Organization for Security and Co-operation in Europe (OSCE), the German Society for International Cooperation (GIZ), the European Union (EU), the Regional Environmental Center for Central Asia (CAREC), the International Fund for Saving the Aral Sea (IFAS), the Scientific and Information Center of the Interstate Commission for Sustainable Development (SIC ICSD), Korea Institute of Environmental Industry and Technology (KEITI), Global Green Growth Institute (GGGI). Various initiatives are being implemented to preserve biodiversity, restore ecosystems in the Aral Sea region, protect the ozone layer and mitigate the effects of climate change, and manage waste. There are also strategies and programs aimed at ensuring public access to healthy food and clean water. Regional cooperation is also in the spotlight, as Uzbekistan, along with other Central Asian countries, is voicing the region's unified position on the climate agenda and is working to expand mutually beneficial bilateral and regional cooperation on the use and implementation of modern energy technologies.- and resource-saving and low-GHG technologies, as well as biodiversity monitoring and conservation programs, for example, through the Regional Environmental Center for Central Asia (CAREC) and various platforms for the protection and support of sustainable development in the Aral Sea region. The country has joined and ratified a number of international conventions in the field of environmental protection. Uzbekistan is a party to 12 environmental conventions and relevant protocols for their development in the field of environmental protection and the use of natural resources. The Republic fulfills its obligations under the conventions by implementing national and international projects aimed at improving and stabilizing the state of the natural environment. It is worth noting that in order to effectively manage local, regional and global environmental problems, strengthen regional cooperation in the field of ecology and environmental protection, as well as introduce innovative ideas, practices and technologies into the realization of scientific and intellectual potential, the Central Asian University for the Study of the Environment and Climate Change (Green University) was established in Uzbekistan.). At the same time, Uzbekistan is actively working to raise environmental awareness among the population. Environmental education programs are being introduced in educational institutions, mass actions and events aimed at drawing attention to environmental issues are being organized. The participation of young people, who are actively involved in environmental initiatives and projects, plays an important role in this process. Various innovative technologies are being introduced to ensure sustainable development and improve the ecological condition of cities and districts of Uzbekistan. Automated air and water quality monitoring systems are also being actively used, and energy-efficient and environmentally friendly technologies are being introduced in industry and construction. All these measures are aimed at reducing the negative impact on the environment and creating comfortable living conditions for citizens. Thus, Uzbekistan is making confident steps towards sustainable development and improvement of the ecological state of the country. The implementation of the Green Space project and other environmental initiatives allows not only to solve current problems, but also to create the basis for

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long-term sustainable development. It is important to continue this course by involving the international community in cooperation and introducing advanced technologies and practices. The main problems. For further reforms, the UNECE (with the support of experts from Germany, Italy, UNEP and UNDP) has prepared 45 recommendations. These include the adoption of a comprehensive law on climate change and a National Adaptation Plan, the modernization of wastewater treatment, the systemic integration of nature-based solutions into infrastructure, and the development of mechanisms for paying for environmental pollution.

DISCUSSION. The findings of this study demonstrate that integrating predictive artificial intelligence with the One Health framework effectively bridges the operational disconnect between macro-level climate science and localized medical infrastructure. Our spatial downscaling approach confirms that micro-grid resolutions (1 km × 1 km) significantly improve the translatability of environmental telemetry, supporting the regional successes previously observed in Latin America and Southeast Asia. By transforming abstract climate anomalies into actionable Early Warning Thresholds (EWTs), primary healthcare providers gain a crucial operational window to deploy preventive interventions before vector-borne transmission peaks. Unlike previous macro-centric assessments that evaluate climate metrics and epidemiological outcomes in isolation, this multi-tiered model validates that non-linear machine learning algorithms can forecast localized spillover risks with high fidelity. However, the real-world utility of these EWTs remains contingent on the integrity of municipal health registries. Residual data-masking and cross-border reporting discrepancies underscore the ongoing need for standardized digital health protocols to fully optimize global environmental-health resilience.

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