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Editorial

Addressing the climate-food-health nexus: strengthening ecosystem-based adaptation and One Health

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The escalating impacts of climate change are dismantling global food systems and intensifying public health crises, with rising temperatures, erratic weather patterns, and extreme events destabilizing agriculture, deepening food insecurity, and amplifying health risks. Globally, over 900 million people are facing acute food insecurity, particularly in vulnerable regions, where livelihoods are becoming increasingly precarious (Lake *et al.*, 2012; Sanober, 2023). Catastrophic floods in South Asia and prolonged droughts in Africa exemplify the escalating challenges, exacerbating economic fragility and pushing communities closer to collapse (Azeem *et al.*, 2023; Delina *et al.*, 2023; Moon *et al.*, 2023). Beyond food insecurity, climate change causes a multifaceted public health crisis, with warmer temperatures and disrupted ecosystems accelerating zoonotic diseases, foodborne pathogens, and malnutrition, devastating fragile health systems (Myers *et al*., 2017; Thornton *et al*., 2021). These risks are further compounded by expanding urbanization, intensive farming practices, pollution, and ecosystem degradation. Traditional adaptive responses have proven inadequate in addressing the scale and complexity of these interconnected challenges, necessitating transformative, integrative solutions like One Health and ecosystem-based adaptation (EBA) to foster long-term resilience and stability.

Climate change is destabilizing global agriculture, fracturing critical supply chains, and directly undermining food production. Disrupted planting cycles, reduced crop yields, and extreme weather events have exacerbated food insecurity, particularly in vulnerable regions. In Bangladesh, rising sea levels and increased salinization of arable land have severely impacted rice production while frequent floods disrupt livelihoods and damage infrastructure (Islam *et al*., 2023). Similarly, prolonged droughts in Sub-Saharan Africa threaten livestock and crop yields, intensifying hunger and poverty (Lombe *et al.*, 2024). Elevated CO_2 levels, compounded by anthropogenic pollutants, further degrade the nutritional quality of crops, disproportionately affecting children, pregnant women, and the elderly (Myers *et al*., 2017). Tackling these interconnected challenges necessitates integrating sustainable, climate-resilient agricultural practices with ecosystem restoration to enhance food system resilience and safeguard vulnerable populations.

Ecosystem-based approaches provide a nature-centered solution to mitigate climate impacts and build resilience in food systems by leveraging natural processes like restoration, reforestation, and biodiversity conservation to address risks such as flooding, drought, and soil erosion (Thiaw *et al*., 2021). Examples include mangrove restoration protecting coastal farmland from storm surges and wetland conservation reducing flooding and improving water quality. Agricultural practices such as agroforestry, crop diversification, and integrated farming systems enhance ecosystem health, bolster biodiversity, and support sustainable food production. Innovations

like Bangladesh's floating gardens demonstrate how cost-effective, region-specific EBA strategies can address local challenges. By aligning biodiversity conservation with sustainable agricultural practices, EBA strengthens soil fertility, water retention, pest regulation, and drought resilience, fostering climate-resilient food systems that secure livelihoods (Smith *et al*., 2019). Marine ecosystems also present significant untapped potential for addressing climate-resilient food security. Leveraging marine resources like seaweed and mariculture offers sustainable, low-carbon food sources that support coastal communities, diversify food supplies, reduce dependence on land-based agriculture, and enhance resilience to climate impacts, extending EBA's reach to global food security (Tacon *et al*., 2021).

Climate change is amplifying public health risks, particularly through its impact on food safety and the proliferation of foodborne and zoonotic diseases. Rising temperatures, shifting rainfall patterns, and altered ecosystems create favorable conditions for foodborne pathogens like *E. coli*, *Salmonella*, *Campylobacter*, and *Vibrio cholerae* to thrive. This challenge is further intensified in resource-limited regions with inadequate food and water storage infrastructure, where outbreaks of foodborne illnesses are more frequent (Anikeeva *et al*., 2024). Warmer temperatures and heightened humidity also accelerate the growth of fungal pathogens producing aflatoxins, which contaminate crops and pose severe health risks, especially in areas lacking proper storage systems (Neogi *et al*., 2024). Simultaneously, zoonotic pathogens, responsible for nearly 60% of all infectious diseases in humans, represent an escalating concern. Pathogens like *Salmonella* and *Campylobacter*, often linked to contaminated poultry, raw milk, and untreated water, alongside viral threats such as Norovirus, Avian Influenza, Coronavirus and African Swine Fever (ASF), jeopardize both human health and global food supply chains. Climate change exacerbates these risks by disrupting ecosystems and increasing interactions between humans and wildlife, creating more opportunities for disease spillovers (Jones *et al*., 2008; Qian *et al*., 2023). Addressing these interconnected health risks demands holistic and integrated interventions that tackle overlapping threats from foodborne and zoonotic diseases while safeguarding ecosystem health.

The One Health framework provides a holistic roadmap for addressing these challenges by recognizing the interconnectedness of human, animal, and environmental health. This integrated approach is particularly crucial in the context of climate change, which disrupts ecosystems, threatens food production, and accelerates the spread of infectious and zoonotic diseases. Central to the One Health strategy are enhanced surveillance systems and biosecurity measures that bridge public health, veterinary science, agriculture, and environmental management. By fostering cross-sector collaboration, the framework aims to reduce disease transmission, fortify food systems, and improve public health outcomes, offering a sustainable path forward in the face of escalating global health and environmental crises (Qian *et al*., 2023; Anikeeva *et al*., 2024).

Sustainable agricultural practices are essential to the One Health framework, enhancing ecosystem resilience and ensuring food security in a changing climate. Integrated farming systems, which combine crops, livestock, and aquaculture, exemplify the benefits of biodiversity and ecological balance. Practices such as organic farming, integrated pest management, and agroecology reduce reliance on chemical inputs, foster healthier ecosystems, and improve soil and water health (Foley *et al*., 2011; Altieri *et al*., 2015). Recycling and repurposing agricultural waste can yield valuable resources such as organic fertilizers and bioenergy, while attenuating the requirement for synthetic inputs (De Corato, 2020; Raza *et al.*, 2022; Xie *et al.*, 2023). Integrated multitrophic aquaculture (IMTA) systems harness natural processes to recycle nutrients and optimize resource use (Troell *et al*., 2014). By minimizing the ecological disruptions often caused by industrial farming, these practices also help reduce zoonotic disease risks while bolstering sustainable food systems and climate resilience.

Combatting antimicrobial resistance (AMR) is a critical component of addressing the intersection of climate, food, and public health. The overuse of antimicrobials in agriculture and livestock production, particularly during climate-related disruptions, accelerates the development of multidrug-resistant (MDR) pathogens. Extreme weather events often increase reliance on antimicrobials to tackle disease outbreaks, further complicating infection treatments in humans and animals (Smith *et al*., 2019). Additionally, climate change expands the geographic distribution of resistant pathogens and introduces antimicrobial agents into ecosystems via runoff. The One Health framework advocates for effective antimicrobial stewardship and robust surveillance on AMR and MDR among microbial populations across agricultural ecosystems, food supply chains, and human populations. Key strategies emphasized in the One Health approach include strengthening local and regional platforms for collaborative, cross-sectoral efforts in surveillance, while promoting enhanced biosecurity measures, reducing use of antibiotics and harmful agrochemicals, and integrating sustainable practices into food systems to safeguard biodiversity, restore ecosystem health, and enhance integrated risk management system for global resilience to emerging threats (Zhang *et al.*, 2024). By aligning these efforts, the One Health approach

offers a pathway to safeguard public health and food security while mitigating the broader impacts of climate change.

Integrating One Health interventions with EBA methods offers a powerful and holistic approach to building a climate-resilience, while simultaneously delivering critical co-benefits for public health. EBA measures, by preserving biodiversity and restoring degraded ecosystem, reviving natural buffering potential resisting the spread of zoonotic pathogens, and disease outbreaks, while sustainable practices like organic farming and integrated pest management minimize harmful chemical exposures, eventually enhancing food safety. Moreover, EBA promotes improved nutrition by diversifying food sources and maintaining agricultural productivity under changing climatic conditions, creating a robust foundation for long-term adaptation (Lucatello and Alcántara-Ayala, 2024; Myers *et al*., 2017).

The convergence of climate change, food insecurity, and public health risks demands urgent, coordinated action through holistic and integrated solutions. Frameworks rooted in One Health and EBA principles, and sustainable agriculture are vital for building resilience and protecting vulnerable populations (Thiaw *et al*., 2021). Key international authorities have underscored the importance of these approaches: the UNFCCC emphasizes climate resilience through sustainable land management and biodiversity conservation, the FAO advocates for agroecological practices to ensure food security, and WHO prioritizes mitigating health risks from zoonotic diseases, MDR, and climate-driven illnesses. However, these goals face significant challenges, including insufficient financial resources, fragmented policy implementation, and the difficulty of integrating agriculture, health, and environmental management, which often operate in silos. Anthropogenic pressures like deforestation, pollution, and intensive agriculture further erode fragile ecosystems, while limited access to data, inadequate sociopolitical capacity, and a lack of cross-sectoral coordination hinder progress (Jones *et al*., 2008). Bridging these gaps demands that development authorities, governments, and local partners prioritize research-based, community-driven solutions through a holistic, multidisciplinary approach that integrates technological innovation, scientific validation, data-driven strategies, and collaborative multi-sectoral efforts.

Transformative change is imperative to build climate-resilient food systems, safeguard public health, and protect ecosystems for future generations. Governments, non-profits, and private sector actors must align One Health and EBA frameworks to implement science-driven, inclusive, and participatory strategies. Investments in sustainable farming, climate-resilient infrastructure, disaster preparedness, and community empowerment are critical, as are cutting-edge technologies like AI-driven climate models to enhance disaster readiness and integrate data-driven approaches. Addressing human-induced impacts such as habitat destruction and resource overexploitation is essential, along with co-developing indigenous-led adaptation strategies, upholding human rights in governance frameworks and connecting scientific insights with policymaking.

The time to act is now, as climate change, the growing human population, and the challenges of the Anthropocene continue to threaten food security, public health, and ecosystems, undermining the path to a sustainable future.

Ethical approval and informed consent

Not applicable.

Data availability

Not applicable.

Conflict of interest

None to declare.

Author's contribution

Conceptualization, formal analysis, writing-original draft preparation, review and editing: Sucharit Basu Neogi. The author has read and approved the final version of the published editorial.

References

Altieri MA, CI Nicholls, A Henao and MA Lana, 2015. Agroecology and the design of climate-resilient farming systems. Agron. Sust. Dev., 35: 869-890.

Anikeeva O, A Hansen, B Varghese, M Borg, Y Zhang, J Xiang and P Bi, 2024. The impact of increasing temperatures due to climate change on infectious diseases. BMJ, 387: e079343.

Azeem S, HA Cheema, A Shahid, F Al-Mamun, S Rackimuthu, MEU Rehman, MY Essar and KY Lee, 2023. Devastating floods in South Asia: The inequitable repercussions of climate change and an urgent appeal for action. Public Heal. Pract., 5: 100365.

De Corato U, 2020. Agricultural waste recycling in horticultural intensive farming systems by on-farm composting and compost-based tea application improves soil quality and plant health: A review under the perspective of a circular economy. Sci. Total Environ., 738: 139840.

Delina LL, NPP Ludovice, J Gaviola and R Cagoco-Guiam, 2023. Living with climate and state fragility in a "chaotic paradise:" securitizing livelihoods in the Philippines' Cotabato River Basin. Clim. Risk Manag., 42: 100558.

Foley JA, N Ramankutty, KA Brauman, ES Cassidy, JS Gerber, M Johnston and DP Zaks, 2011. Solutions for a cultivated planet. Nature, 478: 337-342.

Islam MS, MM Rahman, MR Karim and SM Haque, 2023. Irregular rainfall and high temperatures: Impacts on food crops and nutritional security in Bangladesh. Front. Clim., 5: 1374469.

Jones KE, NG Patel, MA Levy, A Storeygard, D Balk, JL Gittleman and P Daszak, 2008. Global trends in emerging infectious diseases. Nature, 451: 990-993.

Lake IR, L Hooper, A Abdelhamid, G Bentham, ABA Boxall, A Draper, S Fairweather-Tait, M Hulme, PR Hunter, G Nichols and KW Waldron, 2012. Climate change and food security: Health impacts in developed countries. Environ. Health Perspect., 120: 1520-1526.

Lombe P, E Carvalho and P Rosa-Santos, 2024. Drought dynamics in sub-Saharan Africa: Impacts and adaptation strategies. Sustainability, 16: 9902.

Lucatello S and I Alcántara-Ayala, 2024. Sustainable synergy: Strengthening disaster risk reduction in Latin America and the Caribbean through nature-based solutions. Int. J. Disaster Risk Reduct., 113: 104860.

Moon MP, 2023. Food and health security impact of climate change in Bangladesh: A review. J. Water Clim. Chan., 14: 3484-3495

Myers SS, MR Smith, S Guth, CD Golden, B Vaitla, ND Mueller and P Huybers, 2017. Climate change and global food systems: Potential impacts on food security and undernutrition. Ann. Rev. Pub. Health, 38: 259-277.

Neogi SB, S Ahmed, MM Rahman and MA Hossain, 2024. Impact of climate change on food contamination: The role of aflatoxins in public health risks. J. Food Safe. Secur., 42: 12-25.

Qian Y, Y Zhang and J Wang, 2023. Emerging infectious diseases and One Health: A review of cross-sectoral integration. Environ. Sci. Pol., 151: 1-12.

Raza ST, J Wu, ER Rene, Z Ali and Z Chen, 2022. Reuse of agricultural wastes, manure, and biochar as an organic amendment: A review on its implications for vermicomposting technology. J. Clean. Prod., 360: 132200.

Sanober N, 2023. An overview of the influence of climate change on food security and human health. Arch. Food Nutr. Sci., 7: 1-11.

Smith P, PJ Gregory, D van Vuuren, M Obersteiner, P Havlik, M Rounsevell and E Stehfest, 2019. Towards a sustainable food system: Transforming global agriculture. Nature Food, 1: 1-8.

Tacon AGJ, MR Hasan and M Metian, 2021. Aquatic feed and the role of seaweed in global food security. Aqua. Res., 52: 487-502.

Thiaw I, R Munang and M Rivington, 2021. Ecosystem-based adaptation: Strengthening the links between biodiversity, climate change, and sustainable development. Curr. Opin. Environ. Sustain., 51: 123-130.

Thornton PK, PJ Ericksen, M Herrero and AJ Challinor, 2021. Climate variability and vulnerability to climate change: A review. Climate Change, 115: 247-264.

Troell M, RL Naylor and MCM Beveridge, 2014. Multitrophic aquaculture for sustainable development: An overview of the technology and its role in climate change adaptation. Mar. Pol., 44: 79-87.

Xie S, HT Tran, M Pu and T Zhang, 2023. Transformation characteristics of organic matter and phosphorus in composting processes of agricultural organic waste: Research trends. Mater. Sci. Energy Technol., 6: 331-342.

Zhang T, R Nickerson, W Zhang, X Peng, Y Shang, Y Zhou, Q Luo, G Wen and Z Cheng, 2024. The impacts of animal agriculture on One Health—Bacterial zoonosis, antimicrobial resistance, and beyond. One Heal., 18: 100748.