

Biodiversity, Climate Change, and Health: Advances in Vector Biology and Sustainable Control Strategies

Ruth Müller^{1,2}

¹Unit Entomology, Department of Biomedical Sciences, Institute of Tropical Medicine
Antwerp, Belgium

²Department of Biomedical Sciences, Faculty of Pharmaceutical, Biomedical and Veterinary Sciences
University of Antwerpen, Antwerp, Belgium

Biodiversity plays a crucial role in shaping ecosystem health, with profound implications for human well-being¹. One of the most critical intersections between biodiversity and public health is through vector biology—the study of organisms, such as mosquitoes and ticks, that transmit diseases to humans and animals. The diversity of vectors, their habitats, and interactions with other species can significantly influence the transmission dynamics of vector-borne diseases such as malaria, dengue, and West Nile fever. Understanding the ecological underpinnings of vector behavior, breeding patterns, and disease transmission is key to developing effective control strategies.

Climate change is increasingly recognized as a major factor influencing vector biology. Rising temperatures, altered precipitation patterns, and shifts in ecosystems are expanding the geographical range of many vectors, leading to the spread of diseases to new regions². The changing climate also affects vector breeding cycles, biting behavior, and survival rates, further complicating disease management. To mitigate these challenges, vector control approaches are evolving, combining traditional methods with ecologically-based strategies that consider biodiversity and environmental resilience. Integrated control strategies now emphasize the importance of biological control agents, habitat management, and community engagement to address both the direct impacts of vector species and the broader environmental shifts caused by climate change.

In the invited lecture, Prof. Dr. Ruth Müller, a leading expert in medical entomology and vector biology, will outline how she started and continues her endeavor to significantly advance the field's understanding of how climate change and biodiversity affect vector-borne diseases. Her research focuses on the ecology and behavior of mosquitoes and other vectors, integrating eco-friendly control methods that aim to balance effective disease management with the conservation of biodiversity. Her work emphasizes the need for adaptive, sustainable solutions that account for the growing challenges posed by global environmental change.

References

1. Marselle, M., Hartig, T., Cox, D., de Bell, S., Knapp, S., Lindley, S., Triguero-Mas, M., Boehning-Gaese, K., Cook, P., de Vries, S., Heintz-Buschart, A., Hofmann, M., Irvine, K., Kabisch, Kolek, F., Kraemer, R., Markevych, I., Martens, D., Mueller, R., Nieuwenhuijsen, M., Potts, J., Stadler, J., Walton, S., Warber, S.L., Bonn, A. Pathways linking biodiversity to human health: A conceptual framework. *Environment International* **150**: 106420 (2021)
2. Dhimal, M., Kramer, I., Phuyal, P., Budhathoki, S.S., Ahrens, B., Kuch, U., Groneberg, D.A., Nepal, S., Liu, Q, Huang, C., Cissé, G., Ebi, K.L., Klingelhöfer, D., Müller, R. Climate change and its association with expansion of vectors and vector-borne diseases in the Hindu Kush Himalayan region: A systematic synthesis of the literature. *Advances in Climate Change Research* (2021)