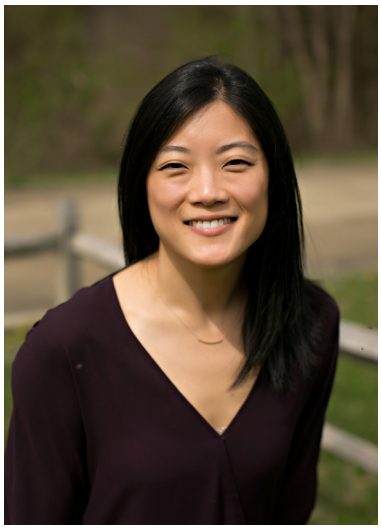
Cary Institute of Ecosystem Studies

Barbara A. Han, Disease Ecologist



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Research mission:

- Predict and understand pathogen spillover
- Reform global disease management from reactive to preemptive
- Push the frontiers of ecological prediction with AI and machine learning

Summary:

Barbara Han's research is at the intersection of ecology, computing, and global health. Han has pioneered the use of machine learning and artificial intelligence tools to understand when and where new zoonotic diseases are likely to emerge, and why.

Han employs complex algorithms to analyze patterns and processes in nature that could result in the next Ebola, Zika, or SARS-CoV-2. Some of these models compare traits of known animal disease carriers — size, diet, reproductive habits, biogeography — with thousands of species not yet known to carry disease, in order to predict which animals might become disease carriers in the future, and where these emergence events are most likely to occur globally. Underlying these research topics is the creative application of AI and the co-development of new AI approaches that enhance prediction and infectious disease intelligence for stakeholders across disciplines.

Han's research is actively contributing to a shift toward preemptive management for infectious disease spillover. This transformation could impact surveillance programs, global health preparedness efforts, and land management decisions, as it becomes obvious that diseases are more likely to emerge from certain habitats or in response to certain types of human behaviors.

Han is an interdisciplinary connector who routinely partners with diverse collaborators including scientists from IBM, NASA, and numerous national and international universities to advance research on global disease prediction. She contributes to efforts led by the World Health Organization, Coalition for Epidemic Preparedness Innovations, Wellcome Trust, and multiple US governmental agencies to apply this research to disease preemption. She is a member of the Board on Life Sciences at the National Academies of Sciences, Engineering, and Medicine, which provides guidance on life sciences-related issues to the US government and the public.

Select publications:

Han BA*, Varshney KR*, LaDeau S, Subramaniam A, Weathers KC, and Zwart J. 2023. **A synergistic future for AI and ecology.** *Proceedings of the National Academy of Sciences.* (*indicates co-lead authors)

Fischhoff IR, Castellanos AA, Rodrigues JPGLM, Varsani A, and Han BA. 2021. **Predicting the zoonotic capacity of mammals to transmit SARS-CoV-2**. *Proceedings of the Royal Society B: Biological Sciences.*

Han BA, O'Regan SM, Schmidt LP, and Drake JM. 2020. **Integrating data mining and transmission theory in the ecology of infectious diseases**. *Ecology Letters.*

Han BA, Kramer AM, and Drake JM. 2016. **Global patterns of zoonotic disease in mammals**. *Trends in Parasitology.*

Han BA and Drake JM. 2016. **Future directions in analytics for infectious disease intelligence: Toward an integrated warning system for emerging pathogens**. *EMBO Reports.*

Han BA, Schmidt JP, Alexander LW, Bowden SE, et al. 2016. **Undiscovered bat hosts of filoviruses**. *PLOS Neglected Tropical Diseases.*

Han BA, Schmidt JP, Bowden SE, and Drake JM. 2015. **Rodent reservoirs of future zoonotic diseases**. *Proceedings of the National Academy of Sciences.*

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