Personal protection measures, such as bed nets and repellents, are important tools for the suppression of vector-borne diseases like malaria and Zika. The ability of health agencies to distribute personal protection equipment, and encourage its use, plays an important role in the efficacy of disease management strategies. Recent modeling studies have discovered that a counterintuitive diversity-driven amplification in community-wide disease levels can occur when a population only partially adopts personal protection measures. In this way, partial adoption becomes detrimental to the larger goal of disease management. This ‘amplification effect,’ however, may overestimate the negative impact of personal protection as a result of implicit, restrictive model assumptions regarding population compliance, access to personal protection measures, and the longevity of those measures. We establish a new modeling methodology for exploring control efforts in vector-borne disease systems featuring personal protection. This new method flexibly accounts for compliance, access, longevity, and control strategies by way of a flow between protected and unprotected populations rather than breaking the population into static protected and unprotected classes as has been done previously. Our new methodology yields large reductions in the severity and occurrence of amplification effects as compared to existing models.
Bill Fagan is Professor and Chair of the Biology Department at the University of Maryland. He received an Honors B.A. from the University of Delaware (1992), a Ph.D. in Zoology from the University of Washington (1996), and then did a postdoc at the National Center for Ecological Analysis and Synthesis. His research, which emphasizes the interplay between data and theory, sits at the interface of mathematics and biology, where he has worked on a wide range of ecological topics with many collaborators from diverse fields. An elected Fellow of both the Ecological Society of America and the AAAS, he also received a Guggenheim Fellowship and the Presidential Award of the American Society of Naturalists. Over his career, he has worked on a variety of projects in ecology, conservation biology, and applied mathematics. He has published >200 journal articles which have garnered ~18,000 citations, yielding an H-index of 61. Currently, his externally funded research focuses on mathematical investigations of long-distance animal movement, the role of phenology (biological timing) in species interactions, and the spatial ecology of the human skin microbiome.

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