Can algorithms help sustain earth's ecosystems? Ecological processes such as bird migration are complex, difficult to measure, and occur at the scale of continents, making it impossible for humans to grasp their broad-scale patterns by direct observation. However, novel data sources – such as large sensor networks and millions of bird observations reported by human “citizen scientists” – provide new opportunities to understand ecological phenomena at very large scales. The ability to fit models, test hypotheses, make predictions, and reason about human impacts on biological processes at this scale has great potential to advance science and conservation.

In this talk, I will discuss the role of algorithms in answering questions about ecology and conservation from big data. I will discuss work across a range of problems in this domain including low-level data interpretation, fitting models of complex and large-scale ecological processes, and designing conservation policies. Applications include continent-scale modeling of bird migration and planning to remove dams and other barriers to restore connectivity of river networks.