

## Washington Statistical Society Statistical Seminar Event

**Title:** One Statistician's Evolving Perspective on Causal Analysis in Ecology

**Speaker:** Dr. Kathryn M. Irvine (Kathi), PhD, Research Statistician, Northern Rocky Mountain Science Center

**Chair:** Mark Otto, President, Washington Statistical Society (WSS)

**Date:** Tuesday, February 8, 2022

**Time:** 11:00AM – 12:00PM EST

### Abstract:

Applications of causal analysis are becoming more common in most areas of science. In both aquatic and terrestrial ecosystems, scientists try to understand ecological mechanisms related to natural or human-induced disturbance (e.g., wildfire, drought, land conversion). Causal modeling requires synthesizing current scientific knowledge such that connections among ecological indicators and key ecosystem states or processes can be conveyed using a directed acyclic graph. Measured or unmeasured variables are represented as nodes in these graphs, and edges between nodes can be direct (suggesting possible cause-effect relationships) or indirect (suggesting more complicated, or mediated, cause-effect relationships). Investing the time to construct and justify causal diagrams provides a framework for explanatory modeling in Ecology by encouraging transparency of assumptions and a strategy for identifying opportunities for sequential learning through further investigation. I briefly discuss the history of classic structural equation models, path analysis, and statistical graphical models. I introduce structural causal models which have emerged as a comprehensive framework for assessing evidence for causal hypotheses conveyed within a causal diagram and, potentially, arriving at causal estimates for the effects of interventions. I introduce key concepts and properties that provide testable implications encoded within a causal diagram. However, as Statisticians we question those assumptions that are untestable and how sensitive our conclusions are to violations of these untestable assumptions. Throughout I use several examples of completed or on-going projects that use causal modeling to understand the “why” behind evidence of trends in natural resource monitoring of aquatic systems. I highlight our evolving workflow for collaborating and co-producing causal inferences with Ecologists and natural resource Managers while acknowledging the realities of ecological data.

**About the speaker:** Dr. Irvine works at the Northern Rocky Mountain Science Center as a research statistician within the U.S. Geological Survey, a bureau within the Department of Interior. My team provides statistical support for monitoring programs led by the National Park Service, Fish and Wildlife Service, Bureau of Land Management, and state agencies. Our work involves development of survey design and analysis strategies for a variety of plants, animals, and other indicators. We currently support monitoring of five needle pines and upland plant communities throughout the Western US, and bats across North America.

For additional information, please contact [Yan Li](#), WSS Methodology Program Chair.

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