

# Sum of their parts: Researchers use math to foster environmental restoration

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A patchwork of resource management boundaries such as those found in the Puget Sound area, pictured here, can make joint restoration efforts a challenge. Researchers Jacopo Baggio of Utah State University and Jesse Sayles of McGill University, report on analytic modeling used to develop tools to foster collaboration and efficient coordination of resources among multiple stakeholders toward environmental restoration Credit: D. Coetzee. Released into the public domain.

The oft-quoted proverb, "Too many cooks spoil the broth," is apt wisdom for describing challenges facing policy makers, public resource managers, ag producers, industry, residents and other stakeholders in attempts to jointly tackle major environmental restoration projects. The myriad of varied interests—some conflicting; some aligning - results in a confusing tangle of authority and responsibility.

"Resource management boundaries seldom align with environmental systems," says Utah State University researcher Jacopo Baggio. "This can lead to a variety of social and ecological problems."

But an answer to this struggle, known alternately as "scale mismatch" or "spatial misalignments," may lie in the power of math.

With colleague Jesse Sayles of McGill University, Baggio employed analytic modeling to unravel the confusion in a case study of estuary watershed restoration efforts in Washington's Puget Sound. The team reports development of quantitative tools to foster collaboration and efficient coordination of resources in the Feb. 20, 2017, Early Edition of the *Proceedings of the National Academy of Sciences*.

Mapping and analyzing social networks among resource management organizations can identify how divergent groups work together and ease conflicts at local, state, regional and national levels, he says.

"The challenges facing Puget Sound, and areas around the world with similar challenges, are often the result of many small impacts," Sayles says. "Not all stakeholders get the direct burden of a particular ecosystem problem, nor do all receive equal benefits. Yet everyone affects the system."

Baggio and Sayles' approach, using social-ecological network analysis, illuminates network connections among stakeholders, revealing strengths

and weaknesses in communication and collaboration.

"Integrating network analysis results with ecological habitat data provides a social-environmental restoration planning perspective," Sayles says. "This research can help [policy makers](#) allocate resources. It's a fundamental step toward addressing scale mismatch, while considering multi-level governance."

**More information:** Jesse S. Sayles et al, Social–ecological network analysis of scale mismatches in estuary watershed restoration, *Proceedings of the National Academy of Sciences* (2017). [DOI: 10.1073/pnas.1604405114](#)

Provided by Utah State University

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