Win-wins in environmental management hard to find

March 24 2022

Shrimp trawler vessel off the US West Coast. Credit: Wikimedia Commons, Public Domain

When a booming marine fishery can increase its shrimp catch while also reducing unintentional bycatch of turtles—that's an example of what environmental scientists and managers call a "win-win." Models often predict this ideal outcome is achievable, yet stakeholders rarely see it manifest in the real world. Now, a Cooperative Institute for Research in Environmental Sciences (CIRES)-led study incorporates the complexity of the real world into models, explaining the discrepancy, validating the concerns of stakeholders and providing more realistic expectations for the future of environmental management.

"If a scientist's model predicts a fishery will catch a certain amount of fish with little bycatch, or predicts a farm will harvest a certain amount of corn while cutting back on harmful fertilizer—but fishermen and farmers on the ground report the opposite, that leads to frustration on both sides," said Margaret Hegwood, a University of Colorado Boulder graduate student in Environmental Studies working in CIRES and lead author on the new study out today in *Nature Sustainability*.

"We used math to show real-world complexity makes win-wins harder to achieve—allowing scientists and stakeholders to compromise and aim for more achievable, realistic goals about environmental impact, food production, biodiversity, economic yield, etc," added Hegwood, also a USDA Food Technology and Food Security Fellow. "When you add more variables, like another species, another stakeholder, an extra regulation, the probability of the win-win starts to go down," said Hegwood.

The team also analyzed 280 previous tradeoff models and created algorithms to show how the severity of these tradeoffs might change as more variables were added. The work allows modelers to better understand what managers deal with, and allows managers to better understand the models.

"At its core, it's a study about how to bridge a communication divide," said coauthor Ryan Langendorf, a CIRES and CU Boulder Environmental Studies postdoctoral researcher. "There's this idea that there is a right and wrong, but scientists and stakeholders just think about the problem in different ways. We hope our work allows them to find common ground, so people can work together more productively."

"It's less about finding a better win-win and more about communicating what the win actually looks like," added Langendorf. That could involve adjusting goals to be more realistic: "Instead of asking, 'is it the ideal outcome for only a single objective?' we need to shift our thinking to ask, 'are we better than where we started?'" said Hegwood.

"Better" might mean sacrificing a little fish catch but reducing bycatch by a lot, which is what happened, for example, in an Australian shrimp fishery when it started adding turtle excluder devices to its trawl nets to protect sea turtles in 2001. Or "better" could mean reducing political or regulatory barriers to reaching win-wins. "If a win-win means a community needs certain resources they can't afford, they will never reach an ideal outcome. By identifying these barriers and minimizing them with proactive policies or technological advancements, you make the win-win more attainable," Hegwood said.

"Managers have always seemed to have an intuition that win-wins are harder to find in the real world than they are in models, because the real world is more complicated than models are," said Mattew Burgess, CIRES Fellow, assistant professor of Environmental Studies and Economics at CU Boulder and corresponding author on the study. "Our study shows, in a precise mathematical way, why the manager's intuition is right. By doing this, we hope that we have given modelers and managers a way to understand each other in a common language."

More information: Matthew Burgess, Why win–wins are rare in

complex environmental management, *Nature Sustainability* (2022). DOI: 10.1038/s41893-022-00866-z.
www.nature.com/articles/s41893-022-00866-z