Beavers support freshwater conservation and ecosystem stability

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One of the most comprehensive studies conducted on beavers has conclusively demonstrated that beavers are essential for freshwater conservation and ecosystem stability by creating and preserving aquatic

and wetland environments in Minnesota. This new research from the Natural Resources Research Institute (NRRI) at the University of Minnesota Duluth was recently published in the journal *Ecography*.

"Although there are many studies on how beavers change ecosystems, the scale of this study—spanning 70 years across five different watersheds—is really unprecedented and, as a result, gave us the unique opportunity to understand how beavers transform and engineer ecosystems over long time periods and large spatial scales," said Tom Gable, coauthor of the study and a postdoctoral researcher in the University of Minnesota Department of Fisheries, Wildlife and Conservation Biology. "We think this work will be of value to many conservationists, scientists and citizens who want to understand how reintroduced or recovering beaver populations can positively affect their ecosystems."

Understanding how ecosystems become more resilient is a key goal for ecologists because it can provide insights into how ecosystems may respond to human impacts and climate change. This study suggests beavers, as ecosystem engineers, can be a biological tool that helps buffer ecosystems against disturbances and alterations.

Ecosystem engineers are ecologically important species that benefit other species by physically altering their environment. Although ecosystem engineers are relatively uncommon, they are not rare: they exist in most major ecosystems.

Most previous research on ecosystem engineers has suggested that their ecological impact does not vary across time or space. However, this research team led by Sean Johnson-Bice—who studied beavers for his master's degree at the University of Minnesota Duluth—determined that how beavers impact ecosystems can vary depending on the scale at which they are studied. In other words, beavers' ecological role varies

between local and regional perspectives.

"In combination with other recent research we conducted on beaver population dynamics in northern Minnesota, our study demonstrates the resilience and stability that beaver populations have within landscapes," said Johnson-Bice, lead author of the study who is currently a PhD student at the University of Manitoba. "Their populations at a landscape scale appear relatively unaffected by environmental conditions and, as such, they can be key drivers of freshwater habitat diversity and promoting ecosystem stability."

In the study, the researchers evaluated how beavers influence water storage along the North Shore of Lake Superior using aerial imagery from five watersheds over 70 years (1948-2017). This period encompassed the full recovery and subsequent stabilization of beaver populations in the region. They found that:

- Beavers are major drivers of water retention in ecosystems, suggesting that restoring beaver populations to ecosystems they no longer inhabit may be a valuable method that managers and conservationists could use for freshwater conservation objectives.
- The longer beavers are present in an ecosystem, the more old and abandoned ponds help contribute towards storing water; although these abandoned ponds may no longer have beavers living in them, their dams can still hold back water allowing the pond to store water.
- At large spatial scales, beaver populations are resilient to moderate environmental and human disturbances.
- Even though beaver populations within each of the five watersheds studied showed considerable variation in population size, water storage remained stable across the entire region. Essentially, changes in beaver population size in one watershed

would be counterbalanced by changes in the other watershed(s), which helped stabilize water storage amounts across the North Shore of Lake Superior.

"Digitizing almost 800 historical and recent aerial photos from 1948 onward represents a tremendous effort on the part of Sean and the NRRI and Twin Cities GIS laboratories," added George Host, now retired director of NRRI's Forest and Land Initiative and Geographic Information System laboratory and a member of the research team. "The resulting dataset provided significant insights into the critical role beavers play in regulating water storage along the North Shore."

More information: Sean M. Johnson-Bice et al, Relics of beavers past: time and population density drive scale-dependent patterns of ecosystem engineering, *Ecography* (2021). DOI: 10.1111/ecog.05814

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