

What can stream quality tell us about quality of life?

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Virginia Tech researchers are using stream quality data to find new insights into the interactions between the health of our natural spaces and human well-being. Credit: Brad Klodowski, Virginia Tech.

As the source of most of the water we drink and a place where we often

go to recreate and enjoy nature, streams represent a crucial point-of-contact between human beings and the environment.

Now researchers in the College of Natural Resources and Environment and the Department of Biological Systems Engineering are using stream quality data to find new insights into the interactions between the health of our natural spaces and human well-being.

Their findings, published in the journal *Ecological Indicators*, reveal that demographics such as race and population density, as well as health indices such as cancer rates and food insecurity, show strong correlations with water quality across the Commonwealth of Virginia.

"We started off wanting to explore the general, intuitive relationship between human well-being and ecosystem health," explained Paul Angermeier, professor in the Department of Fish and Wildlife Conservation and assistant unit leader of the Virginia Cooperative Fish and Wildlife Research Unit for the U.S. Geological Survey. "Many of us intuit that healthy ecosystems produce benefits that accrue to people, but that outcome isn't well documented in a quantitative way."

To document that relationship, the research team had to break from the environmental quality management processes that too often separate the natural world from human experiences.

"When we consider natural resources, we tend to think about whether we're managing an environment for nonhuman considerations or human ones," said Associate Professor Leigh-Anne Krometis, of the Department of Biological Systems Engineering, which is in both the College of Engineering and the College of Agriculture and Life Sciences. "For instance, at the state level we have a department of environmental quality and a department of health, which both deal with the subject of water quality, but in different ways. What we wanted to

see was how those two perspectives converge."

To find correlations across the state, the researchers used two key data sets: [water quality](#) measurements provided by the Virginia Department of Environmental Quality and county-level demographics data from the U.S. Census Bureau. They considered 13 indicators of human well-being, four demographic metrics, and two indicators of stream health.

"We had [large data sets](#) that we had to organize and process," explained Professor Marc Stern of the Department of Forest Resources and Environmental Conservation. "Our expectations on finding meaningful relationships between stream health and human factors weren't that high. The fact that they showed up so distinctly was a surprise."

What the researchers found is that there is a strong correlation between ecosystem health and human demographics, particularly along the lines of race. Stream conditions were found to be better in counties with higher percentages of white residents. More polluted streams were correlated with higher degrees of overall mortality.

"The term environmental justice is important to bring into our discussion," noted Stern, a senior fellow in the Center for Leadership in Global Sustainability. "These findings relate to the broader issue of systemic prejudices and the reality that our institutions and social systems do not favor marginalized communities. They get caught up in a cycle of being left behind, and while it's not impossible to break that pattern, it's going to take work."

Virginia is a suitable microcosm for revealing such dimensions: the state has high-density urban cities, suburban and rural areas, coastal and mountain geographies, and a broad socio-economic diversity that make it a useful starting point for broader research into the subject of human-environment interactions.

A crucial next step for the researchers is understanding how people are interacting with natural environments.

"We still don't have hard data on how people are interacting with nature," said Angermeier, who, along with Krometis, is an affiliate of Virginia Tech's Global Change Center housed in the Fralin Life Sciences Institute. "For instance, we found that mortality rates for people are correlated with contamination levels in fish. What does that mean? Are people eating contaminated fish, are they merely sharing a polluted water source, or is it something else? A better understanding of the mechanisms by which people are interacting with water will help us draw clearer conclusions about health outcomes."

More information: Paul L. Angermeier et al. Exploring relationships among stream health, human well-being, and demographics in Virginia, USA, *Ecological Indicators* (2020). [DOI: 10.1016/j.ecolind.2020.107194](https://doi.org/10.1016/j.ecolind.2020.107194)

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