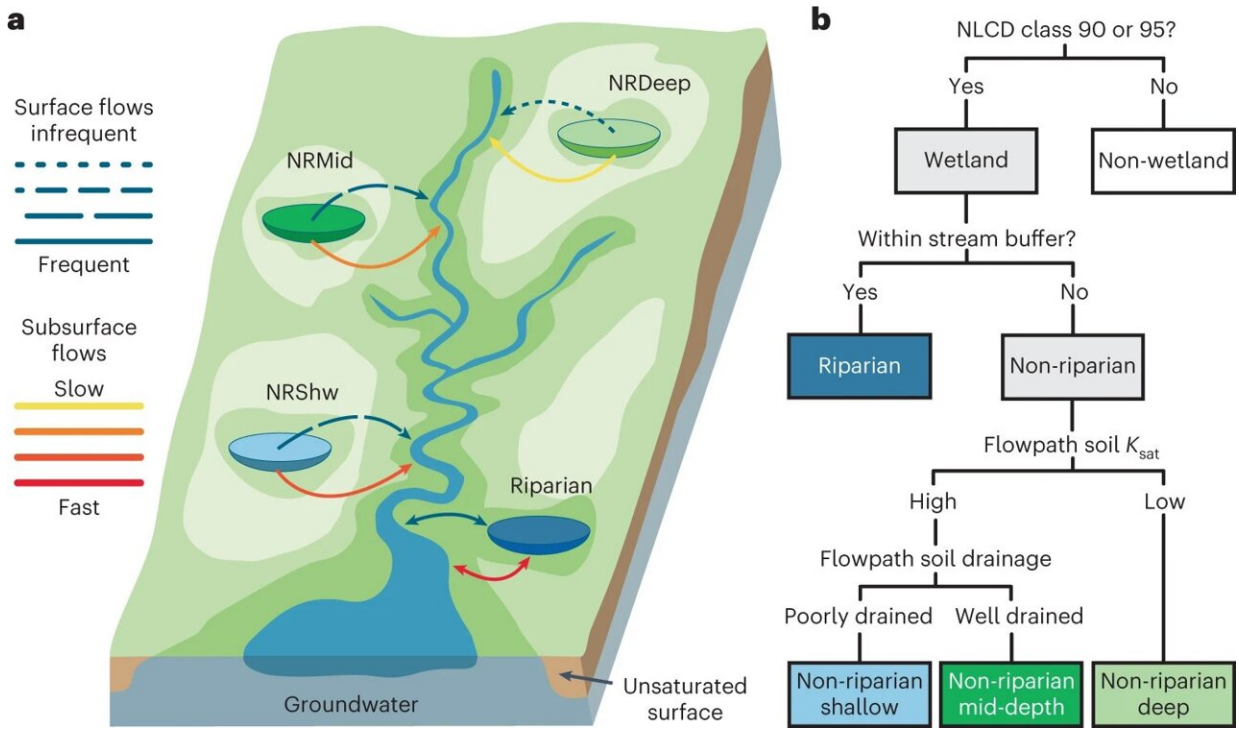
Research collaboration aims to improve nationwide water quality, restore wetlands

April 20 2023



Wetland hydrologic connectivity classification. **a**, Four hydrologic connectivity classes: Riparian wetlands have an outlet within one 30 m pixel from a stream and bidirectional flows. The three non-riparian classes are greater than one pixel from a stream and all have unidirectional flows. NRShw have permeable and poorly drained soils on the flowpath between the wetland and downstream water. Owing to poor drainage, subsurface flows are shallow and surface flows can occur relatively frequently through saturation excess overland flow[17]. NRMid have permeable and well-drained soils on the flowpath. Owing to good drainage, subsurface flows are deeper (mid-depth), but surface flows can occur occasionally through infiltration excess overland flow[17]. NRDeep have

impermeable soils on the flowpath. Non-channelized surface flows can occur when the wetland basin is filled with water and additional water input causes the wetland to either spill over or merge into downstream waters[18], but this is limited to rare and episodic flooding events. Water transport is more common via deep subsurface flowpaths from the bottom of the wetland to downstream waters. Note that depth in the non-riparian class name refers to flowpath and not wetland depth. **b**, Flow chart summarizing classification of wetland hydrologic connectivity classes. Note wetlands are defined on the basis of 2011 NLCD[33] classes 90 (woody wetland) and 95 (emergent herbaceous wetland); however, woody versus emergent herbaceous type is not incorporated into the resulting classification. For details, see Methods. Credit: *Nature Water* (2023). DOI: 10.1038/s44221-023-00057-w

Wetlands, such as swamps and marshes, are home to some of the planet's most valuable ecosystems.

They act as sponges, preventing pollution from seeping into streams and other bodies of water, yet the depth of their federal protection is murky. In collaboration with the U.S. Environmental Protection Agency, a University of South Florida geologist has developed the first-ever classification system for wetland connectivity, helping improve water quality and management nationwide.

The new classification system, published recently in *Nature Water*, demonstrates the effects wetlands have on water quality at a continental scale—invaluable data that can be used to better define whether wetlands are federally regulated under the U.S. Clean Water Act.

"Since the Clean Water Act was established in 1972, we have continued to debate what constitutes our 'nation's waters,' and wetlands continue to be lost due to draining and filling, despite their immense value in controlling the water quality in our major waterways," said USF geology

Professor Mark Rains, who was appointed by the state in 2021 to serve as Florida's chief science officer.

"However we define the 'nation's waters' will have a huge influence on whether we continue to protect the remaining wetlands or if we will lose more."

Aerial view of wetlands in Alaska, near Katmai and Lake Clark National Parks. Credit: Mark Rains, USF

The researchers categorized freshwater wetlands into four classes based

on their proximity to streams and whether water flows between them at or below the surface. They then used the new classification system to show that wetlands play important roles in controlling a stream's water quality.

The goal is to provide a better understanding of how wetlands contribute to the chemical, physical and biological integrity of downstream waters, especially nutrient runoff that can cause damaging algal blooms.

"It's the disruption of these processes that has led to many of the water quality challenges we face today," Rains said.

"My hope is this will be the start of change for the way we think about wetlands, especially those not directly adjacent to streams. This was the most rewarding collaboration of my career—it was a great group of people who were really committed to doing science that serves the public."

The EPA plans to make this classification system available for researchers to download and use. In addition to its impact on water quality, the system provides researchers and resource managers insight into improved methods for spatially targeting wetland restoration and protection.

"Until now, there hasn't been a way to classify how wetlands connect to other waters at large scales," EPA Research Ecologist Scott Leibowitz said. "This has limited our ability to understand how wetland connectivity might contribute to water quality in watersheds."

Rains says the research doesn't stop here, as this classification system will likely lead to more projects in the near future. "We still have much to learn about how wetlands connect to downstream waters in different geographic regions," Rains said. "This classification system gives us a

place to start."

More information: Scott G. Leibowitz et al, National hydrologic connectivity classification links wetlands with stream water quality, *Nature Water* (2023). DOI: 10.1038/s44221-023-00057-w

Provided by University of South Florida