Scientists assess saltwater intrusion into well water along the Rhode Island coastline

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URI graduate student Jeeban Panthi conducts electric resistivity tests at a beach in Charlestown. Credit: of Jeeban Panthi

Many drinking water wells at homes along the Rhode Island coastline are being contaminated by an intrusion of saltwater, and as sea levels rise and storm surge increases as a result of the changing climate, many more wells are likely to be at risk. So a team of University of Rhode Island researchers is conducting a series of geophysical tests to determine the extent of the problem.

"Saltwater cannot be used for crop irrigation, it can't be consumed by people, so this is a serious problem for people in communities that depend on freshwater groundwater," said Soni Pradhanang, associate professor in the URI Department of Geosciences and the leader of the project. "We know there are many wells in close proximity to the coast that have saline water, and many others are vulnerable. Our goal is to document how far inland the saltwater may travel and how long it stays saline."

Saltwater can find its way into well water in several ways, according to Pradhanang. It can flow into the well from above after running along the surface of the land, for instance, or it could be pushed into the aquifer from below. Sometimes it recedes on its own at the conclusion of a storm, while other times it remains a permanent problem.

Pradhanang and graduate student Jeeban Panthi are focusing their efforts along the edge of the salt ponds in Charlestown and South Kingstown, where the problem appears to be most severe.

Since saltwater is denser than freshwater, it typically settles beneath the freshwater. So the scientists are using ground penetrating radar and

electrical resistivity tests—using equipment loaned from the U.S. Geological Survey and U.S. Department of Agriculture—to map the depth of the saltwater/freshwater interface.

"In coastal areas, there is always saltwater beneath the freshwater in the aquifer, but the question is, how deep is the freshwater lens sitting on top of the saltwater," said Panthi, who also collaborates with URI Professor Thomas Boving. "We want to know the dynamics of that interface."

The URI researchers plan to drill two deep wells this month to study the geology of the area and the chemistry of the groundwater to verify the data collected in their geophysical tests.

The first tests were conducted in the summer of 2019, and a second series was completed this fall after being delayed by the pandemic. Final tests will be conducted next spring when groundwater levels should be at their peak.

"The groundwater level was at its lowest point in 10 years this summer because of the drought," said Panthi, a native of Nepal who studied mountain hydrology before coming to URI. "That will be a good comparison against what we expect will be high levels in April and May."

Panthi has collected well water samples from nearly two dozen residences for analysis. One of the contaminated wells was located a mile inland from Ninigret Pond in Charlestown.

"A homeowner had a deep well drilled for a new house and it ended up with extremely saline water," said Pradhanang. "Deep wells close to the salt ponds or the coast are more likely to have saltwater intrusion than shallow wells, though shallow wells can also have problems if they become inundated with saltwater."

Another URI graduate student, Mamoon Ismail, is developing a model to simulate saltwater intrusion into drinking water wells based on the changing pattern of precipitation and the potential for extreme storms. They hope to be able to predict how far inland saltwater will intrude following a category 1 hurricane compared to a category 2 storm, for instance.

Provided by University of Rhode Island