Digging for past clues on climate change

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Scientists are hoping samples of soil formed up to 20,000 years ago that they dug from the Meadowlands will provide clues to dramatic shifts in climate, geology and plant life that may have hit the region in the past.

Meadowlands Commission researchers will study samples recently plucked from the reedy marshes along the Hackensack River for evidence of catastrophic events, such as a tsunami or severe drought, which could help planning officials.

They also hope to learn how much carbon the marshes have been capturing out of the air and storing in vegetation, to better understand the role wetlands play in reducing the impact of carbon emissions.

"Scientists would like to determine which kinds of plants are best at sequestering carbon and how the amounts varied in the past," said paleoclimatologist Dorothy Peteet at Columbia University's Lamont-Doherty Earth Observatory, who will help the Meadowlands team. "If the weather was hotter or drier, did plants sequester more or less carbon? The million-dollar question is how fast plants can sequester carbon."

Researchers will also measure the presence of man-made pesticide residue in the plant material.

"There's so much science here, you have to break it into projects," said Cyndi Steiner, a Rutgers University graduate student who will work with Peteet on the samples.

The scientists will look through a microscope for fossilized seeds and flecks of ancient pollen that could indicate what kinds of plants grew in the Hackensack basin thousands of years ago.

"The Meadowlands marshes are like nature's refrigerator," said Francisco Artigas, director of the Meadowlands Environmental Research Institute, or MERI, the commission's research arm.

The Hackensack basin served as a path for the Wisconsin Glacier about 18,000 years ago, as it reached south to Perth Amboy. A general warming 16,000 years ago began to shrink the glacier, leaving Glacial Lake Hackensack behind. At some point, a breach occurred, draining the lake.

Researchers estimate the breach occurred 10,000 to 7,000 years ago, and the arrival dates for the first forests on the former lake bed have been purely speculative. The famed white cedars that populated the marshes did not arrive until about 600 years ago, during a cooler period called the Little Ice Age, when sea levels dropped and more fresh water entered the marshes.

The new core samples could improve scientific understanding of the region's geological and botanical development. Peteet hopes the samples will aid in understanding the region's warm and cold cycles going back thousands of years, to better predict the likelihood of long-term drought due to climate change.

By studying seeds and charcoal present in core samples from the Hudson River Valley, she has determined that the region endured a severe 500-year drought around A.D. 800 to 1300. The presence of charcoal indicated numerous wildfires.

The core samples from the Meadowlands could provide similar evidence

of a drought and warm period. "This information is important, because if catastrophic events happened here in the past, there's no reason they couldn't happen in the future," Artigas said.

To collect the samples, the Meadowlands team dug in two spots. First, they pulled up samples nearly 22 feet deep from an area along the Hackensack River in Secaucus.

The group recently went to a spot on the Lyndhurst side of the river, just north of NJ Transit's Bergen Line railroad bridge.

After guiding their small boat to shore, the researchers picked their way through the stiff green shoots of phragmites taller than their heads. The scientists stepped around old bottles, and their wading boots crunched on dead brown reeds.

Joe Grzyb, an MERI envirochemist, and Frank Amatucci, a Rutgers graduate from Wantage, did the heavy labor, pressing a stainless steel and aluminum peat borer into the spongy earth. Grzyb used a handle on top to twist a canister at the bottom of the borer, which took a slice of the earth. Dark gray water gurgled out of a hole as they pulled the borer out, making it look as if the men had struck oil.

Amatucci turned the borer on its side and pried open the curved metal canister to reveal the first 20-centimeter-long sample - a loose slug of moist soil mixed with yet-to-be decomposed phragmites leaves. The fetid odor of rotten eggs filled the researchers' nostrils. "A sad-looking top core," Artigas said.

Steiner and Arlette Santana, a Rutgers graduate and Clifton resident, took the sample and carefully placed it in a wooden box with spaces for each core sample.

The borer was placed back down the hole for more samples, and eventually the material that emerged from deep beneath the Meadowlands was more solidified, claylike and pale gray. It was cold to the touch.

To drill deeper - they went about 18 feet that day - Grzyb screwed long extension tubes onto the borer. The drilling became harder, and the men used a large chunk of wood as a mallet, pounding down on the borer. They strained and fought against the liquid suction of the marsh soil to pull the borer back out.

Finally, the reluctant sample emerged. "Oooh, that is huge, man!" Artigas blurted out when he saw the sample.

This core sample began like the others, with claylike material. But then, in a dramatic change, a layer of brown, corklike material appeared for about a foot. The bluish-gray clay then resumed, followed by light-colored, fine sandy material.

"Maybe there was a forest here and it flooded and killed off all this vegetation," Artigas said. "That's purely speculation, but once we analyze this we'll find out."

The samples were laid carefully in the box, marked and covered with plastic wrap. That day, Steiner would put the samples in a deep freezer to preserve for analysis.

The researchers sent photos of the core samples to Peteet. She said the pale gray layer beneath the wood layer was probably from the lakebed of glacial Lake Hackensack and could be 20,000 years old. The wood could be alder, a bushy plant prevalent long before the arrival of the swamp cedars.

"I'm excited about the potential of this project," Peteet said.

Artigas agreed. "See," he said, "the Meadowlands has disappeared and reappeared many times over thousands of years."