

# How coastal forests are managed can impact water cycle

March 29 2021, by Laura Oleniacz

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Sensors placed above a forest at the Alligator River National Wildlife Refuge help to track forests over time. Credit: Physiology and Ecosystem Science Lab.

Younger trees take up and release less water than mature trees 10 years or older, researchers from North Carolina State University found in a new study that tracked how water moves through wetland pine forests near the North Carolina coast.

Their findings, published in *Agricultural and Forest Meteorology*, suggest managers should time timber harvests to leave older trees alongside new growth to mitigate runoff.

"The [water balance](#), especially in coastal sites, is very important," said the study's lead author Maricar Aguilos, postdoctoral research associate in forestry and environmental resources at NC State. "We have so much water there. We wanted to understand how land-use changes impact water use and drainage in the forests, as well as how they affect the growth of the trees."

The findings come from a long-term research project designed to understand how wetland forests in eastern North Carolina—including [pine forests](#) managed for timber and a natural hardwood [forest](#) at the Alligator River National Wildlife Refuge in Dare County—are responding to changing [climate conditions](#).

Using meteorological sensors perched on towers above the forest canopy, the researchers are able to track [water flow](#) to and from the site, including during a severe drought in 2007-2008. They've also used the sensors to track [carbon sequestration](#)—an important marker for the forests' ability to mitigate or contribute to climate change. They have gathered data on forest carbon and water cycling spanning 14 years.

"In order to study the response of coastal ecosystems to climate change and [sea-level rise](#), we need long-term observations," said study co-author John King, professor of forestry and environmental resources at NC State. "The longer we can let those studies run, the better our data will be, and the more effectively we can help inform policy. "The latest study evaluated how much water the trees use and release as vapor, compared to how much is lost as drainage.

The researchers found that younger pine plantations had increasingly

higher "evapotranspiration," which is the amount of water released in combination from two sources: through evaporation of water from the soil, and the process in which trees consume water and release it from their leaves as vapor, which is known as "transpiration." Mature plantations had the highest ratio of evapotranspiration to rainfall, and drained less water than younger pine forests.

"We found that the trees use more [water](#) as they mature," said study co-author Ge Sun, a research hydrologist and project leader at the U.S. Department of Agriculture Forest Service and adjunct professor in forestry and environmental resources at NC State. "Water use stabilized by about year 10 in the pine forests."

That finding suggests clear-cutting a site and replanting it could lead to increased drainage and flooding off the site initially, but the impacts would diminish as the trees grow.

"The mature plantations help to mitigate effects of forest harvesting on drainage at a landscape scale," Aguilos said. "If you harvest to leave trees of different ages, they can help each other."

**More information:** Maricar Aguilos et al, Effects of land-use change and drought on decadal evapotranspiration and water balance of natural and managed forested wetlands along the southeastern US lower coastal plain, *Agricultural and Forest Meteorology* (2021). [DOI: 10.1016/j.agrformet.2021.108381](#)

Provided by North Carolina State University

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