

The U.S. Forest Service is deploying a climate sensor network powered by energy harvested from living trees.

By Laurie Sullivan

July 2, 2009—The [U.S. Forest Service](#) has confirmed that it will purchase a climate sensor network this summer from [Votree Power](#) that is powered by energy harvested from living trees. The system employs low-power radio transceivers, sensors and patented bioenergy-harvesting technology to predict and detect fires.

Victoria Henderson, branch chief of equipment and technology for the U.S. Forest Service's Fire and Aviation Management unit, says the network will be deployed at the fire center in Boise, Idaho, and tested through the end of this year. The Fire Service will then make a decision regarding whether to widely deploy the technology.

Initial tests of a prototype began two months ago, outside the city limits. The tests have been aimed at determining the system's capabilities. The Forest Service has been evaluating the system's ability to collect data on wind speed, humidity, temperature and moisture, and to transmit it back to fire officials monitoring conditions in their respective areas.

Representatives from the U.S. Forest Service met with Votree's CEO, Stella Karavas, on June 30 to finalize the design, agree to a contract and identify an estimated delivery date. "We'll try and break the system," Henderson says, "and if we don't find any issues with the design, we'll purchase an additional quantity."

Votree's wireless mesh network, which utilizes the ZigBee standard, will integrate into a remote weather system to transmit data signals from one unit to another, until it reaches a central monitoring station built by [Vaisala](#), a Finnish company that builds monitoring and measurement systems for meteorology and the environment. These stations provide a satellite microwave uplink connection enabling the system to share information with numerous government agencies.

According to Karavas, Votree has been developing the fire-detection application for nearly two years, with help from the U.S. Forest Service. "In trying to maintain a healthy PH balance between itself and the soil, the trees produce energy," she says. "A circuit harvests and stores the energy that helps to power a mesh wireless system. Nodes that collect data are run under the forest canopy."

From the weather stations, the data will flow into an application used by numerous government agencies, including the Bureau of Land Management, the National Park Service, the Fish and Wildlife Service and the Bureau of Indian Affairs. Each state also uses a variety of fire data and applications.

While the goal is to gather information from a larger area with fewer portable weather stations, in an effort to predict which are high-risk areas for fires and how the fires will react, the network has much

broader capabilities for the future, Henderson says. "We are looking at a very small piece," she states. "Once we get through this phase, the government has the ability to think much broader, and expand the project to collect whatever data it needs through the sensors."

The Voltree network will be linked to portable, remote, automated weather stations. These solar-powered units weigh approximately 120 pounds and sit on the ground in the forest, transmitting information about weather conditions to the satellites. The Voltree system can handle large amounts of data, Henderson notes, but limitations in the satellite transmission system at the U.S. Forest Service will restrict the installation to five nodes per portable fire station.

Theoretically, the Voltree system could transmit one-and-a-quarter miles with new satellite capabilities supported by Geostationary Operational Environmental Satellite R-Series (GOES-R) that provide a backbone to communicate weather information. The hope is that the government will have a new system in orbit and working by 2015, according to Andreas Mershin, an [MIT](#) research scientist and an advisor to Voltree.

The biggest difficulty Voltree faces, Mershin says, is bringing customers up to speed on the system, and putting an infrastructure in place that can manage all of the data. Features have been "dumbed-down because customers are just not quite ready," he says. For instance, the U.S. Forest Service will send information from sensors to users, but the system has bi-directional communication capabilities.