JDSF Newsletter
Jackson Demonstration State Forest
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NASA TESTS RADAR ON JDSF

Dana Cole

Scientists from the National Aeronautics and Space Administration (NASA) recently came to JDSF to conduct an unusual experiment as part of the background work for future space missions. Dr. Walt Westman and David Peterson from NASA's Ames Research Center in Mountain View and Dr. Jack Paris from NASA's Jet Propulsion Laboratory in Pasadena are interested in using radar systems to survey worldwide forest resources. Radar, which is an acronym for radio detection and ranging, is a generic term for a broad class of electromagnetic sensing systems that operate in the microwave region and at longer wavelenths. To date, radar has had applications in the detection of aircraft and ships, and in the fields of geology, oceanography and meteorology. But due to the poor resolution of radar imagery, it has not yet proven useful to forest managers. However, distinct potential advantages of radar, including the ability to detect objects in the absence of light as well as through cloud cover and forest canopies, have led scientists to seek new means of applying radar systems to forestry.

Since radar sensors do not use electromagnetic radiation in the visible range, resulting images are not photographic; that is, they are not recognizable to the untrained human eye. Special detector systems are required to "decipher" the images. So while a radar image of a tree may not "look" anything like a tree, it contains information about the tree, such as moisture content and biomass, that is inaccessible to the human eye. The challenge is to learn how to interpret the image that is received.

This is the purpose of the NASA experiments. Prior to contacting us, NASA spent several months constructing a six-foot forest model at the Ames Research Center. Artificial trees were constructed using wooden dowels to represent branches and spongy material to represent leaves. This model permitted manipulation of simulated branch angles, numbers and arrangement of branches, and leaf moisture content. Radar waves were transmitted to the model and a computer sensitivity analysis was performed to deter-

mine the contribution of the various features to backscatter of the radiation.

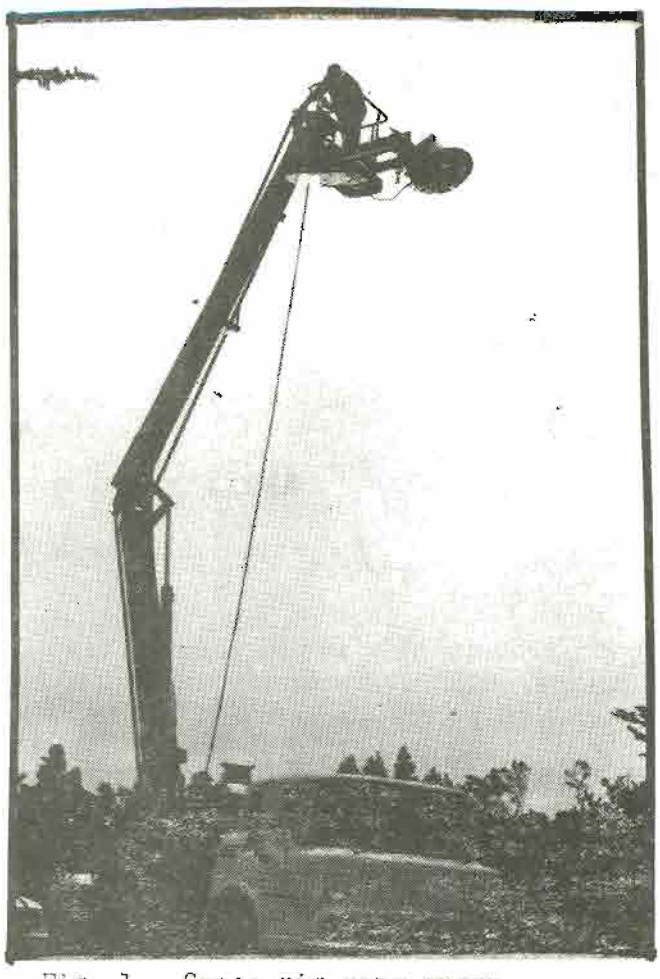

Fig. 1. Space rig zaps pygmy.

To field test the system, NASA required a real, living forest. But since the radar apparatus to be tested had to be mounted on a semi-stationary platform (in this case, a 30-foot truck-mounted boom), and since the platform had to be stationed above the forest canopy in order to simulate a satellite's perspective, a special type of forest was needed. NASA scientists contacted us and arranged to use a portion of JDSF's pygmy forest for its investigations.

The pygmy forest occurs only in a small portion of coastal Mendocino County. Due to an unusual combination of changing sea levels, geologic uplift, subsequent landscape aging, and the action of chemicals leaching out of the vegetation, a unique soil type--the highly leached and acidic Blacklock soil--has formed in isolated pockets along this stretch of California's coast. The Blacklock soil supports a sort of natural bonsai forest of stunted trees, such as 100-year-old pines that are commonly no more than 5 to 10 feet tall with 2-inch diameters. While not productive for traditional types of forest products, the pygmy forest is one of the most unique forest ecosystems in the world, and is of immense interest to, among others, soil scientists, ecologists, and even film makers. The BBC visited JDSF to film the pygmy forest for its widely acclaimed series, The Living Planet. JDSF's pygmy forest is also a registered national landmark.

The pygmy forest proved ideal for NASA's purpose of testing its radar system on an actual "miniature" forest. For two days in August, NASA technicians busily beamed radar down on to the forest while scientists clipped and weighed vegetation samples for moisture content determination, and monitored radar microwave scattering using an instrument called a scatterometer and a specially designed, battery operated computer. These measurements helped the scientists decipher just what the radar is sensing.

In the next few years, further tests will be carried out from a slightly higher platform than the boom used at JDSF as

radar systems are sent into space aboard various Space Shuttle missions. Then, some time in the 1990's, NASA expects to launch an earth orbiting satellite that will contain a permanent radar imager that will, among other things, monitor the world's forest resources.

In the meantime, we at JDSF are proud to have played a part in the development of a system that, once in place, should help scientists get a handle on forestry's "big picture".

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CDF AND US FOREST SERVICE BRASS MEET

Forest Tilley

A meeting was held at JDSF Headquarters October 10 and 11 with leaders from the California Department of Forestry (CDF) and the US Forest Service Pacific Southwest Forest and Range Experiment Station (PSW). The purpose of the meeting was to review the cooperative Caspar Creek Watershed Project and to discuss the wildland arson problem.

CDF participants included Director Gerald Partain, Deputy Director Ken Delfino, and Assistant Chiefs Brian Barrette, Ed Martin, Ray Jackman, and Don Striepeke. They met with PSW Director Roger Bay and members of his staff, including Deputy Director Ben Spada, Assistant Director Ron Stewart, and Project Leader Bob Ziemer from the Redwood Sciences Lab in Arcata.

The group toured the Caspar Watershed on the afternoon of the 10th and observed many of the ancillary investigations being conducted as part of this project. The primary effort is geared toward the measurement of sediment and its movement through the watershed. Following a calibration period, the effects of logging will be studied by clearcutting selected sub-basins. In addition, subsurface drainage is being investigated in the watershed. Two methods will be used to study how rainfall is routed to main channels. The first method attempts to study the soil moisture and pore pressures in swales using tensiometers and pieziometers. The second method attempts to identify and measure the movement of water through soil pipes which exist throughout the watershed. These pipes vary in size from less than one inch in diameter to as large as several inches and are believed to be developed from rotten root channels and animal burrows. Subsequent erosion enlarges and joins these pipes into a subsurface water transport network.

The group also discussed the role of organic debris in storing and releasing sediment throughout a watershed system.

Friday morning's discussion centered on the wildland arson problem. The group reviewed some existing research and discussed the difficulty in identifying wildland arsonists.

Meetings of this nature are scheduled between the two agencies on an annual basis in an effort to identify major problems in the resources management field and cooperate in their solution.

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PLASTIC CULVERTS

Glen Pinoli

As part of JDSF's demonstration program, the Chamberlain Creek 1983 Timber Sale agreement required the installation of polyethylene (plastic) culverts for road drainage. Both 18- and 24-inch diameter full round culverts were installed, and a small amount of half-round was used for downspouts. Following is an evaluation of plastic culvert performance based on two years of observation.

Approximately half of the plastic culverts were installed during the first year of sale operations, while the remaining culverts were installed the following year. The culverts that were not installed the first year were stockpiled on site. During the year of storage, several culverts were observed to develop cracks and/or splits at one or both ends at the seams where the culverts were molded together. These cracks followed the seam for 2 to 10 inches.

Difficulties were encountered loading and transporting the 20-foot sections of plastic culvert on the jobsite. With two people lifting a culvert, one at each end, the center dragged on the ground; two people picking up the center of a culvert resulted in the ends dragging. A solution was finally devised using a backhoe with a front-mounted, three-in-one bucket supporting the culvert in the middle. Since the bucket is about 5 feet wide, culvert sections were adequately supported to be manuevered without excessive "wobble."

Once culverts were located at the installation site, care was needed to ensure that the culvert bed was dug to a desired grade of 3 percent with no bows, which would allow the culvert to bend and form a low spot where water could pool and fail to run off. Backfilling also required extra care. While JDSF requires metal culverts to be compacted in 6-to 8-inch lifts, this is not practical with plastic culverts, which require full depth

coverage before compaction can be performed. If this is not done, the culvert will bow to the side away from compaction.

Since half-round plastic culverts are not commercially available, some of the full-round plastic culvert was bucked into 10-foot lengths, then ripped into half-round sections for use as downspout. Where more than one 10-foot section was used for downspout, cracking and splitting occurred where sections were bolted together. No cracking or splitting was observed where single 10-foot sections were bolted to plastic culverts, nor did plastic culvert crack or split when metal downspouts were attached. However, corrugations matched better and installations were easier when both culvert and downspout were plastic.

Following installation, cracking and/or splitting was observed at both the head and tail of the plastic culverts. Again, these occurred at the seam for lengths of 2 to 10 inches.

The primary advantage of plastic over steel or aluminum culverts is longevity, especially where rust and/or corrosion hazards are high, such as in acidic soils, or near the coast, where salt-laden air is prevalent. However, plastic culverts are approximately twice as expensive as steel culverts, and the culvert contractor estimates that approximately 30 percent more personnel and equipment time were required to install plastic culvert than to install the same amount of metal culvert.

We will monitor the longevity of plastic culvert to determine whether the higher initial purchase and installation costs are warranted.

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NEW PUBLICATIONS

JDSF forester **Norm Henry** and former aide **Karen Sendek** have published California Forestry Note No. 96, "Caspar Creek Watershed Study--North Fork Phase Status and Plans, 1983-1990." Another article of Norm's, co-authored with former aide **Roy Woodward**, appeared in the July 1985 issue of the Journal of Forestry. The title of that article is "Quantifying Residue After An Intermediate Harvest of a Second-Growth Redwood Stand."

In the August 1985 issue of the Journal of Forestry, an article appeared that was co-authored by JDSF forester **Dana Cole**, UC-Berkeley professor Joe McBride, and State Lands ecologist Diana Jacobs. This article is entitled, "Fire History and Perpetuation of Natural Coast Redwood Ecosystems."

Copies of these articles may be obtained by writing JDSF.

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