Remote sensing: An aid to managing forest resources

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This simplification of the wildlife fuels map shown in color (inside back cover) emphasiz means of a dark-gray tone the locations of highly flammable stands of chamise. Such a indicates where active fuel modifications should begin.

Dead vegetation in much of California's wildlands continues to accumulate each year, assuring the potential for high-intensity wildfires that are difficult to control and are highly damaging to resources, lives, and property.

Managing this hazard can be accomplished by fuel modification methods that fall under five broad classifications: biological, chemical, manual, mechanical, and prescribed fire. These methods can be applied in various combinations to any vegetative type to obtain specific desired objectives within existing physical, environmental, ecological, social, and legal constraints. To this end, brushfield managers in California are developing and implementing intensive plans for fuel management, entailing construction of firebreaks and/or greenbelts to break up large expanses of highly flammable vegetation. The plans also cover safer access for firefighters and their equipment to enable them to control wildfires at small sizes and with less damage to resources.

Remote sensing

A key element in developing these plans is the use of "remote sensing" by which high-altitude aerial photographs and space images are acquired by NASA for those areas where severe fuel management problems are known to exist. Remote sensing data, augmented with ancillary data, provide a base for developing plans. Information derived from remote sensing is desirable because it can be gathered quickly and frequently for extensive inaccessible areas, and can be easily manipulated to meet fuel management objectives.

In February 1976, the Mendocino County Board of Supervisors, recognizing the need for a comprehensive wildland fuel management plan, established a Fuel Control and Brush Range Management Committee (FMC), that includes representatives from county, state, and federal agencies; Cooperative Extension; and private land owners. Its purpose was to develop and implement fuel management plans for pilot areas throughout the county. In addition, U.C.'s Department of Forestry and Conservation, through its Remote Sensing Research Program (RSRP) has advised the FMC, with financial support of the NASA Office of University Affairs.

An experimental wildland area of 476,000 acres in northeastern Mendocino County was established. Space imagery of this area was taken from an altitude of 570 miles by a satellite, "Landsat-2." Detailed classification of vegetation (fuel) types is made from such imagery through the use of computer-assisted techniques at a cost of approximately one cent per acre. An overlay showing property ownerships is then superimposed. In addition, tabular information giving the acreage for each fuel class within the study area is provided. It is possible from computer analysis of Landsat data to identify and map, in color-coded form, the seven wildland fuel classes that have been defined by fuel specialists from the California Department of Forestry and the U.S. Forest Service, who have major fire control responsibilities in the area. Of particular interest are the stands of highly volatile *chamise* (yellow), especially when they occur adjacent to valuable stands of *commercial conifer* (dark green). In addition, the location of areas classified as

barren/grassland (blue) is of interest in relation to fuel management planning because it is within these areas that man-made firebreaks can best be tied.

The classified map has been further simplified, so that only the chamise fuel class (dark grey) is displayed. Such a presentation graphically illustrates where this highly volatile fuel is concentrated within the study area and where fuel management planning should therefore begin. Based on an analysis of this and other remote sensing-derived information, augmented by such ancillary data as soil and topographic maps, portions of the heavy stands of chamise are presently being modified through the use of prescribed burning, i.e., the burning of vegetation in a predetermined manner under carefully controlled conditions. Further plans are being developed to modify the remaining chamise stands.

Future work in Mendocino County will focus on maximum integration of remote sensing technology with the government-sponsored Coordinated Resource Planning, a program aimed at improved resource management through the cooperative efforts of private land owners and public agencies under the leadership of the U.S. Forest Service.

Achieving the following objectives of Coordinated Resource Planning, as applied to Mendocino County, will rely heavily on remote sensing work of the University's personnel for valuable information:

1. Improving the quality and quantity of forage and habitat for domestic animals and wildlife.
2. Maintaining and improving the harvest of forest products compatible with other resource values.
3. Managing the watershed so as to:
   (a) Increase the quantity and quality of water; and
   (b) Prevent or reduce pollution, siltation and erosion.
4. Providing for maximum public benefit from the land and its resources, including recreational benefits.
5. Improving the economic status of each ranch unit or other land parcel that is involved.
6. Reducing substantially the potential for disastrous fires.

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A wheel-mounted power pack developed by forestry engineers at U.C. Davis has a unique suspension system that enables it to traverse rough ground, steep slopes and obstacles to isolated spots in the forest. Its 15 h.p. gasoline engine provides enough power for reforestation activities, to operate hydraulic chainsaws, or to power winches in tractor or cable logging. It weighs only 1470 pounds.