FIRE DYNAMICS IN CHAPARRAL

C.W. Philpot
Assistant Director
Pacific Southwest Forest and
Range Experiment Station
Riverside, CA

ABSTRACT:

Fire is an integral of chaparral ecosystems. The vegetation has inherent characteristics which make it highly flammable and fire dependent. These characteristics, coupled with a Mediterranean climate, result in high intensity, fast-spreading, large fires vegetation becomes older. Managers have opportunities to impact fire size, intensity, and frequency by recognizing these relationships in land management plans and operational programs. Wildlife managers have a major role to play in determining fire management strategies on chaparral lands.

Chaparral communities are unique representatives of California's diverse ecosystems. This vegetation type is ideally adapted to a severe environment which includes extended drought, poor soils, unstable terrain, desiccating winds, and periodic fire. A lack of understanding of how these ecosystems function has resulted in management direction which limits their potential to produce resources and has endangered their inherent stability. It is imperative that resource managers understand chaparral ecosystem dynamics and incorporate this knowledge into management plans and operations.

Although there is some disagreement, the area of California covered with chaparral is generally set at around 10 million acres. Another 4 to 6 million acres can be added if associated ecosystems are included, such as woodlands and riparian-like zones. Chaparral is found from 500 to 3000 feet in the north and from 1000 to 5000 feet in the south. It is evergreen, winter active, and summer dormant although recent evidence shows some summer activity.

Chaparral is composed of many species and its composition changes with environment. Chamise, manzanita, toyon, ceanothus, and scrub oak are primary constituents. These shrubs and shrub-like trees may occupy unbroken, even-aged stands over thousands of acres.

Chaparral has been associated with fire for nearly 2 million years. The species making up chaparral are therefore well adapted to periodic fire (stand replacement) and exhibit inherited physical and chemical characteristics which make them highly flammable at some stage of development. Chaparral is one of the best examples of the Mutch hypothesis which states that vegetation that has developed in a fire environment and is adapted to fire also has inherent characteristics that make it flammable. (Mutch 1970) Reproduction, species stability, and ecosystem maintenance are all related to fire in chaparral.

Gill (1977) classifies the mechanisms by which fire-dependent or tolerant species deal with fire. He breaks them down into (1) vegetative survival of woody plants, including bud protection and lignotubers; (2) flowering stimulation; (3) on-plant seed storage and fire-stimulated dispersal; and (4) in-soil seed storage and fire-stimulated germination. With the possible exception of stimulated flowering, all of these mechanisms are exhibited by chaparral.

The characteristics of chaparral species that make them highly flammable include physical, physiological, and chemical properties. Many of the properties also relate to chaparral's ability to cope with a severe environment. The silica-free mineral content, which is inversely related to flammability, is low in many chaparral species. Solvent extractives, directly related to flammability, are high, reaching 12 percent dry weight or more in leaves. The spatial biomass all contribute to high flammability. Chaparral species attain very low moisture contents as the annual drought period continues. During this same period, solvent extractives build up to an annual peak. Both of these seasonal changes contribute to flammability. Additionally, more than 50 percent of the standing biomass can be dead at age 30 years.

The fire cycle, or autosuccessional cycle, for chamise, *(Adenostoma faciculatum)* can be used to demonstrate the dynamics of these processes. Currently, the cycle begins in a 20- to 30-year-old stand of chamise with a few other brush species and little or no understory. The fire sets the stage for autosuccession. Due to the destruction of phytochemicals, removal of the overstory, heat treatment of seeds and root crowns, or other fire effects, a whole conglomeration of "fire annuals" and grasses appear on the site. The root crowns of the brush species sprout and new brush plants are produced from heat-treated seed stored in the soil surface. After 2 to 5 years, the annuals disappear and the brush species begin to redominate the site thereby continuing the cycle. The flammability of the species insures its continuation as the dominant vegetation.

Current state-of-the-art fire behavior models which predict forward rate of spread, fire intensity, and fire size work quite well for chaparral fuels. Those models utilize many of the fuel characteristics mentioned previously, such as biomass, distribution, chemical properties and moisture content. These models can be used to show the change in expected fire behavior as chaparral stands age.

The fire histories for the Angeles and San Bernardino National Forests can be used to display recent fire occurrence and give some insight to the role fire is currently playing. Fires of 100 acres or more were plotted by 10-year periods. This display clearly shows that large fires occur in the older chaparral age classes, successful suppression occurs many times at age class boundaries, and large fires are not being eliminated from chaparral. Furthermore, these analyses give strong support for controlling potential fire size by managing chaparral as an even-age mosaic with age-class areas being used to control fire size.

Land managers can take advantage of many characteristics of chaparral ecosystems to impact fire size, frequency, and intensity. By understanding the vegetative responses to these variables, the distribution, density, vigor, and species composition can be controlled and manipulated. Offsite damage can be reduced, sediment production redistributed, and productivity of commodity and noncommodity resources increased.

What is the role of wildlife biologists in the management of chaparral? Your role is to help describe what managed chaparral should look like. It's no longer acceptable for wildlife managers and other resource specialists to accept the predictable outcome of fire management policies developed without adequate consideration of a full array of management alternatives and needs. You and your counterparts in Watershed and Recreation must determine <u>your objectives</u> and desired outputs for chaparral lands so that more appropriate and responsive fire management policies can be developed.

LITERATURE CITED

Mutch, R. W. 1970. Wildland fires and ecosystems--a hypothesis. Ecology 51:1046-1051.

Gill, A. M. 1977. Plant traits adaptive to fires in Mediterranean land ecosystems. Proc. Symposium on the Environmental Consequences of Fire and Fuel Management in Mediterranean Ecosystems, USDA Forest Serv., Gen. Technical Rep. WO-3.