

Use of Fire in Land Clearing

controlled burns by planned application and confinement of fire to preselected wildland area a tool of many uses

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Controlled fire as a land clearing tool was applied to approximately 102,000 acres of California brushland in 1950—and during the same time, wildfires burned more than 300,000 acres of other state and private lands.

The controlled burning was done by 286 landowners who invested time, labor, equipment hours, and money in the project. The program was sanctioned by state law and directly aided by state appropriation for standby crews.

The contrast between controlled fire, the tool, and wildfire, the destroyer, is intensified in California by variability in ownership, in soil type, and in land use.

Controlled fire may be one step in the process a landowner may employ to increase the net return from his property while a nearby owner may consider any kind of burning on his lands to be harmful.

Many uses of fire—many types and sizes of burn—may be included under the general heading of controlled burning, if the term is defined as *the planned application and confinement of fire to a preselected land area*.

Controlled burning is used for many purposes in land management. Cattlemen employ it to clear brushland for range

The first of five articles reporting the findings in investigations in the effectiveness, the safety and the cost of the use of controlled burning as a tool for land clearing. No attempt is made to provide one formula for prescribed burning in California; each fire is an individual case to be planned on the ground.

use. Sheep and goat raisers use it to remove mature foliage from trees and brush in order to stimulate sprout growth for browse. Some landowners use controlled fire in a program to increase food and cover for wildlife. Controlled burning is one of the agents used to fireproof upwards of 5,000 miles of California highways each year. Fire is used on timberlands to reduce hazardous slash and debris accumulations following logging.

Each of these jobs—where burning is a tool—requires a particular type of fire used in a specific way.

A Complicated Tool

A fire in a fireplace and a fire used to clear brush from land are governed by the same fundamentals of fire behavior. In both cases size, distribution of the

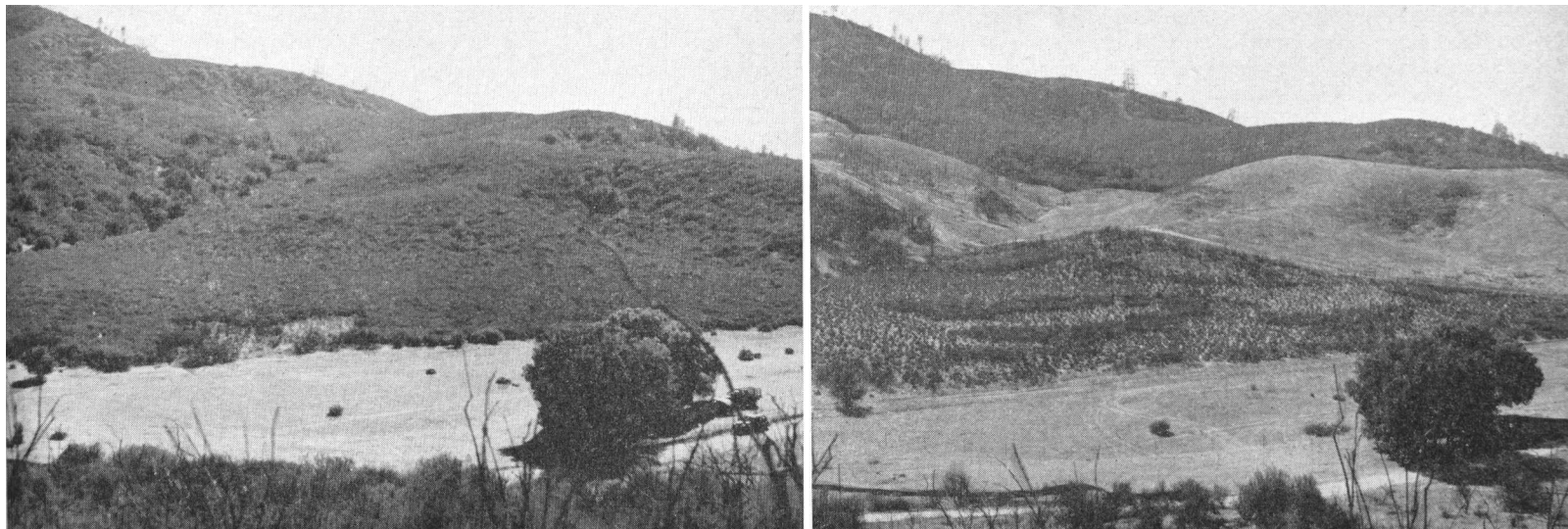
fuel, and moisture content of the fuel particles largely determine how the fire burns. In addition to these factors the fire in use for land clearing is subject to variations in topography, and to rapid fluctuations in wind, humidity, temperature and solar radiation.

The combined effects of these variables on fire behavior make planning and conducting a successful controlled burn a critical and important task. A successful controlled burn is one which removes the undesirable vegetation, is confined to the predetermined area, and whose cost is in line with the anticipated increase in returns.

The simplest type of controlled burn is the *convenience fire where the only elements planned are time and place of burn*. At the other extreme is the *prescribed burn* where fire is conducted systematically over an area at a time when weather and fuel conditions produce intensities of heat and rates of spread which should maximize expected benefits to soil and vegetation.

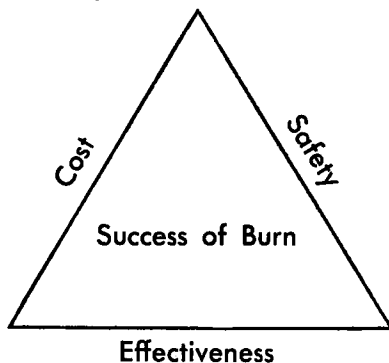
Most controlled burns actually are more accurately described as convenience fires rather than prescribed burns. A convenience fire may be the most expensive

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Left. Area in San Benito County before any brush removal treatment. Photograph taken in 1948. **Right.** Same area after brush removal treatment. The brush on the slope in the left-center was burned standing; burning conditions left islands and brush stumps have sprouted. The diagonal strip in the middle background was burned after brush was railed down with bulldozer and allowed to dry about ten months. Photograph taken in 1950.

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way to burn an area, and only by chance are results satisfactory. Such a burn may, in fact, consist of little more than confinement of wildfire within preselected boundaries. An effective and safe burn is not guaranteed by constructing control lines between existing roads, gathering friends and neighbors on a predetermined date, and stringing fire around the edge of a brush area.



Effectiveness, safety, cost—the three elements on which hinges the success or failure of controlled burning. An effective burn removes all undesirable vegetation. A safe burn limits damage to that accepted in advance as part of the cost of the burn. A low cost burn assumes that no other means can do the same job at lower cost and that increased returns from treatment will equal or exceed costs.

In contrast, when prescribed burns are made, decisions—as to how, where, and when the fire should be started, and the location of control lines—must be based on fire behavior under given conditions. Weather and fuel are two conditions which limit the time when satisfactory burns can be made.

A complete plan for a prescribed burn is based on the reason for the burn—the purpose to which the land is to be put—then soil, cover, topography and other factors are considered. A plan for a particular fire should be coordinated with over-all fire plans of neighboring ranchers, and with burning plans for future years. Finally, a natural burning unit is selected, weather condition limits within which the burning should be done are determined, and then the fire is set to take full advantage of land slope, natural air drafts, and convection currents.

Effectiveness

A successful controlled burn achieves maximum effectiveness with complete safety at lowest cost. Controlled burns are failures when insufficient vegetation is removed, or when escapes lead to excessive control costs and damage, or when costs of conducting burns are greater than increased returns following them.

The results of most burns lie somewhere between the two extremes, or compromise one or more elements to the advantage of the others. The problem of applying fire to any given area is to effect

a proper balance between the three elements of effectiveness, safety, and cost.

Fire is not a consistently effective tool. One day fire burns all vegetation hot and fast—the next day it merely creeps through the grass.

Landowners' opinions concerning 261 range improvement controlled burns made in 1950 show how variable the results may be. In 59% of these cases the fire was effective in removing a sufficient amount of brush cover to satisfy the landowner that his investment in time and effort had been worth-while. Effectiveness of the job accomplished by fire can be measured in terms of results anticipated by the landowner and does not necessarily imply a complete removal of the brush. There is a relationship between the success of a controlled burn and the landowner's experience with fire, his planning and preparation as well as the nature of the terrain and kind of cover.

On 41% of these burns landowners were not satisfied with the amount of undesirable vegetation removed by fire. Fire skipped parts of many burns or did not spread from the points of initial ignition. On other burns, grass, dead leaves, and other fine fuels were consumed without affecting the green brush and heavy fuels. Some of these poor and unsatisfactory results occurred on areas where fuel or topographic conditions precluded the possibility of a successful burn. In other areas fuel and topographic conditions were such that only under certain weather conditions would fire run through the brush crowns.

Areas which embrace more than one natural burning unit rarely can be burned satisfactorily. *A natural burning unit is an area of such size and shape that fire can be directed over it in a way to remove the maximum amount of undesirable vegetation, and yet can be controlled with minimum effort; it is determined by the*

nature and combination of its fuel types, prevailing local winds, topography and natural barriers.

An area of several thousand acres usually contains two or more natural burning units. Barriers to fire which exist between these units may prevent its spread over the entire area if it is planned as a single controlled burn. Moreover, variations in soil, cover, topography, and other factors dictate different treatments for different natural burning units in order to obtain effective burns.

Size alone and limitations which size imposes on timing and location of firing may preclude the possibility of a satisfactory controlled burn of several thousand acres. The area may be too large for controlled fire to cover within a uniform burning period of a night or a day. Poor burns or escapes are the result. In other cases fire may smoulder down slopes which should be subjected to a fast-running headfire. Again, fire may back against the wind when better results would come from burning with the wind.

Safety

A fire confined to a fireplace can safely provide heat but without adequate safeguards, sparks from this fire can ignite nearby rugs or furniture, or a faulty flue can start a fire in the attic. In the same way a controlled burn conducted with little planning, minimum effort, or without reference to fire behavior may lead to great damage. Not only does a poorly planned burn endanger nearby properties and improvements but it increases control costs.

Each year 11% to 17% of the controlled burns for range improvement conducted in California escape and become wildfires. A study of 46 such escapes indicates the nature of factors which affects the safety of controlled burns.

Range land cleared for seeding by successful controlled burning.



Causes of Escapes of Range Improvement Controlled Burns

Cause	Escapes	
	Number	Percent
Spot fire	20	43.5
Wind shift	10	21.8
Whirlwind	5	10.8
Inadequate patrol	4	8.7
Improper methods	4	8.7
Burning log rolling over line ...	2	4.3
Rabbit on fire	1	2.2
Total	46	100.0

Escapes due to natural causes can not be eliminated but they can be minimized by careful planning, adequate preparation and skillful execution of the controlled burn. The safety element must be an important consideration when the decision is made to use fire.

Cost

A controlled burn may be a costly or inexpensive tool. However the cost of controlled burning is significant only when safety is balanced against effectiveness.

In 1950 one Mendocino County rancher expended 300 man hours of labor and 70 hours of equipment operation to prepare and burn a 300-acre area. A nearby rancher burned 400 acres with only half the man- and equipment-hours. In Amador County—in the Mother Lode—where two 250-acre tracts of chamise were burned, one required 300 bulldozer hours of preparation, the other 16 hours. Some controlled burns are conducted for as little as 2¢ per acre; in other cases preparation and burning cost as much as \$50 per acre.

The wide discrepancies in these figures can be explained in terms of differences in burning conditions, errors in judgment, and variations in desired results.

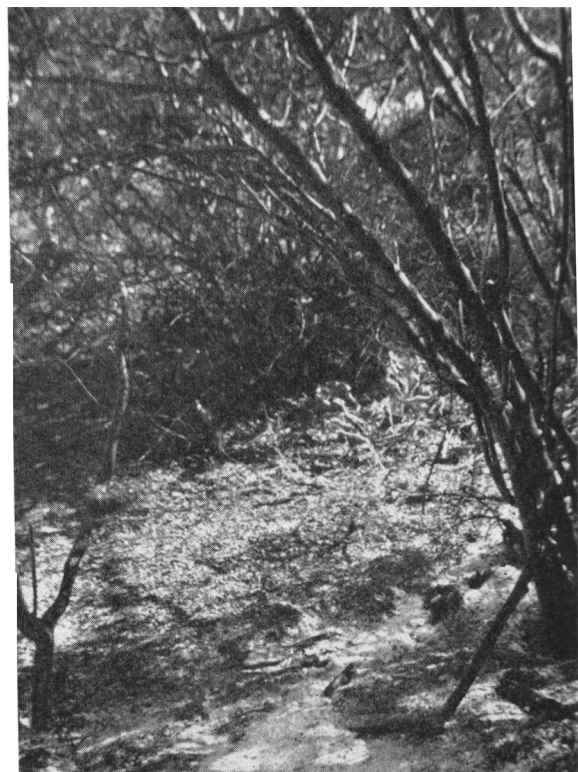
Burning log above firebreak. Chunks from such logs may roll across the fire line, causing escapes.



There are basic differences in vegetative cover, topography, soil, existing barriers to fire, and protection requirements of adjacent property values. These elements may exist in a pattern which reduces or increases effort necessary to burn. For example, 160 acres of chamise located in a remote area surrounded by roads or open fields presents minor problems in fire control and can be burned at low cost. Controlled burning of 160 acres of chamise located on a slope immediately below a stand of timber and surrounded by summer homes will provide a major problem in burning, and associated costs will be high.

There are errors in judgment and some prepared fire lines are too wide and therefore costly without contributing to safety or effectiveness. Other fire lines are too narrow or are improperly located. Additional errors include failure to utilize existing natural fire lines; ignoring hazards such as snags or dry brush piles; too few or too many men; inadequate instruction of control forces; poor timing and location of firing; selecting areas which will not burn under existing conditions.

Landowners burn for different purposes and expect various results. As an example, the 300-acre burn in Amador County, where a tractor was utilized in riling down brush to prepare for burning, resulted in an exceptionally effective burn, conducted during a period when danger of escape was low. The cost is high, but land which is to be put into grain can repay a fairly high clearing cost. On the other hand, 16 hours of tractor work on another brush field prepared the area for burning the brush standing. This was achieved safely and at a low cost. It could be considered an effective burn for the purpose of opening up an area for browse. Either of these burns could have been considered poor if predicted results had not been obtained.



If conditions are not right for green brush and heavier fuels to burn, a fire merely consumes grass and other light, dead material and makes it difficult to run a fire through that area for another three to ten years.

Fire in Land Management

The 102,000 acres burned under permit in 1950 leave no doubt that controlled fire is used as a land-clearing tool. Though 41% of the burns failed to satisfy landowners and 11% to 17% escaped, controlled fire can be used effectively, safely, and at moderate cost if two conditions are observed—characteristics of fire behavior are understood, and fire use is confined to tasks it can do.

Controlled burning is assuming its logical place as just one step in an overall plan of land management. To finally clear an area of noxious vegetation fire will require help from chemicals, from cultural techniques such as disking or seeding, and through proper grazing practices.

(To be continued)

Part II, "Selecting and Preparing the Area to Burn" will be published in April. Sections on "Planning and Organizing for the Fire," "Managing the Fire—How, When, Where of Ignition," and "Managing the Fire—Control, Patrol, and Mop-up" will be published in subsequent months.

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