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HERBICIDES TO PREVENT FOREST FIRES

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For the next twenty minutes I am going to be talking about the U. S. Forest Service, Region 4, Administrative Fuel-Break Study.

This study began over six years ago, as a cooperative effort between the Intermountain Region, an Administrative Region of the Forest Service, responsible for management of National Forest land in the States of Idaho, south of the Salmon River, Wyoming, west of the Rockies and Utah and Nevada and the Pacific Southwest Forest and Range Experiment Station, Forest Fire Laboratory, at Riverside, California --a research arm of the Forest Service.

In recent years, population pressures forcing urban expansion into adjoining wildlands and increased recreation use had caused a greater risk of man-caused fires. This plus the costs of constructing and maintaining firebreaks by conventional mechanical methods, and increased awareness of environmental esthetics, have prompted a new approach to cope with some of our fire problems.

Before we get into the actual study, let me first put the program in proper perspective by showing you some of the problems which precipitated the study. Beginning in southwestern Idaho, with this subdivision located on the outskirts of Boise. The land immediately surrounding the subdivision is covered with a heavy stand of cheatgrass and is the playground for most of the children. Last year a 400 acre man-caused fire occurred on the mountain in the upper left hand corner.

Moving eastward into central Idaho, roadside picnic areas such as this, along the main Salmon River provide an ideal location for the start of a fire in cheatgrass by a careless camper or smoker.

In southern Idaho near Pocatello, urban expansion is progressing much the same as around Boise. This fire, which started in cheatgrass, scorched the siding and roof of some of the homes in the background. Fire has threatened this area four times in the last five years, one of them just last year.

Moving south into Utah, this highly flammable cheatgrass-oakbrush type covers many thousand acres. This fuel type, combined with the lack of proper zoning restrictions regarding wildland fire potential leads to potential disaster situations such as this. This is nearly a carbon copy of the situation which exists in southern California where fire consumes many homes annually.

The fire scarred trees in the background are the result of fire escaping from the fireplace grate into adjacent cheatgrass. at the Flaming Gorge National Recreation Area, in eastern Utah. I could have shown many other pictures depicting other problem areas, but I think these are sufficient to illustrate the magnitude of the problem and wide geographic area involved.

Now, let's look at the economics of the situation. In 1969, which was a less than normal fire load year, one-third of a million dollars was spent in fire prevention programs in the Intermountain Region. Even after this, expenditures of two thirds of a million dollars for man-caused fire suppression were incurred. This figure doesn't include the value of resources or improvements which were lost on the areas that burned, which would be nearly $2,000,000.

A common denominator in all of the problem areas which we have looked at, is the presence of a fuel called cheatgrass--the crux of our problem and the main target of our study. Cheatgrass is a shallow rooted annual grass which matures and dries early in the spring. Just how to deal with the cheatgrass problem has perplexed many people for years. It was finally decided that we would try a concept developed some years ago in southern California. The fuel-break concept.

By definition:

A fuel-break is a long, usually narrow strip of land on which the vegetation has been modified by mechanical methods, chemically through the use of herbicides, by planting, or a combination of these to facilitate fire control.

Thus, the objectives of our study were to:

1. Break up continuous expanses of fuel into smaller, more manageable units.

2. Change fuel types having potentially extreme or high rates of fire spread to those of medium or low rates of spread.

3. Reduce ignition potential of a given fuel type by eliminating highly flammable fuels.

This fuel-break in southern California was constructed by mechanical manipulation of the Chaparral fuel and use of some herbicides. In our fuel type, which is primarily grass-brush, it was not felt that mechanical manipulation would be economically feasible, so we turned to herbicides.

The research phase of our program, like many others, began by arbitrarily selecting herbicides which we felt might be somewhat selective if used at light rates of application. Our sights were ultimately set at finding a herbicide which would eliminate cheatgrass from mixed annual-perennial grass stands, but leave the perennials undamaged, to provide for watershed protection and leave the area esthetically pleasing.

Six herbicides were selected:

	Initial Rate (lbs. /A)
Atrazine	1.5
Simazine	1.5
Bromacil	2.0
Diuron	1.5
Monuron	1.5
Fenac	5.0 Gal. /A

Three replications of each herbicide were applied in the fall at two different rates; the initial rate and double the initial rate. Results one year after application look like this. Atrazine and bromacil were very effective in eliminating cheatgrass at both rates; simazine was almost as effective, but monuron, diuron, and fenac were respectively less effective compared to control plots where no treatment was made.

This picture contrasts atrazine at 1 1/2 pounds per acre on the left with a control, or area receiving no treatment on the right. Note the heavy stand of cheatgrass in the control and the green perennials left in the treated area where cheatgrass has been selectively removed. Elimination of competition from cheatgrass has enabled the remaining perennials to have more moisture and nutrients available. This higher moisture content will help to impede the spread of fire.

A closeup of this plot later in the summer shows a distinct absence of cheatgrass and the basal portion of the perennial grass still green.

In this picture bromacil, on the left a 2.0 pounds per acre, the other herbicide which effectively controlled cheatgrass, did so at the expense of the perennial grass. In fact, complete site sterilization occurred at the low rate. These results caused us to try bromacil at even lower rates, but at rates at which the perennials were left undamaged, effective cheatgrass control was not obtained. Bromacil is compared here to atrazine at 1 1/2 pounds per acre.

Following the progression for two more years, the second year after application showed a gradual succession back toward the normal species composition found in controls, with atrazine still yielding acceptable control of cheatgrass and minimum effect on perennial grasses. The three pound rate of atrazine was more effective than the 1 1/2 pound rate the second year, but the additional cost was not justified, considering the small extra margin of cheatgrass control. Monuron at the heavy rate, 3.0 pounds per acre, controlled cheatgrass but damaged perennials. Diuron and fenac were relatively ineffective.

The two main grass species depicted in the preceding plot pictures were cheatgrass and sand dropseed. Moisture trends for these grasses show why cheatgrass contributes so much to fire potential.

In a normal year, shortly after June 1, cheatgrass has reached a minimum of 5-10 percent fuel moisture, while sand dropseed is just reaching its maximum fuel moisture content. Our herbicide treatment caused perennial grasses within a fuel-break treated area to have a higher fuel moisture content and extend the drying period two to three weeks longer in the growing season.

Within three years after the initial research got underway, results looked good enough that we felt we could proceed to the operational expension phase.

Expansion meant the concept would be tested on a variety of soil and vegetation types and under various rainfall regimes. Early in the study it was found that application rates had to be closely correlated with soil type, as both clay content and organic matter content render a portion of the herbicides unavailable for plant uptake. This was done throughout the operational phase.

Let's look at some of the results.

The first operational fuel-break treatment was made along the Wasatch Front between Ogden and Salt Lake City, Utah. Atrazine at 2 pounds per acre was applied in the fall of 1968. In this picture, the following spring, note the absence of dried cheatgrass and the dark green color of the perennial grasses, indicative of their high moisture content, compared to this adjacent untreated area which has an abundance of highly flammable cheatgrass.

In the fall of 1969 this roadside was treated in Kingston Canyon in central Nevada. The right side of the road received treatment with atrazine at 2 pounds per acre, the left side received no treatment, and as you can see, supported a healthy stand of cheatgrass during the summer of 1970.

At Flaming Gorge National Recreation Area in eastern Utah, cheatgrass occupied the area immediately behind the fireplace grate. One year later after treatment with atrazine at 3/4 pounds per acre, the area is free of cheatgrass and the campground fire-safe.

We tested the fuel-break concept on 10 of the 18 National Forests in Region 4, with results similar to those you have just seen. A major concern as we began operational expansion was what specialized equipment would be needed. Before looking into specialized equipment we decided to try one of our standard slip-on firefighting pumpers and adapt a special nozzle to obtain a uniform, regulated spray.

Our prototype, as seen here, turned out to be our standard model for fuel-break application. One pass with this pickup mounted slip-on pumper covers a 33-foot wide area with a flat spray. The nozzle we selected was a Boomjet, 5-orifice nozzle. Because of the reggedness of terrain and high vegetation often encountered, we selected this nozzle over the conventional agricultural spray boom-type.

Herbicides were weighed and premixed in five gallons of water, then added to the water tank, at the rate of one pound of herbicide per twenty gallons of water. Premixing facilitated the herbicide staying in suspension as it is nearly insoluable in water. Once in the tank, bypass agitation provided ample circulation to prevent the herbicide from settling out.

Our operational expansion confirmed our thoughts that we had a sound method of fuel management for cheatgrass. But at this point one major question was as yet unanswered. What effect would our fuel-break actually have on the rate of fire spread and ignition potential? To answer this we conducted fire spread and ignition tests.

Three each untreated spread and ignition test plots having a heavy stand of cheatgrass and three each spread and ignition test plots treated with atrazine at two pounds per acre were located along the Wasatch Front near Farmington, Utah, in the fall of 1969. In August 1970 when fire danger was high, the tests were conducted.

On-site weather and fuel moisture was monitored for two weeks prior to the tests. Temperature, relative humidity, and winds were monitored during the test by the Salt Lake City Weather Bureau, Fire Weather Meteorologist in his mobile unit.

Temperature was over 90°, relative humidity from 15-20%, winds averaged just under six miles per hour with gusts up to twelve miles per hour. Fuel moisture was six percent. This combination of weather and fuel factors provided optimum wildfire test conditions.

For the spread tests, a 40-foot wide front was ignited with fuses and allowed to run into the fuel-break test plot. Rate of spread data was collected by using a stop watch to time the forward movement of the fire front as it passed the lath in the center of the plot in the preceding picture.

Flame height was estimated as the fire passed the marked lath and used as a measure of fire intensity.

Results were that the fuel-break treatment caused a 45 percent reduction in rate of spread and a 50 percent reduction in fire intensity.

Three firebrands--cigarettes 1 1/8" in length (about that which would be discarded by a smoker), paperbook matches, and wood stick matches were in the ignition test trials. Twenty-five of each kind were intorduced into each of three treated and three untreated test plots.

The results were somewhat surprising. Of 150 cigarettes tested in both the treated and untreated plots, no cigarettes caused a fire to start.

Matches proved to be a different story. Matches caused ignition on 98 percent of the trials. In over 50 percent of the trials in untreated plots, matches ignited the heads on the cheatgrass before the matches reached the ground. The speed of ignition in untreated plots could be likened to ignition of gasoline fumes nearly explosive in nature.

Although fires ignited in both treated and untreated plots, the subsequent rate of fire spread was the significant difference. In atrazine treated plots, there was a 70 percent reduction in the rate of fire spread over that in untreated plots.

In twenty minutes, I have capsulized over six years of research on herbicides. Based on the foregoing results, we have drawn the following conclusions regarding our method of using herbicides.

1. It is possible to reduce flash fuel volume and break up the the continuity of fuel types.

2. This reduction in flash fuel volume is accomplished without disturbing the soil, a definite advantage over mechanical methods.

3. A percentage of the original grass stand is left for watershed protection and stability. The remaining vegetation also serves to maintain environmental esthetics by blending into the surroundings.

4. Fuel-breaks can help to buy time in fire suppression efforts by reducing or perhaps even stopping the rate of spread.

5. Fuel-breaks give the fire fighters an already established fireline which can be easily reinforced or widened.

6. Decreased cost over conventional methods. Even though definite costs are not available current estimates are that fuel-breaks can be established from 60 to 80 percent cheaper than by present mechanical methods.

7. In many areas, fuel-breaks could contribute to an overall reduction in occurrence and burned acreage and serve to contribute toward meeting regional goals for man-caused fires and tolerable burned acreage. Subsequent benefits would be a reduction in initial attach costs and overall suppression costs.

8. In steep terrain, an added margin of safety for fire fighting crews may be obtained, as it has in southern California.

In summary--in an article titled "As I See the Forest Fire Problem," which appeared in the June 1969 issue of American Forests magazine, the Chief of the Forest Service wrote: Quote,

> "Hazards must be reduced without sacrificing esthetic or soil values. Great promise along these lines is seen in using less flammable patterns and mixes of species in forest cover. Greenbelts, fire-resistant plants, cleaner harvesting...and fireproofing road systems will make the spread of fire less likely and will assist in control efforts." End quote.

We in Region 4 feel that the herbicide fuel-break concept fits quite nicely within the scope of this statement and certainly provides a partial solution to a problem we've had for years.