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# Effect of 2,4-D and 2,4,5-T on Water Quality after a Spraying Treatment

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ABSTRACT: Stream pollution has not resulted from removing and chemically spraying vegetation at the bottom of Monroe Canyon on the San Dimas Experimental Forest. The riparian zone and intermediate slopes were hand-sprayed several times with a mixture of 2,4-D and 2,4,5-T herbicide. In another study, brush on side slopes was cut and sprayed. Soil samples taken the first month after treatment showed no traces of herbicides.

Many foothill communities in southern California still depend on local sources for their major water needs. As the population there continues to soar, every acre-foot produced of this high quality water may be used. To find ways of boosting usable water yield from brush-covered watersheds, the Pacific Southwest Station is conducting studies at the San Dimas Experimental Forest, [1] northeast of Glendora, California.

Rowe found that removing riparian vegetation from the canyon bottom of a southern California watershed, and controlling regrowth with chemicals, increased water yield. [2] But what about the quality of this streamflow? The question is important in view of reports that use of some chemical sprays next to water sources had contaminated streams.

Our studies were made on the 875-acre Monroe Canyon watershed of the San Dimas Experimental Forest. They show that herbicidal sprays used as part of a vegetation conversion program to increase water yield did not impair streamflow quality. We also found that water yield can be increased through the conversion program.

At the time the Monroe Canyon watershed was cleared (1957-1959), sprouting vegetation was sprayed with a herbicide mixture

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[1] Maintained by the U.S. Forest Service in cooperation with the California Division of Forestry.

[2] Rowe, P. B. Streamflow increases after removing woodland-riparian vegetation from a southern California watershed. Jour. Forestry 61(5):365-370, illus. 1963

of equal parts of 2, 4-D and 2, 4, 5-T in diesel oil. During the clearing operations, 88 gallons of herbicide were applied. Sprouts and other herbaceous vegetation were to be sprayed annually thereafter; the first maintenance spraying was done in June 1960.

## CANYON BOTTOM STREAMFLOW

In cooperation with the California Department of Water Resources, we collected each month a series of water samples at the gaging stations near the mouth of the study watershed. Samples were analyzed at a commercial testing laboratory to determine herbicide and diesel oil content. Rowe had reported no trace of herbicide in a chemical analysis of the surface streamflow. But he found in some samples small traces of oil used in the spray mixture. The monthly sampling, begun in 1958, was interrupted when a wildfire destroyed the vegetative cover in July 1960.

Before the fire, we had collected water samples only at the gaging stations. After the fire a more intensive system was deemed necessary. Four sampling points were established in Monroe Canyon: (a) at the stream gaging station near the mouth of the watershed; (b) on the surface water just above the gaging station; (c) at a shallow groundwater well (8 feet deep) several hundred feet upstream of the canyon mouth; and (d) at a shallow groundwater well at the upper end of the treated area.

Hand spraying of stump sprouts and other vegetation was resumed on May 10, 1961. At times of spraying, there was surface streamflow throughout the entire treated area. This streamflow increased the possibilities for pollution. In spraying, we were careful to avoid direct contamination of the stream. We used 45 gallons of herbicide.

Herbicide content of samples taken at the Monroe Canyon sampling locations during a five-month period in 1961 was well below the safe limit of 1 part per million (p. p. m.) (table 1). No traces of the diesel oil were found.

A high-intensity storm in November 1961 buried all the sampling sites under debris and later sampling was confined to the gaging station site.

Hand spraying for maintenance was again carried out during June 1963. Water samples taken at the end of that month--the last in the series--showed no traces of herbicide or diesel oil.

## SPRAYING SIDE SLOPES

In another water-yield study in Monore Canyon, we are trying to convert vegetation on steep side slopes from deep-rooted brush to grass. Brush was sprayed by helicopter and individual plants were handsprayed in June 1961. The helicopter spray mixture consisted of 3/4 gallon (3 pounds acid equivalent) each of low volatile esters of 2, 4-D and 2, 4, 5-T in 1 gallon of diesel oil and 17 1/2 gallons of water applied in two 10-

gallon amounts, for a total of 20 gallons per acre. As a follow-up treatment, we handsprayed the brush with a herbicide mixture of 1/2 gallon (2 pounds acid equivalent) each of 2, 4-D and 2, 4, 5-T in 1 gallon of diesel oil, and 98 gallons of water.

Table 1. --Concentrations of 2, 4-D and 2, 4, 5-T herbicide in water samples from Monroe Canyon[1]

| Date sampled | Site | | | |
|---|---|---|---|---|
| | Weir | Surface | Well 1 | Well 2 |
| | In parts per million | | | |
| May 10, 1961 | 0.00 | -- | -- | -- |
| May 22, 1961 | .00 | -- | -- | -- |
| June 5, 1961 | .05 | 0.09 | 0.01 | 0.01 |
| July 24, 1961 | .05 | .03 | .00 | .00 |
| July 31, 1961 | .00 | .00 | .00 | .00 |
| Aug. 28, 1961 | .00 | .00 | .00 | .01 |
| Sept. 25, 1961 | .00 | .00 | .04 | .00 |
| Oct. 30, 1961 | .00 | .00 | .00 | .00 |
| Jan. 29, 1962 | .00 | -- | -- | -- |
| Feb. 26, 1962 | .00 | -- | -- | -- |
| June 20, 1963 | .00 | -- | -- | -- |

[1]Riparian zone vegetation was handsprayed during the week following the May 22, 1961 sampling and just before the June 20, 1963 sampling.

To determine the presence of herbicide, we took several soil samples from the brush-conversion area. Samples were taken from the top 3 inches of soil at several elevations on south-facing slopes. These soils are generally residual and immature, moderate to coarse textured, and normally mixed with large amounts of fractured rock. They average less than 3 feet deep, have low water-retention capacity, and usually have no profile development.

We found neglegible amounts of herbicide in the samples. In one of the two samples taken 8 days after spraying, we detected a small amount of herbicide (table 2). But no trace of herbicide was found in four samples taken a month and a half after initial spraying. Between the dates of spraying and the final sampling, no precipitation occurred. This eliminated the possibility of chemical leaching below the sampling level in the soil.

Table 2. --Concentration of 2, 4-D and 2, 4, 5-T herbicide in Monroe Canyon soil after helicopter spraying[1]

| Date sampled | Elevation | Concentration |
|---|---|---|
| | Feet | In parts per million |
| June 19, 1961 | 2,100 | 0.00 |
| June 19, 1961 | 3,150 | .17 |
| Aug. 28, 1961 | 2,140 | .00 |
| Aug. 28, 1961 | 2,150 | .00 |
| Aug. 28, 1961 | 3,175 | .00 |
| Aug. 28, 1961 | 3,180 | .00 |

[1]Initial helicopter spraying was done on June 12, 1961.

Although 2, 4-D and 2, 4, 5-T are similar compounds, their herbicidal effects do not endure for the same length of time; 2, 4-D detoxifies more rapidly than 2, 4, 5-T in the soil. Persistence of herbicides in soil depends on several factors including (a) moisture content of the soil, (b) soil texture, (c) pH, (d) soil temperature and extended period of warm days, and (e) organic matter content[3].

These five factors also affect growth of soil micro-organisms which have been credited with decomposing herbicides. Furthermore, high soil temperatures are known to cause a revolatilization of 2, 4-D and 2, 4, 5-T. Therefore extended hot seasons become ideal for detoxification of herbicides which revolatilize from the surface soils of the slope conversion areas.

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[3]Alexander, Martin. Introduction to soil microbiology. pp. 238-244. New York: John Wiley & Sons, Inc. 1961.