MANAGEMENT NOTES

The Pinyon-Juniper Type of Arizona

DONALD A. JAMESON AND ELBERT H. REID
Principal Plant Physiologist, and Chief, Division of Range and Wildlife Habitat Research, Rocky Mountain Forest and Range Experiment Station[1].

Juniper (*Juniperus* spp.) and pinyon (*Pinus edulis* Engelm.) have invaded former grasslands and thickened established stands on much of Arizona's 14 million acres of pinyon-juniper type. These invasions and the growth of trees and unpalatable shrubs have reduced the quantity and quality of forage available for livestock, and increased the difficulty and cost of handling animals. Also, suppression of palatable understory browse species by overstory evergreens has reduced the forage supply for both game and livestock.

Pinyon-juniper invasions of protected grassland communities and the growth of established trees indicate their ability to dominate understory plants. Such invasions of grasslands, therefore, seem a natural process of plant succession. A series of studies by the Rocky Mountain Forest and Range Experiment Station on the pinyon-juniper type has shown how the ecology of trees and forage plants are related, and some of the steps that can be taken to reduce the tree stands.

Successional changes in vegetation between 1940 and 1953 were compared on protected and grazed plots. Trees and shrubs increased on both kinds of plots. Mid-grasses increased under protection and decreased under grazing. Forbs generally increased slightly under both protection and grazing, although some species showed minor losses on both types of plots. Blue grama (*Bouteloua gracilis* (H.B.K.) Lag.), red three-awn (*Aristida longiseta* Steud.), and other short-grasses as well as ring muhly (*Muhlenbergia torreyi* (Kunth) Hitchc.) decreased more under protection than under grazing. Half-shrubs decreased under both grazing and protection. Broom snakeweed (*Gutierrezia sarothrae* (Pursh) Britt. & Rusby) was the predominant half-shrub species.

The effect of pinyon and juniper trees on understory perennials was determined by a sequence of measurements taken on areas where tree cover ranged from scattered trees to almost complete cover. In general, understory plants decreased with increasing amounts of overstory trees.

Pinyon and juniper reduce the production of understory grasses and forbs by suppressing their growth. Air-dry herbage yields ranged from about 600 pounds per acre on transects with no tree overstory to less than 100 pounds per acre on transects with 60 percent canopy intercept. Transects with 80 percent or more canopy intercept produced less than 50 pounds per acre.

Several methods of reducing pinyon-juniper stands are widely used as range improvement practices. Increases in forage production following juniper control often allow increases in livestock numbers, or prevent reductions in livestock numbers which would result from decreasing forage supplies. The herbage increased from 200 to nearly 700 pounds per acre on the sites studied. Several years are required to attain this increase.

Cabling or chaining is an inexpensive means of uprooting dense stands of old pinyon and juniper trees, but followup treatments usually are needed. Bulldozing has been used extensively to uproot individual trees in stands unsuited to cabling and chaining.

No chemical has yet been recommended for general use in juniper control, although several can be used in particular situations.

Although small-scale broadcast burning of live stands of pinyon-juniper under controlled conditions has been tried, more knowledge is needed before it can be recommended as a general practice. The largest part of the pinyon-juniper type is usually too open for fire to carry from one tree to another. In open stands, oil and propane burners can be used to kill individual trees.

The burning of grassland communities to kill small, invading trees has been tried on a small scale. This method may be justified where there are many invading trees, but in scattered stands it is probably less costly to treat invading trees individually.

Removal of large overstory trees results in an immediate release of the small pinyon and juniper if they are missed in the control operation. Shrubs and half-shrubs in the understory may also increase greatly. Short-grasses and most mid-grasses increase in response to juniper control. Annuals increase the first year and reach a peak during the second growing season after the clearing.

[1] *Forest Service, U.S. Department of Agriculture, with headquarters at Fort Collins, Colorado, in cooperation with Colorado State University.*

After the second year, they decrease as they are displaced by perennials.

A light layer of slash left by the clearing of open stands favors the reestablishment of grasses and forbs. In one study, light slash increased production by almost 100 pounds per acre in 1 year.

Excessive slash combined with the release of small trees that were missed poses a serious problem on cabled areas. In slash-burning experiments conducted in three seasons, a burn in December removed the least slash and killed the fewest trees missed by cabling. An August burn removed the most slash and killed the most trees, while an April burn gave intermediate results. There was a 38-percent increase in grass production on the burned plots after 3 years.

Cost comparisons for cabling, dozing, and clearing with hand axes show that cabling or chaining has been the least expensive control method. To obtain optimum benefits from cabling or chaining, followup treatments usually are necessary. This method is best for removing stands of large trees. Small trees can often be controlled more cheaply and efficiently by individual tree treatments.

For details of the results see "The pinyon-juniper type of Arizona: Effects of grazing, fire, and tree control," U. S. Dept. Agr. Prod. Res. Report No. 84, by Joseph F. Arnold, Donald A. Jameson, and Elbert H. Reid, September 1964. Copies can be obtained upon request from the Director, Rocky Mountain Forest and Range Experiment Station, 221 Forestry Building, Colorado State Univ., Fort Collins, Colorado 80521.