

Managing Pinyon-Juniper Woodlands

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A renewed interest in pinyon-juniper woodlands has accelerated debate regarding management of this unique ecosystem. Should these woodlands be managed only to provide livestock forage through overstory removal-popular programs in the 1950s and 1960s-or should they be managed for production of multiple resource products and amenities? Pinyon-juniper woodlands have varying capabilities of producing fuelwood, wildlife habitat, forage for livestock, watershed protection, and other products such as pinyon nuts (Figure 1). In addition to these more traditional resources, we must now consider increasing recreational demands, increased human development, impacts of management for threatened, endangered, and sensitive plant and animal species, and protection of archeological sites.

Three recent conferences dedicated to these woodlands, and sponsored by state and federal agencies and several professional organizations, accentuated their emerging importance (Everett 1987, New Mexico Commissioner of Public Lands and New Mexico Agricultural Experiment Station 1991, and Aldon and Shaw 1993). A national workshop on pinyon-juniper management strategies was sponsored by the Rangeland Technology and Equipment Council in Albuquerque, New Mexico, in 1993. Regional workshops were conducted in Prescott, Arizona, in 1988 and in Santa Fe, New Mexico, in 1989.

Conflict and confusion over managing pinyon-juniper woodlands, coupled with an ecosystem approach to management adopted by some federal agencies, suggest that attitudes toward woodlands be re-evaluated. Multiresource goals have been legally mandated on most public lands. Although single resource goals may often be targets on private lands, decisions attempt to ensure maximum return without jeopardizing site productivity. The differences among pinyon-juniper sites must be recognized during development and implementation of management strategies. More scientific information is needed for developing holistic strategies for pinyon-juniper woodlands. We will briefly describe management options and discuss informational shortcomings that could affect implementation, particularly in the Southwest.

The Current Situation

Arguments concerning the distribution of woodlands before European settlement and how it has changed since



Fig. 1. A typical pinyon-juniper stand in north-central Arizona that could be managed for multiple woodland resources.

livestock introduction and fire suppression are being "dusted off", refurbished, and readvanced. Estimates of the size of pinyon-juniper woodlands vary from 40- to 60-million acres in the West; differences in estimates may be attributed to the way marginal lands were defined. It is one of the dominant vegetation types in the Southwest (Arizona, New Mexico, southern Colorado, and southern Utah). Woodlands are generally found at elevations from 4,500 to 7,500 feet where annual precipitation ranges from 12 to 22 inches.

The Colorado pinyon is the common pinyon in these stands. Pinyons are generally 9 to 35 feet high and 5 to 18 inches in diameter, although larger individuals can be commonly found on moist sites. These trees are slow-growing but relatively long-lived, up to 400 years.

Junipers are generally small, multi-stemmed trees less than 40 feet high. There are four common species in the Southwest; one-seed juniper, Utah juniper, alligator juniper, and Rocky Mountain juniper. Stands may contain one or several species of juniper. Understory biomass is generally quite low beneath the woodland canopy, but the total number of woody and herbaceous under-story species is great because of the pinyon-juniper woodland's wide distribution.

Historically, pinyon-juniper woodlands have not been valued for production of wood fiber. From the end of World War II to the mid-1960s considerable emphasis was

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placed on eliminating the woodland overstory to produce more forage for livestock. Increased water yields and improved wildlife habitats were often touted as secondary benefits. All too often, the realized benefits were nebulous. Large areas were treated, using a variety of techniques such as bulldozing or cabling, with little regard for site characteristics or capabilities. As a result, many control programs not only failed to produce more water and better wildlife habitat, but they also often failed to produce the expected additional forage. On many areas where forage did increase, reinvasion or release of pinyons and junipers was so pervasive that these benefits were only short-lived. This problem was exacerbated by failure to adjust livestock management or by a lack of subsequent treatments when trees were in a more vulnerable state (i.e., control burning during seedling stage). Management procedures were rarely modified because few of these projects were ever evaluated after the initial treatments were applied. All of these factors have contributed to large scale reoccupation of areas treated 30 to 40 years ago. Generally, very few of these programs could be judged successful from either a resource or economic standpoint.

Management started to change in the 1970s partly because site conversion costs and fuelwood demands escalated, both induced by increasing prices of fossil fuels. Some managers became concerned that fuelwood demands would soon exceed the supply. The importance of pinyon nuts as a cash crop has also increased in recent years. This has created a developing awareness that management of pinyon-juniper woodlands on public lands be redirected to encompass all potential resources.

Some Things to Consider

It can logically be assumed that a few sites are best suited for forage production (i.e., invaded areas on low elevation woodland-grassland interfaces) and that other sites are best suited for wood fiber production (i.e., mature uneven-aged stands). For example, Conner et al. (1990) estimated that 88% of the pinyon-juniper woodlands in Arizona have the potential to produce wood products on a sustainable basis. Most sites within the pinyon-juniper complex have the potential to be managed for multiple resources.

Managing woodlands for sustained wood fiber or pinyon nut production is not without its problems. Little information is available for developing silvicultural prescriptions specific to pinyon-juniper lands. Since one primary goal of integrated resource management will be to obtain a satisfactory level of wood production for the future, proper prescriptions must be implemented that ensure regeneration and growth while enhancing or maintaining other components of the ecosystem.

Pending completion of research, Bassett (1987) reviewed the applicability of prescriptions commonly used in commercial forests to the woodlands. He concluded that single-tree selection and two-step shelterwood methods, which retain a cover of residual trees, likely were best for sustained stand productivity (Figure 2). Both methods are com-

patible with dispersal patterns of heavy tree seed, provide protected micro-sites for regeneration, and are aesthetically acceptable. Single-tree selection can be designed to reduce stand density while retaining a variety of tree age classes, as well as horizontal and vertical diversity. Group selection will create small openings (1-2 acres), and type conversions (clearcuts) can be designed to create openings of any size. Type conversions generally result in unsatisfactory tree regeneration because of poor seed dispersal and a lack of sheltered regeneration sites. Research concerning silvicultural prescriptions for multiresource woodland management is continuing.

Openings can create a diverse landscape that can favor many wildlife species. Clearing small, dispersed areas will benefit deer, elk, and small mammals (see review by Severson and Medina 1983, Severson 1986) as well as a host of birds that require open areas for foraging. Openings should not be too large. The proportion of a unit to be "converted" and the optimum size of openings will vary depending on the kind of site, requirements of wildlife species, and specific management objectives. The actual size of the opening may not be critical if the longest distance at which an animal could be seen across the opening does not exceed 600 feet and/or continuous corridors of adequate width are maintained. Another option is to retain some trees in cleared areas to create a Savannah effect that would provide some thermal and security cover and be more aesthetically pleasing. Stands surrounding openings could remain untreated or be partially harvested.

Managers must decide if areas cleared for forage production should be maintained or if trees can be allowed to reoccupy the sites. It may be necessary to develop a management strategy to create spatial arrangements of differ-



Fig. 2. This pinyon and one-seed juniper stand in western New Mexico was harvested according to a single-tree selection prescription.

ent-aged seral stands that would include both cleared and partially cut areas if tree regeneration is one of the identified goals. It may not be necessary to have all age classes on each acre. Treatments that favor tree regeneration could benefit livestock and native ungulates by providing some additional, although temporary, increases in forage while maintaining some degree of thermal and security cover (Figure 2). However, the impacts of residual trees on understory vegetation is unclear. In most cases, rather large reductions in tree canopy cover are necessary to improve total herbage yield; however, individual species in the understory respond differently to tree reduction. In New Mexico, for example, Pieper (1990) determined that biomass of some cool season grasses decreased while that of blue grama and total understory increased when the overstory canopy was reduced. Additional understory-overstory studies are needed across the range of pinyon-juniper to assess variability. Further, relationships among tree cover, forage yields, and tree regeneration have not been addressed. How much of a reduction in tree density is necessary to produce significant increases in herbaceous species without compromising the tree resource?

Slash disposal is an often debated issue in management of these woodlands. While pinyon slash will deteriorate at a slow rate, juniper is particularly resistant to weathering. Disposal should not follow an all-or-nothing plan, but prescriptions should vary according to management objectives. On any one management area, several slash treatments may be warranted and practical. Burning piled slash is generally considered unacceptable because of the adverse effects on soils and site productivity. However, a few piles could be burned to create a pattern of earlier seral stages that would increase the floristic species richness on the area. Other piles could be left unburned to provide habitat for small mammals. Slash piles have the added benefit of breaking up sight distances, thereby providing security cover for wild ungulates. Slash can also be scattered or left in place to provide protection for herbaceous growth and nursery sites for young trees. Slash can retard surface water movement and serve as sediment collection sites. On other areas, scattered slash could be burned in cool fires to promote temporary increases in nutrient contents of the forage. The total amount of slash will depend on the overstory treatment being implemented. The more drastic treatments will likely require partial slash reductions.

What Will the Future Be?

Private landowners have the option of managing pinyon-juniper woodlands for whatever resource or resources they choose. In most cases this may be forage for livestock. Even under these circumstances, however, consideration should be given to harvesting fuelwood and other wood products. While circumstances would depend on local markets, the practice may yield a cash return and make subsequent activities easier. Even when livestock production is a primary concern, a viable objective could be to create mosaics of tree-covered areas interspersed with savannahs

and grasslands. This pattern could favor a mixture of cool-season and warm-season grasses (e.g., Pieper 1990). This mosaic landscape would also be aesthetically pleasing.

Management strategies for public lands and American Indian lands will be much more complex because of the number of potential uses and differences in local conditions. Biological diversity should be increased by managing for a range of seral stages in space and time. Previous work with wildlife has emphasized game animals, such as deer and elk, and many of these species require a diverse mix of seral stages for optimum habitats. Little emphasis, and therefore little research, has been directed at those species that may be dependent on the woodland interior. Information is available that indicates pinyon-juniper woodlands are important migratory bird wintering areas and that the food and cover provided by a closed canopy is important (Balda and Masters 1980). However, information is lacking on the extent and characteristics of tree canopy necessary for most species. Hence, a true ecosystem management strategy for pinyon-juniper woodlands will require public land managers to carefully deliberate that point at which our pursuit of diversity becomes forest and habitat fragmentation. This undertaking will certainly exacerbate an already complex problem.

The renewed interest in the pinyon-juniper woodlands challenges public and private land managers to re-evaluate old practices and to integrate new information and philosophies into management strategies. Objectives will vary but decisions should be based on available scientific information, a recognition of differences among woodland sites, and the potential benefits from multiresource management.

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