

Management of Thinned Emory Oak Coppice for Multiple Resource Benefits

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Abstract—Managers are increasingly moving toward an ecosystem-based, multiple-use approach in managing Emory oak woodlands in the Southwestern United States. Often of particular interest is managing the coppice that evolves from earlier fuelwood harvesting activities. Emory oak (*Quercus emoryi*) is a prolific sprouting species and, as a consequence, post-harvesting stands can support copious coppice on the cut rootstocks. Thinning the coppice to obtain a desired density of multiple benefits is one management option. A decision matrix based on resource proxies derived from earlier studies has been developed to assist managers in prescribing coppice thinning treatments to optimize one or more resource benefits.

Introduction

Options for thinning coppice in Emory oak (*Quercus emoryi*) stands following earlier fuelwood harvesting can be oriented toward minimizing on-site water losses through transpiration, maximizing fuelwood production, sustaining livestock production, maintaining structural diversity for wildlife habitats, or optimal combinations of these options. Because of the ecosystem-based, multiple-use orientation of managing Emory oak stands in the Madrean Archipelago, the latter option is a common management goal. A decision matrix based on resource proxies derived from earlier studies is presented to assist managers in attaining this goal.

Resource Proxies

Water loss through transpiration by thinned coppice has been estimated by Ffolliott and others (2003). Knowledge of these transpiration rates is a key to selecting a coppice thinning treatment that minimizes water loss on a site and, therefore, is the proxy for water. Average daily transpiration rates for thinned Emory oak rootstocks ranged from lowest to highest in thinned clumps of one, two, and three sprouts, respectively, while unthinned rootstocks transpired the highest amount of water.

Growth and volume of Emory oak coppice is the proxy for wood. When the management objective focuses on utilizing the coppice for fuelwood and a decision must be made to thin the coppice resulting from earlier harvesting activities, thinning to retain one residual sprout is recommended (Farah and others 2003). Growth and volume are concentrated in the single stem, and, as a consequence, that stem will attain a desired volume for fuelwood in a shorter time period. The next “best options” are thinning the coppice to two sprouts and then to

three sprouts. Growth and volume are comparatively minimal in the absence of thinning.

The proxy for livestock production is annual herbage production. Earlier studies suggest that increasing densities of Emory oak overstories does not reduce the production of herbaceous plants (Gottfried and Ffolliott 2002). It has been assumed, therefore, that the thinning of Emory oak coppice will have little effect on herbage production.

The abundance of foliage in the tree crowns is the proxy for wildlife habitats. A decision not to thin Emory oak coppice might be the preferred management option when maintaining the structural diversity of wildlife habitats is the management objective. Harvesting removes the taller trees that provide a greater number of habitat niches for non-game bird species and other wildlife than shorter trees (Sharman and Ffolliott 1992). Thinning also eliminates much of the structural diversity by removing many of the intermediate trees. Ordering of the options to maintain structure diversity of wildlife habitats from most to least preferred is no thinning treatment, thinning to three residual sprouts, thinning to two sprouts, and thinning to one sprout.

Incorporating the resource proxies into a decision matrix for selecting thinning options for Emory oak coppice results in table 1. While other management options are likely, those displayed are the basis for solving the decision-making problem illustrated below.

Information on the cost of thinning Emory oak stands following earlier fuelwood harvesting is not available. This cost is assumed less than the multiple resource benefits that can be obtained by thinning and, therefore, has not been considered a decision variable in this problem. Reliable information on thinning costs will be necessary if managing this coppice by thinning becomes an operational option and, depending on its magnitude, another decision criterion.

Decision-Making Problem

A manager is faced with the decision-making task of obtaining a fair and equitable solution to problems of integrated resource management. This task can be viewed in the sequential steps of problem recognition, specification of strategies, specification of decision criterion or criteria, and selection of the optimum management strategy. To illustrate this process in the thinning of Emory oak coppice, it is assumed that the problem confronted is minimizing water loss on a site while optimizing fuelwood production, livestock production, and structural diversity of wildlife habitats. Strategies available for solving this problem are thinning the coppice to one, two, or three of the dominant sprouts or retaining the coppice as it evolves naturally following a fuelwood harvest. The decision criterion is to optimize the water, wood, livestock, and wildlife benefits of a selected thinning practice. Methods available to solve this problem include the use of a simplistic approach (which is used here) or more rigorous optimization approaches.

The simplistic approach requires knowledge of the “values” that stakeholders place on the resources considered. There are two cases to consider in applying this approach. All of the resources have equal benefit to stakeholders in the first case, while stakeholders place preferential values on the resources in the second case. As these latter values reflect the “collective biases” of the stakeholders; the stakeholders with “decision-making advantages” will dominate when collective bargaining becomes necessary.

Solution to Problem

The decision outcome for this problem is based on all of the resources being weighed equally. This being the case, thinning rootstocks of Emory oak coppice to one residual sprout is the best compromise (table 1). Water losses to the transpiration process are minimized and the growth and yield of the residual sprout are maximized by thinning to one residual sprout. Herbage production is likely not to change regardless of thinning treatment and, therefore, is not a decision variable. While the structural diversity of wildlife habitats is reduced by this thinning treatment relative to the other options, the need for non-game bird habitat niches might still be met at “some acceptable level” with this thinning prescription. Solution to this problem involved making a decision among ordinal rankings of benefits, and, therefore, managers should be aware of “interpretative guidelines” commonly associated with decision-making through the use of ordinal rankings of benefits (Kenney and Raiffa 1976).

Conclusions

Knowledge of how hydrological and ecosystem processes are affected by thinning Emory oak coppice is necessary in

Table 1—A decision matrix for selecting thinning options for Emory oak coppice.

Criteria	Alternative thinning treatments ^a			
	One	Two	Three	No Thinning
Water	4	3	2	1
Wood	4	3	2	1
Livestock	-	-	-	-
Wildlife	1	2	3	4

^a Ranking: 4 = most preferred; 1 = least preferred.

selecting a thinning treatment that meets ecosystem-based, multiple-use management objectives. The information presented in this paper can contribute to this management. The decision matrix should be useful to managers planning to optimize water, wood, livestock, and wildlife habitat benefits. However, incorporating other resources (settings for recreational opportunities, etc.) into the decision matrix is necessary before truly holistic stewardship is possible.

Acknowledgment

Preparation of this paper was supported largely by funds provided to the International Arid Lands Consortium by the USDA Forest Service and Cooperative States Research, Education, and Extension Service.

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