The increasing popularity of lease hunting in the Cross Timbers of Oklahoma follows a trend common to private lands states. Lease hunting provides an additional source of income to the landowner, lease hunters control trespassing and poaching, and increasing game populations in recent years have favored hunter success. The inherently low carrying capacity of livestock and strong demand for outdoor recreation by urbanites may result in lease hunting replacing livestock grazing as the dominant enterprise in the Cross Timbers. The year-long lease, the most common lease arrangement, is usually priced by the acre, and may include one or several species of game and different types of hunts (e.g., archery, primitive firearm, rifle).

A lease-hunting program was initiated in 1995 on the Cross Timbers Experimental Range in north central Oklahoma. The hunting lease was for white-tailed deer hunting inclusive of the legal 87-day archery season, nine-day primitive arms season, and nine-day gun season. The program provided us an opportunity to evaluate how habitat structure, created by managing woody plants with herbicides and fire, influences the quality of the hunting experience.

Brush Management for Deer Hunter Habitat On the Cross Timbers Experimental Range

JOHN R. WEIR AND DAVID M. ENGLE

The Cross Timbers Experimental Range is divided into twenty-two, 80-acre pastures. Brush management treatments were applied in 1983 to mature post oak-blackjack oak forest in 16 pastures. Most of the post oak-blackjack oak overstory was killed on the eight pastures treated with tebuthiuron (Stritzke et al. 1991). Four of these pastures received no additional herbicide or fire so eastern redcedar, tolerant of tebuthiuron at the rates we used, subsequently increased and dominated the overstory. The four other pastures treated with tebuthiuron were burned periodically to control eastern redcedar and various shrub species such as smooth sumac. Compared to the pastures treated with tebuthiuron only, the burned pastures produced more growth of grasses and forbs (Engle et al. 1991).

Eight pastures were treated with triclopyr, which reduced the post oak-blackjack oak overstory. On four pastures treated only with triclopyr, eastern redcedar, tolerant also of triclopyr, subsequently dominated the overstory. Eastern redcedar trees were bulldozed in 20-foot wide strips in the fall and winter of 1992 in these four triclopyr-no fire pastures. The pastures were then burned in the spring of 1993. Most remaining eastern redcedar were removed mechanically with a hydraulically powered rotary saw. Our objective
Land managers planning brush management on cross timbers rangelands should consider retaining some mature trees that provide archery hunters with an opportunity to hunt from tree stands.

in this intensive management treatment was to reduce eastern redcedar and increase herbaceous production.

The four other pastures treated with triclopyr were burned periodically to control the eastern redcedar and understory shrubs and resprouting hardwoods. Understory shrubs, resprouting overstory hardwoods, and eastern redcedar were reduced and herbaceous plant production increased, but resulting vegetation structure was an open canopy of mixed brush.

Four pastures served as controls and received no application of herbicide or fire. These pastures contained stands of mature post oak-blackjack oak trees in a closed overstory with a few interspersed small meadows of tallgrass prairie. The two remaining pastures were not treated with herbicide but have been burned periodically. Fire killed many of the small eastern redcedar and other brush species, creating a more open understory than in the control pastures. For more details on the Cross Timbers Experimental Range, see Stritzke et al. (1991) and Engle et al. (1991).

Results of Hunter Survey

Hunters were limited to a single group, with no more than ten hunters. Hunter access began three months before the first season opened and ended 30 days after the final season closed. We required all hunters to sign in and out each day of hunting and to record the time in and time out of CTER, pasture or pastures hunted, number and class of deer (buck, doe, fawn, unknown) seen, and if a deer was harvested. We summarized the information from the 20 different hunters over a three-year period and categorized the time in hours by hunt type and by hunt type within brush treatment (Table 1). A statistical analysis (analysis of variance with means separated by protected LSD) showed that the time spent hunting with primitive firearm and rifle did not differ among brush treatments, but the time spent archery hunting was different. We assumed initially that archery hunters preferred the no herbicide-no fire treatment because they saw more deer in these pastures. However, archery hunters saw more deer in other treatment pastures (Figure 1).

Archery hunters indicated in interviews that they preferred the no herbicide-no fire treatment pastures over pastures subjected to brush management treatments because of the presence of mature, large trees capable of supporting a tree stand. Moreover, numerous large trees are located near trails and habitat preferred by white-tailed deer in this treatment. Archery hunters throughout the southeastern U.S. traditionally consider hunting from a tree stand to be

Table 1. Hours spent hunting by hunt type within brush treatment.

<table>
<thead>
<tr>
<th>Hunt Type</th>
<th>Tebuthiuron</th>
<th>Tebuthiuron-fire</th>
<th>Triclopyr-mechanical</th>
<th>Triclopyr fire</th>
<th>No herbicide-no fire</th>
<th>Fire-no herbicide</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Archery</td>
<td>33.6</td>
<td>41.3</td>
<td>22.6</td>
<td>30.7</td>
<td>180.1</td>
<td>27.1</td>
<td>335.4</td>
</tr>
<tr>
<td>Primitive firearm</td>
<td>27.5</td>
<td>120.8</td>
<td>19.3</td>
<td>46.8</td>
<td>80.8</td>
<td>14.8</td>
<td>310</td>
</tr>
<tr>
<td>Rifle</td>
<td>117.0</td>
<td>103.0</td>
<td>28.0</td>
<td>78.5</td>
<td>50.5</td>
<td>15.0</td>
<td>392</td>
</tr>
</tbody>
</table>
more effective than hunting from the ground. Hunting from a tree stand elevates the hunter above the line of sight of deer and reduces the possibility of the hunter's scent being detected by deer.

Conclusions
Our experience with white-tailed deer hunters on the Cross Timbers Experimental Range indicates that if archery hunting is important in a lease hunt enterprise, then brush management systems should allow for the presence of mature trees to serve as tree hunting stands. This facilitates close-range shots by archery hunters, which is more important to archery hunters than seeing large numbers of deer. If land managers wish to increase income from recreational lease hunting, they should not neglect the habitat requirements of hunters and should consider the different habitat preferences among hunters. Managers should recognize that improving deer or livestock habitat through brush management would not necessarily improve hunter habitat.

The greatest increase in cattle stocking rate and weight gain and the greatest return on investment in a stocker cattle enterprise is achieved with a combination of tebuthiuron and periodic prescribed fire (McCollum et al. 1991, Bernardo et al. 1992). Deer food and diet nutritional quality and body weight will increase with a combination of herbicide and fire treatments (Soper et al. 1993a, 1993b), but white-tailed deer prefer pastures treated with triclopyr and triclopyr-fire over other treatments (Leslie et al. 1996). Optimizing income from the combined enterprises (deer lease hunt and stocker cattle) requires tebuthiuron, triclopyr and prescribed fire applied to different portions of the managed landscape (Bernardo et al. 1992). Our experience with lease hunting suggests that managers apply three different vegetation treatments (tebuthiuron-fire, triclopyr-fire and no herbicide) either separately or in combination, to form a mosaic of habitats for cattle, white-tailed deer, and deer hunters.

Supporting Literature

John Weir is Superintendent of the OSU Research Range, and David Engle is Professor, Division of Agriculture and Natural Resources, Oklahoma State University, Stillwater. The Director, Oklahoma Agricultural Experiment Station, approved this article for publication.