



Assessment of White-tailed Deer (*Odocoileus virginianus*) Impacts on the Woody Plant Community in the Vireo Ridge Restoration Area, 2002

Travis County Parks and Natural Resources

Project Number 0905-01915

December 2002

INTRODUCTION

This report presents the results of a deer browse study conducted at the Vireo Ridge tract of the Jollyville Unit by Travis County Natural Resources field staff from October to November 2002. The purpose of the study was: 1) to determine white-tailed deer (*Odocoileus virginianus*) herd size relative to the carrying capacity on this site; 2) to establish the need to maintain or reduce herd numbers; and 3) to monitor the regrowth of woody plants following habitat manipulation.

BACKGROUND

Central Texas currently has the highest population density of white-tailed deer in the United States (Richards 2000). Data collected by Texas Parks and Wildlife Department (Gore and Reagan 1984) indicate that, despite hunting pressure, this population continues to increase. Due to their increasing population, white-tailed deer have become a serious management problem for preserve managers and other land stewards in Travis County. With no significant limiting factor on herd numbers, deer can cause extensive damage to native plant communities, affecting long-term changes in the landscape. Deer foraging habits adversely affect native plant communities by eliminating some species, diminishing or enhancing the regeneration of others, and affecting changes in plant size and biomass production.

Deer overpopulation can be a critical problem on lands managed to protect endangered species. Over-browsing by white-tailed deer significantly reduces understory vegetation and thus available nesting cover for the black-capped vireo (*Vireo atricapillus*). Deer foraging habits also impact the golden-cheeked warbler (*Dendroica chrysoparia*) by inhibiting regeneration of hardwood species that are important components of their habitat.

White-tailed deer feed on forbes, mast, grasses, and browse. Browse is defined as the leaves and tender twigs of woody plants that are used as forage. Although deer prefer forbes, browse actually makes up the greatest part of their diet, constituting a dependable food source throughout the year (Armstrong 1991; Nelle 1994). Because browse is such an important part of the white-tailed deer diet, utilization of browse species can provide information on relative herd size and condition (Armstrong 1991; Nelle 1994). The presence or absence of certain browse species, the degree to which deer are utilizing these resources, and the extent of species regeneration, can all indicate whether deer numbers are too high relative to the carrying capacity of the local habitat.

In 2001, approximately 50 acres of Vireo Ridge were manipulated to create black-capped vireo habitat -- a matrix of grasslands interspersed with clumps of woody plants that are especially bushy from ground-level to 2 m (Grzybowski 1995). In the restoration areas, most woody plants were cut at ground-level. Since most of the desirable woody plants re-sprout, while the undesirable plants such as Ashe juniper (*Juniperus ashei*) do not, this type of manipulation should eventually create ideal black-capped vireo habitat. However, the size of the deer population is of special concern in this restoration area. First, this area, which was formerly very dense with woody plants - especially Ashe juniper - and practically impenetrable by deer, is now very open and easily accessible to deer for browsing. Second, if the deer population is larger than the carrying-capacity of this site, the deer will likely inhibit regeneration of these woody plants to a size suitable for black-capped vireo habitat.

In this study, our goal was to measure the impact of white-tailed deer on the vegetation in an area currently being restored to black-capped vireo habitat. Two plant community characteristics were of particular interest: 1) woody plant composition, and 2) the degree of woody plant use by deer, or degree of browsing. We also collected data on the density and frequency of woody plant species.

METHODS

Circular plots were used to determine woody species composition, density, relative density and frequency. Seven plots with a radius of eight meters each, totaling 0.35 acres, were randomly established in the black-capped vireo habitat restoration area on Vireo Ridge. Each woody plant within a plot was recorded. Density was calculated as the total number of individuals of species *i* (including seedlings and saplings) divided by the total number of acres sampled. Relative density is the total number of individuals of species *i* divided by the total number of all species. Frequency is the number of plots in which a species occurred divided by the total number of plots sampled. Because an exact count of live oak seedlings and root sprouts was impossible, numbers for these were estimated.

Following TPWD (2001) guidelines for evaluating browse intensity, each individual woody plant was classified as severely browsed, moderately browsed, or not browsed at all. The age of each individual plant was also recorded. Shrubs were classified as seedlings or mature plants, while trees were classified as seedlings, young trees, and mature trees. In the 2001 study, plant age was based solely on plant height, with three categories: 1) seedlings and suppressed seedling-sized saplings 0 – 50 cm high; 2) young trees (including saplings) 51 cm high – 15 cm dbh; and 3) mature trees > 15 cm dbh. However, because the 2002 site had

been recently disturbed, almost all plants were less than 50 cm tall. Therefore, if a plant appeared to be resprouting from an adult that had been cut down, then it was classified as mature, regardless of height. Root sprouts of live oaks were not differentiated from seedlings for purposes of age classification.

Woody plant species were then placed in four categories according to deer preference: preferred, good, low quality, and other (based on research by Armstrong (1991) and Nelle (1994)). For our purposes, the designations "low quality browse" and "little utilized browse" used by Armstrong (1991) were combined into one category. Additional species listed by Nelle (1994) as "low quality browse" were included in this category as well. Browse species that were not listed by either researcher were designated as "other species."

RESULTS

Thirty woody species were found in the seven plots at the Vireo Ridge study site (Table 1). Five species were preferred browse, 12 were good browse, 10 were low quality browse, and three were species not classified by Armstrong (1991) or Nelle (1994). Four species, three of which were categorized as low quality browse, were found in all plots – or had a frequency of 1.00 (Table 2): Ashe juniper, evergreen sumac (*R.hus virens*), flameleaf sumac (*R. lanceolata*), and live oak (*Quercus fusiformis*). In contrast, seven species were present in only one plot. Most of these plants with a low frequency were either preferred or good browse.

Woody plants with the greatest density (Table 2) included poison ivy (*Toxicodendron radicans*), live oak, and shin oak. Virginia creeper (*Parthenocissus quinquefolia*), flameleaf sumac, greenbriar (*Smilax Bona-nox*), redbud (*Cercis canadensis* var. *texensis*), twisted-leaf yucca (*Yucca rupicola*), Ashe juniper (*Juniperus ashei*), evergreen sumac, and wild grape (*Vitis mustangensis*) were also dense at this site.

Most (77%; Figure 1) of the individual plants encountered were categorized as good browse. Additionally, 20% of the plants were low quality browse, 2% of the plants were preferred browse, and the remaining 1% were not categorized by Armstrong (1991) or Nelle (1994). For all plants combined, 58% (Figure 2) showed no signs of browse, 31% were moderately browsed, and 11% were severely browsed. This browsing pattern was similar to that observed in good and low quality browse (Figure 3), where most plants (greater than 50%) showed no signs of browse. In contrast, the majority of preferred browse plants were either moderately or severely browsed.

Texas oak (*Quercus texana*), a preferred browse plant, was the only species (with sample size greater than 20) with a majority (70%; Table 2) of plants severely browsed. In addition, 6 good quality browse species and 2 low quality browse species had a majority of plants browsed either moderately or severely. The good quality plants that suffered from browse pressure were shin oak (77%), flameleaf sumac (75%), greenbriar (73%), elbowbush (67%), wild grape (59%), and redbud (54%). Although evergreen sumac and twisted-leaf yucca are low quality browse, both species suffered greatly (81 and 73%, respectively) from browse pressure.

DISCUSSION

The composition of woody plant species at Vireo Ridge suggests that deer numbers are low to moderate relative to the carrying capacity of the habitat. Excluding species that were not categorized by Armstrong (1991) or Nelle (1994), 63% of all plant species and 80% all individual plants sampled were preferred or good quality deer browse species. However, it is likely that the current woody plant composition of this site is related to the situation prior to habitat manipulation. Prior to manipulation, the woody plants were growing so densely, especially with Ashe juniper, that deer were probably unable to access interior parts of the woodland, thus protecting highly palatable browse. Now that the area has been opened up through clearing and deer have unlimited access to areas that have been manipulated, patterns of herbivory are likely to change. If the deer herd is indeed too large to be supported by the vegetation at Vireo Ridge, it can be expected that the woody plant composition will change over time.

Of the plants experiencing browse pressure, either moderate or severe, most are important components of black-capped vireo habitat, either in the form of nest sites or cover. Species present on Vireo Ridge that frequently occur in black-capped vireo habitat include shin oak, Texas oak, live oak, sumac species, and redbud (Grzybowski 1995). With the exception of live oaks, all these species are suffering greatly from deer browse. Therefore, although the woody plant composition on Vireo Ridge indicates low to moderate deer numbers, the deer are browsing plant species that are a crucial component of black-capped vireo habitat and their foraging preferences could have a negative impact on restoration success.

RECOMMENDATIONS

Culling There are a number of options for reducing white-tailed deer herd numbers once the need has been established. Experts recommend culling on preserve properties as the most effective management strategy. It allows a large number of deer to be harvested by expert sharpshooters in one season.

Fencing Professionals in the field of wildlife management concur that white-tailed deer management is ineffective without deer-proof fencing of properties. This is due to the ingress and egress of deer between populations on adjacent properties. As long as deer from surrounding properties can migrate into the preserve, no amount of culling will adequately reduce overpopulated herds.

Exclosure studies Further study of plant community characteristics at Vireo Ridge tract is necessary to better understand the impact of white-tailed deer on the native flora. Exclosures allow biologists to quantify plant community characteristics in the absence of herbivory by deer.

Plant monitoring Annual plant monitoring programs, such as the current browse study, will allow managers to assess the effectiveness of deer management strategies on a yearly basis.

Deer censusing TPWD recommends that a deer census be completed each year on lands where deer are harvested. An annual census will allow managers to evaluate the effectiveness of management strategies, determine whether desired deer densities have been attained, and calculate future harvest recommendations.

LITERATURE CITED

Armstrong, W.E. 1991. Managing habitat for white-tailed deer in the Hill Country area of Texas. Texas Parks and Wildlife Department, Austin. 18pp.

Gore, H.G., and J.M. Reagan. 1984. White-tailed deer population trends. Texas Parks and Wildlife Department. W-109-R-7. 78pp.

Grzybowski, J.A. 1995. Black-capped Vireo (Vireo atricapillus). Pages 1-24 *in* A. Poole and F. Gill, editors. The birds of North America. No. 181. The Academy of Natural Sciences, Philadelphia, and The American Ornithologists' Union, Washington, D.C.

Richards, B. 2000. The deer dilemma: to fence or not to fence? Conference sponsored by Texas Parks and Wildlife Department. Reicher Ranch. June 15, 2001.

Texas Parks and Wildlife Department. 2001. Browse Resource Evaluation. Texas Parks and Wildlife Department, Austin. 3pp.

USDA. 1994. The use and management of browse in the Edwards Plateau of Texas. United States Department of Agriculture, Natural Resources Conservation Service, Temple, Texas. 7pp.

Table 1. Species composition, density, relative density, and frequency of woody plants in study plots at Vireo Ridge, October - November 2002. Species arranged in order of browse preference by white-tailed deer, *Odocoileus virginianus,* (Armstrong 1991; Nelle 1994).

		Density/acre	Relative density	Frequency
Preferred Browse Species				
Carolina Buckthorn	*Rhamnus caroliniana*	54	0.007	0.29
Cedar Elm	*Ulmus crassifolia*	34	0.005	0.57
Texas Kidneywood	*Eysenhardtia texana*	9	0.001	0.14
Texas Oak	*Quercus texana*	66	0.009	0.57
Texas Sophora	*Sophora affinis*	3	0.000	0.14
Good Browse Species				
Black Cherry	*Prunus serotina*	9	0.001	0.14
Cow itch	*Cissus incisa*	11	0.002	0.14
Elbowbush	*Forestiera pubescens*	97	0.013	0.43
Flameleaf Sumac	*Rhus lanceolata*	403	0.056	1.00
Greenbriar	*Smilax Bona-nox*	286	0.039	0.86
Hackberry	*Celtis sp.*	11	0.002	0.43
Poison Ivy	*Toxicodendron radicans*	3240	0.446	0.86
Possumhaw	*Ilex decidua*	20	0.003	0.29
Redbud	*Cercis canadensis* var. *texensis*	254	0.035	0.71
Shin Oak	*Quercus sinuata* var. *breviloba*	706	0.097	0.86
Virginia Creeper	*Parthenocissus quinquefolia*	426	0.059	0.71
Wild Grape	*Vitis* sp.	117	0.016	0.86
Low Quality Browse Species				
Ashe Juniper	*Juniperus ashei*	157	0.022	1.00
Evergreen Sumac	*Rhus virens*	123	0.017	1.00
Fragrant Sumac	*R. aromatica*	26	0.004	0.57
Live Oak	*Quercus fusiformis*	717	0.099	1.00
Mexican Persimmon	*Diospyros texana*	97	0.013	0.71

		Density/acre	Relative density	Frequency
Low Quality Browse Species, cont'd.				
Mimosa	*Mimosa* sp.	20	0.003	0.14
Prickly Ash	*Zanthoxylum hirsutum*	9	0.001	0.29
Prickly Pear	*Opuntia lindheimeri*	14	0.002	0.57
Twisted-leaf Yucca	*Yucca rupicola*	166	0.023	0.71
Wafer Ash	*Ptelea trifoliata*	94	0.013	0.86
Other*				
Southern Dewberry	*Rubus trivialis*	3	0.000	0.14
Texas Ash	*Fraxinus texensis*	23	0.003	0.14
Yaupon	*Ilex vomitoria*	60	0.008	0.43
Total		7254	1.000	

[1] density per acre = no. of individuals per acre
[2] relative density = no. individuals of species *i* / total individuals of all species
[3] frequency = no. of plots where species *i* occurs / total no. of plots
*refers to species not listed in Armstrong (1991) or Nelle (1994)

Table 2. Browse pressure by white-tailed deer (*Odocoileus virginianus*) on woody plants in study plots at Vireo Ridge, October-November 2002. Browse pressure was evaluated for each plant and classified as not evident, moderate, or severe. Percent in each class is given followed by number of individuals in each age class.

		Browse not evident				**Moderate browse**				**Severe browse**			
		% of total	Number of			% of total	Number of			% of total	Number of		
			seedling	young	mature		seedling	young	mature		seedling	young	mature
Preferred Browse Species													
Cedar Elm	*Ulmus crassifolia*	75	9	0	0	25	3	0	0	0	0	0	0
Texas Oak	*Quercus texana*	9	1	1	0	22	2	3	0	70	3	12	1
Carolina Buckthorn	*Rhamnus caroliniana*	68	11		2	11	0		2	21	3		1
Texas Kidneywood	*Eysenhardtia texana*	0	0		0	33	1		0	67	1		1
Texas Sophora	*Sophora affinis*	100	1		0	0	0		0	0	0		0
Good Browse Species													
Black Cherry	*Prunus serotina*	67	1	1	0	0	0	0	0	33	0	0	1
Hackberry	*Celtis* sp.	50	1	1	0	25	1	0	0	25	0	0	1
Shin Oak	*Quercus sinuata* var. *breviloba*	23	55	0	3	61	138	4	8	16	3	6	30
Cow itch	*Cissus incisa*	100	4		0	0	0		0	0	0		0
Elbowbush	*Forestiera pubescens*	32	6		5	41	5		9	26	0		9
Flameleaf Sumac	*Rhus lanceolata*	25	16		19	52	22		51	23	9		24

		Browse not evident				Moderate browse				Severe browse			
		% of total	Number of			% of total	Number of			% of total	Number of		
			seedling	young	mature		seedling	young	mature		seedling	young	mature
Good Browse Species, cont'd.													
Greenbriar	*Smilax Bona-nox*	27	17		10	32	14		18	41	5		36
Poison Ivy	*Toxicodendron radicans*	69	756		25	28	253		64	3	8		28
Possumhaw	*Ilex decidua*	57	1		3	43	3		0	0	0		0
Redbud	*Cercis canadensis* var. *texensis*	46	22		19	36	4		28	18	1		15
Virginia Creeper	*Parthenocissus quinquefolia*	89	109		23	9	10		4	2	3		0
Wild Grape	*Vitis* sp.	41	3		14	44	9		9	15	2		4
Low Quality Browse Species													
Ashe Juniper	*Juniperus ashei*	100	21	33	1	0	0	0	0	0	0	0	0
Live Oak	*Quercus fusiformis*	73	170	5	9	11	23	5	0	16	27	12	0
Evergreen Sumac	*Rhus virens*	19	3		5	72	2		29	9	0		4
Fragrant Sumac	*R. aromatica*	22	2		0	78	5		2	0	0		0
Mexican Persimmon	*Diospyros texana*	53	10		8	38	3		10	9	0		3
Mimosa	*Mimosa* sp.	0	0		0	14	1		0	86	6		0
Prickly Ash	*Zanthoxylum hirsutum*	33	1		0	67	0		2	0	0		0

		Browse not evident				Moderate browse				Severe browse			
		% of total	Number of			% of total	Number of			% of total	Number of		
			seedling	young	mature		seedling	young	mature		seedling	young	mature
Low Quality Browse Species, cont'd.													
Prickly Pear	*Opuntia lindheimeri*	100	5		0	0	0		0	0	0		0
Twisted-leaf Yucca	*Yucca rupicola*	28	11		5	47	13		14	26	5		10
Wafer Ash	*Ptelea trifoliata*	88	17		12	12	1		3	0	0		0
Other*													
Texas Ash	*Fraxinus texensis*	50	3	1	0	50	1	3	0	0	0	0	0
Southern Dewberry	*Rubus trivialis*	0	0		0	0	0		0	100	0		1
Yaupon	*Ilex vomitoria*	52	8		3	33	1		6	14	0		3

*refers to species not listed in Armstrong (1991) or Nelle (1994)

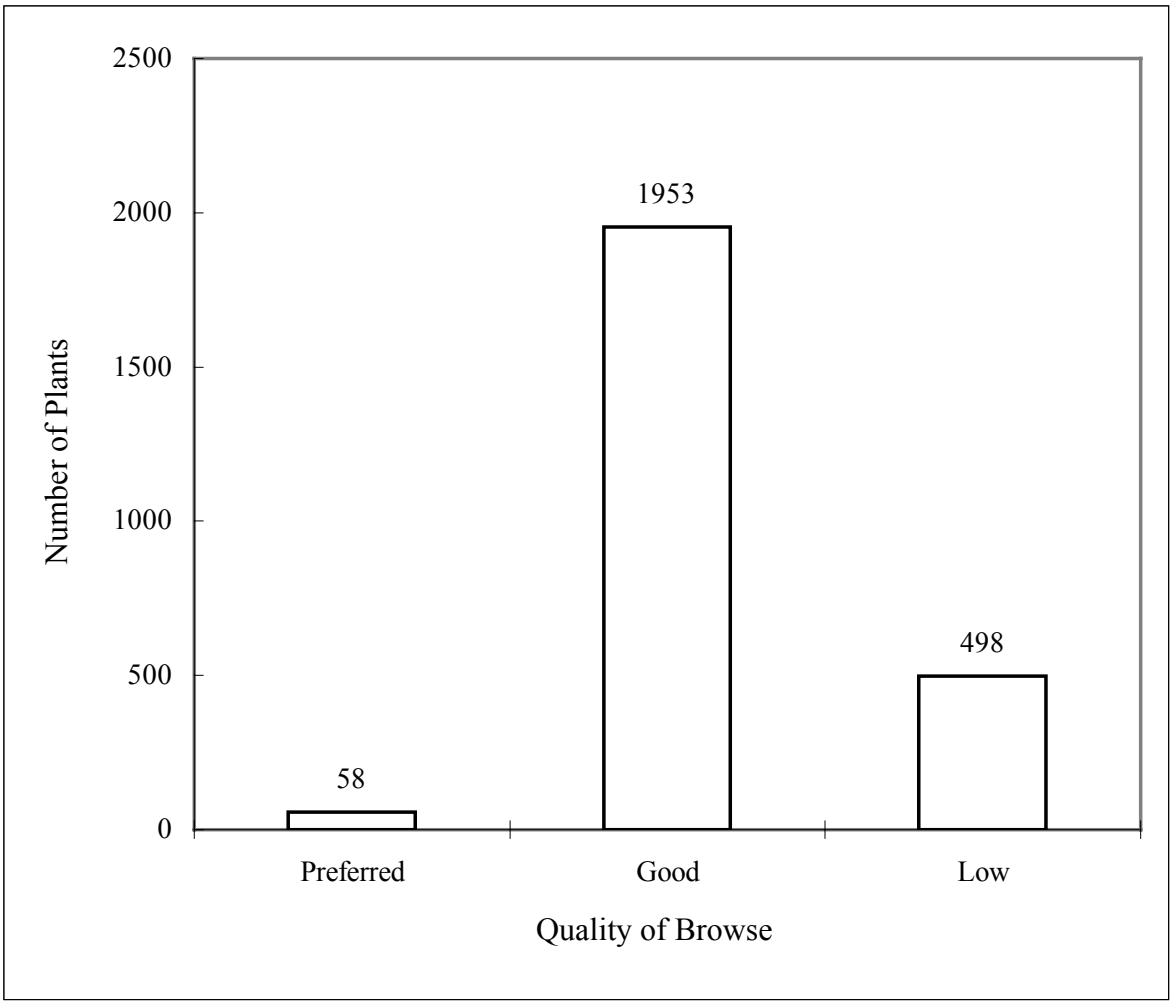

Figure 1. Distribution of woody plant browse quality in the Vireo Ridge restoration area, October-November 2002. Quality of browse is classified according to Armstrong (1991) and Nelle (1994).

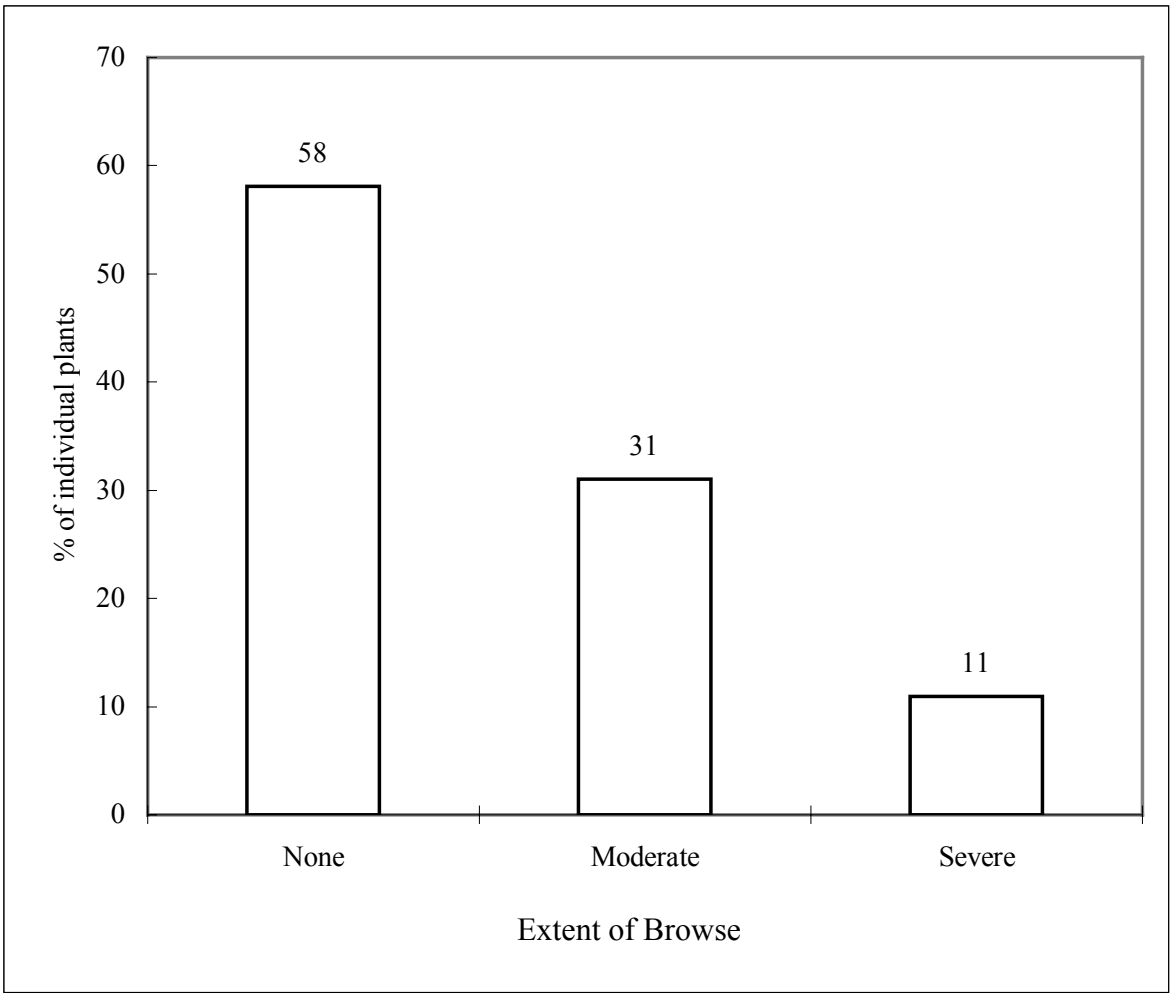

Figure 2. Browse pressure suffered by woody plants in the Vireo Ridge restoration area, October-November 2002. Browse pressure is classified according to TPWD (2001) guidelines.

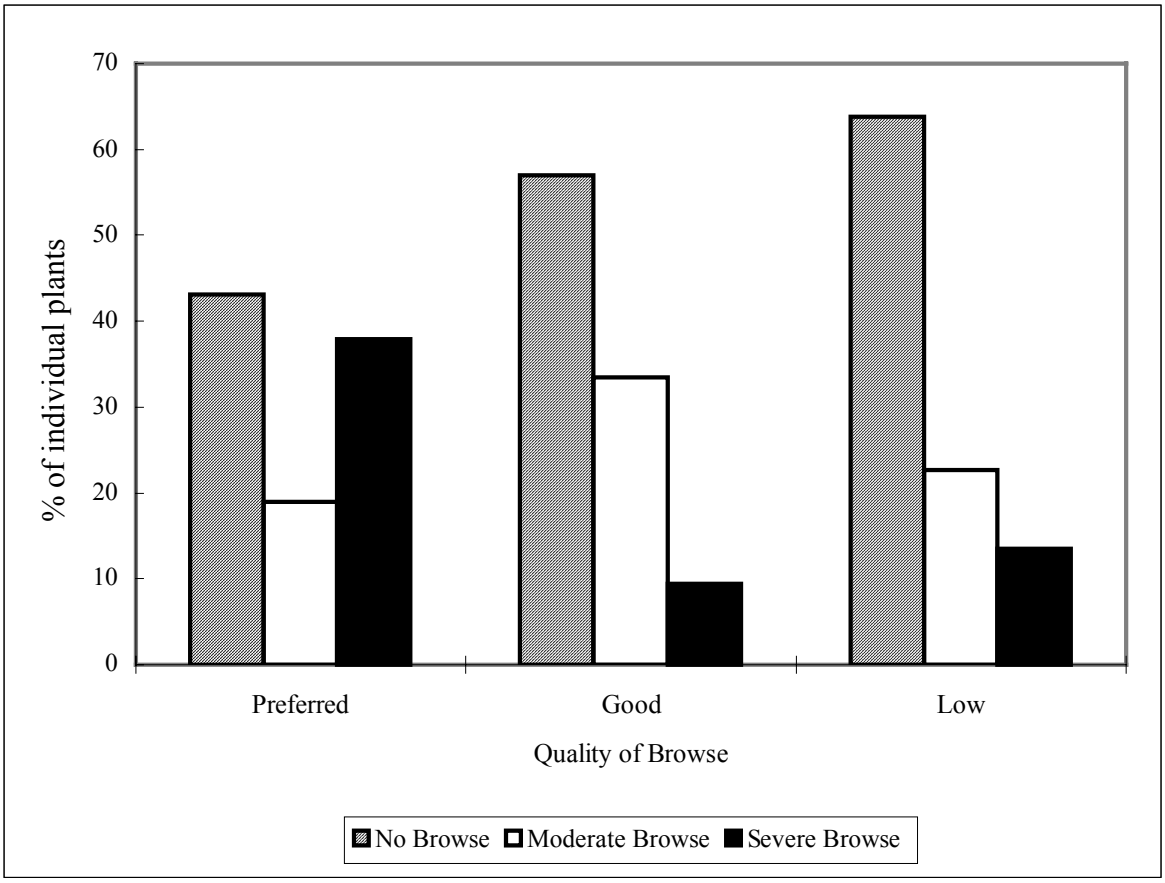

Figure 3. Browse pressure on woody plants in the Vireo Ridge restoration area, October-November 2002. Quality of browse is classified according to Armstrong (1991) and Nelle (1994), and browse pressure is classified according to TPWD (2001) guidelines.