



FOREST RESEARCH REPORT

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A Survey of 1993 Browsing Damage to Conifer Plantations in Eastern and Central Nova Scotia

Introduction

Browsing of seedlings by snowshoe hare (*Lepus americanus*) and white-tailed deer (*Odocoileus virginianus*) is an important reforestation problem affecting plantations throughout much of North America (Krefting & Stoeckeler, 1953; Oxenham, 1983; Parker, 1984; Bailey, 1982; Radvanyi, 1987; Gaul, 1986). At high levels, browsing can severely reduce tree growth and survival, particularly in newly established plantations, where small stock can often be destroyed after one browsing (Bailey, 1982; Parker, 1984; Anon, 1986; Gillis, 1976). In response to reports of increased browsing damage in some eastern Nova Scotia plantations, the Department of Natural Resources initiated a survey to:

1. determine the current level of browsing damage in young plantations,
2. examine the susceptibility of various reforestation species to browsing, and
3. investigate the influence of site factors on browsing.

Browsing Factors

Browsing damage in young plantations occurs primarily from hare and deer feeding during late fall, winter, and spring, when leafy herbaceous growth is unavailable (Radvanyi, 1987; Gaul, 1986; Bailey, 1982). This may include the early part of the spring planting season. Snow cover protects seedlings from browsing through much of the winter (Radvanyi, 1987; Gaul, 1986).

It is generally reported that most serious browsing damage in Nova Scotia is caused by hare

(Gaul, 1986; Gillis, 1976; Bailey, 1982), and is highly dependent on hare population densities (Krefting & Stoeckler 1953). This is supported by the observation that browsing damage was widely reported during the last hare population peak of the mid 1970's to early 1980's (Gillis, 1976; Bailey, 1982; Gaul, 1986; Anon, 1979), while few reports of damage were recorded between 1985 and 1990, when low hare populations coincided with high deer populations and record high levels of tree planting (White, pers. comm., Aug 95)¹.

Plantations are most susceptible to damage from hare when they contain good habitat that encourages occupation of the site (Radvanyi, 1987). Hare habitat consists of 3 main components; cover, food, and interspersions. Cover, the most important, is required at all times for shelter and protection from predators (Parker, 1984; Radvanyi, 1987). Low growing conifer branches, 1 to 2 m in height, are the most valuable cover, while dense brush and slash are also beneficial. Deciduous browse also is important for habitat. It becomes the primary food during late fall, winter, and spring. Interspersion of habitat types, and edge (such as boundaries between plantations, slash piles, and forest cover),

affect habitat use, as well as hare movement, and dispersal (Radvanyi, 1987).

In areas where hare browsing hazard is considered high, the following silvicultural methods have been suggested by researchers to control browsing through the reduction of hare habitat within plantations (Gillis, 1976; Bailey, 1982; Parker, 1984; Radvanyi 1987):

1. Thorough, uniform site preparation to eliminate cover,
2. Herbicide treatment to control deciduous vegetation,
3. Design of harvests and site preparation to minimize edge,
4. Planting of vigorous stock to maximize seedling growth.

Deer have similar food requirements as hare, utilizing primarily deciduous twigs when the availability of herbaceous food declines (Gaul, 1986). As the amount of vegetation developing in cutovers and plantations increases, their value as a source of food and cover improves (Gaul, 1986). Deer range over greater distances than hare, and are less restricted by a lack of plantation cover (Gaul, 1986).

Methods

Thirty-four plantations from central and eastern Nova Scotia, were surveyed between June and November 1994 (Figure 1, Appendix I). Two were established in 1992, and the balance in the spring of 1993. Plantation size averaged 7.4 ha (range 0.5 to 22.1 ha). Plantation spacing averaged 2.2 m (1.9 - 2.9), seedling height averaged 22 cm (14 - 34 cm), and leader growth averaged 8 cm (4 - 15 cm). The plantations were established exclusively with multipot stock and consisted of 14 black spruce (*Picea mariana* [Mill.] B.S.P.), 12 Norway spruce (*Picea abies* [L.] Karst.), 6 white spruce (*Picea glauca* [Moench] Voss), 1 red spruce (*Picea rubens* Sarg.), and 1 eastern larch (*Larix laricina* [Du Roi] K.Koch)

plantation. Three of the Norway spruce plantations were site prepared in alternating treated and untreated strips. Red spruce was fill planted in the untreated strips.

Plantations were systematically sampled at an intensity of 1 percent with a minimum of 10 plots established. Plots consisted of 4 quarter-circle subplots, established using a 2.25 m radius, with each subplot containing 1 "potential" planting spot.

The following measurements and observations were recorded at each planting spot: Status of tree (healthy, unhealthy, dead, missing), microsite (mineral soil, humus, wet, non-plantable), vegetative competition level (nil, light, moderate, heavy), and degree of lateral and terminal browsing on the

¹ Brian White, Manager of Reforestation, NSDNR

1993 growth (nil, light, moderate, severe). The height and leader of at least 10 average and 10 dominant trees were measured in each plantation.

The major species of vegetation were recorded at each plantation, along with an estimate of their average height and percent cover.

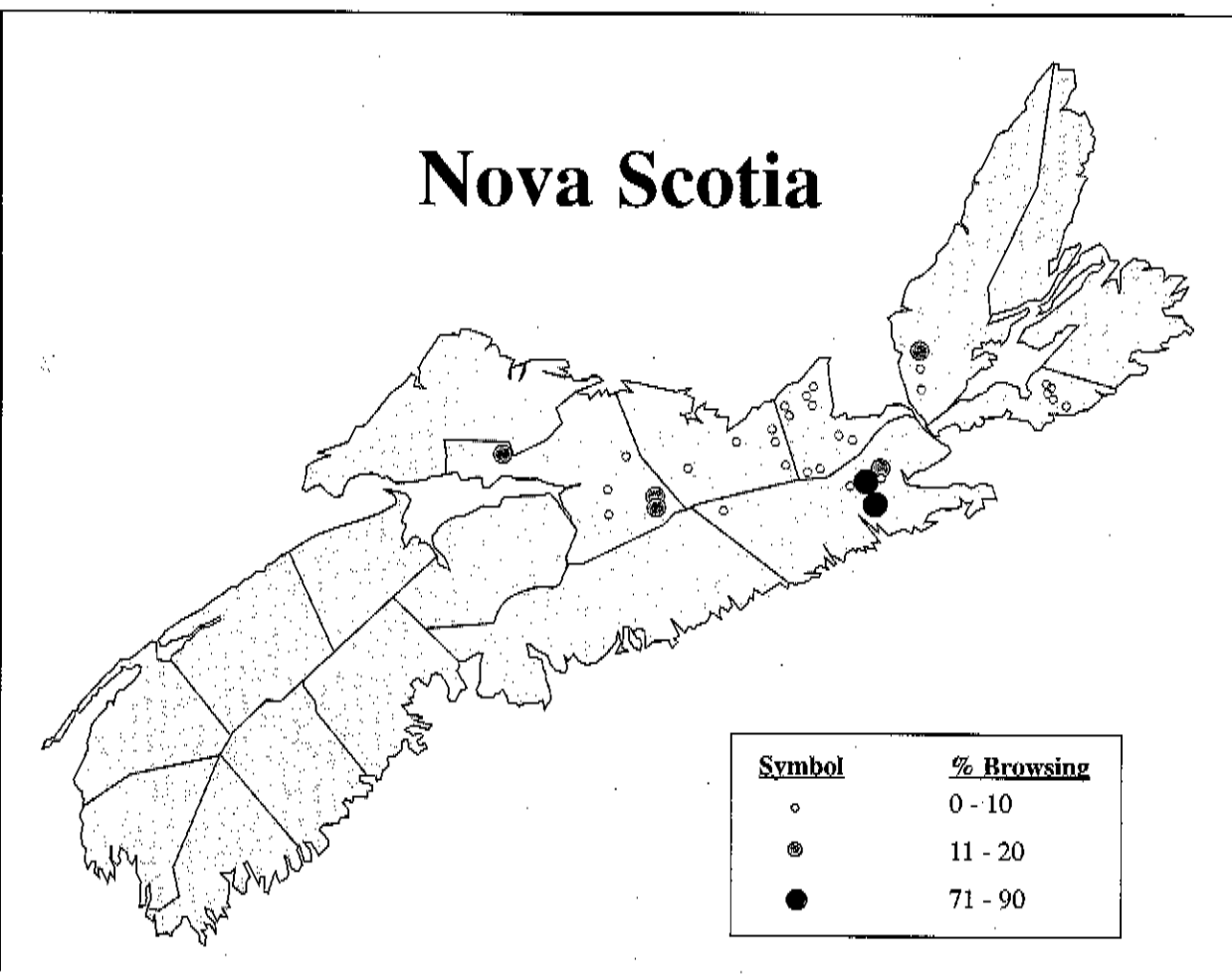


Figure 1. Location of Sampled Stands.

Hare and Deer Populations

Estimates of the annual hare harvest are compiled by the Wildlife Division, NSDNR, from hunter harvest reports. This data indicates that hare populations were at moderately low levels at the time of the survey, having increased slightly from a low in 1990 (Figure 2).

Following peak levels during the mid 1970's to early 1980's, hare populations experienced a 10 year decline to 1990. Although still below aver-

age, hare populations have grown steadily since then.

The Nova Scotia deer populations have been estimated since 1983 using an annual pellet group inventory (Wildlife Division, NSDNR). This data indicates that deer numbers were at very low levels at the time of the survey, having experienced a steady decline to less than half of the 1986 peak (Figure 3).

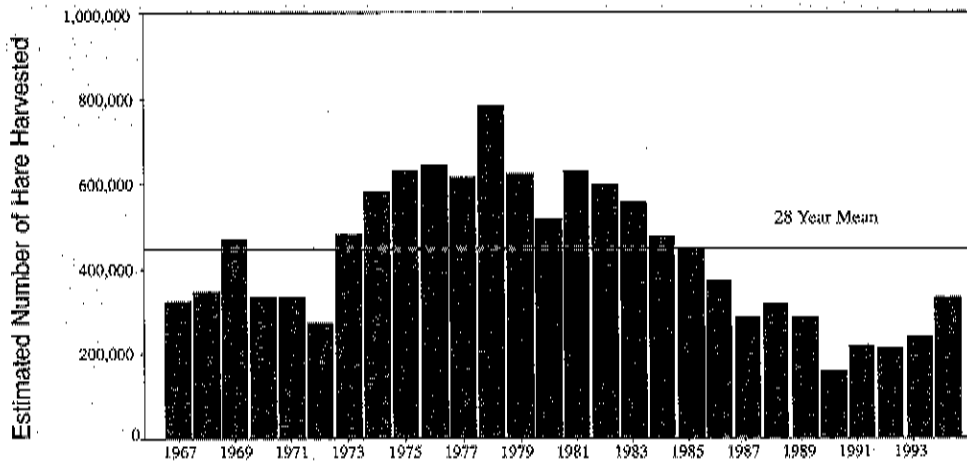
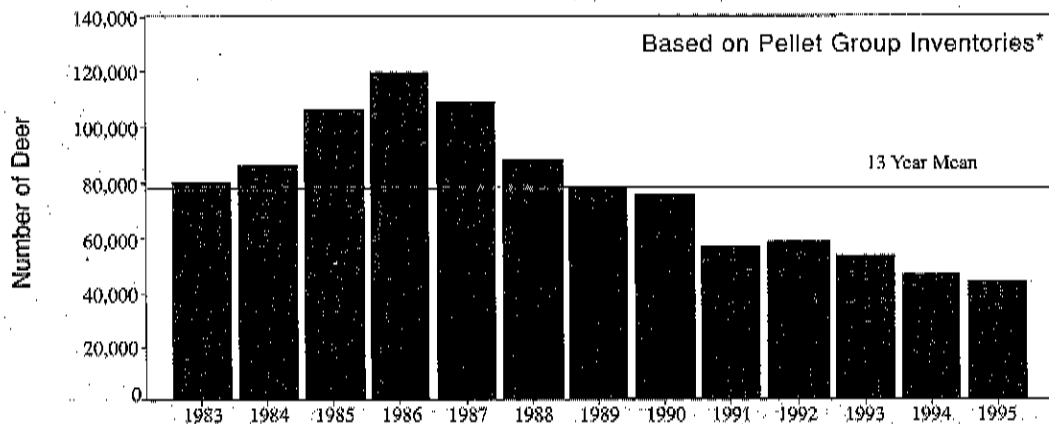


Figure 2. Estimated Annual Hare Harvest in Nova Scotia 1967 to 1994



* Pellet group inventory trends may lag actual populations by 1 year pers. comm. Tony Nette, Manager Wildlife Resources "Large Mammals" NSDNR

Figure 3. Annual Estimate of Provincial Deer Population in Nova Scotia

Survey Results

Health and Survival

Plantation survival averaged 76 percent. Fifty percent of plantations had 80 to 100% survival, 35 percent had 60 to 79% survival, and 15 percent had less than 60% survival. Ninety-three percent of live trees were rated healthy.

Sixty percent of all potential planting spots surveyed contained healthy trees, 5% contained unhealthy trees, and 2% contained dead trees. The

trees were missing (reasons unknown) at 21% of the potential planting spots, and an additional 12% of the potential spots were considered non-plantable.

Browsing Levels

Browsing percentages were determined for existing (live and dead) trees. Overall, 8.5% of trees were browsed, 88% of which were browsed at the leader. At the plantation level, browsing var-

icd between 0 and 90 percent, with the average plantation experiencing 9.0% browsing (Appendix I). Approximately one quarter (26%) of the plantations had no trees browsed, and half (53%) had 10% or less browsing (Figure 4). Fifteen percent had from 11 to 20% browsing, and 6% had greater than 70 percent of their trees browsed .

Since most of the plantations contained small seedlings (less than 1 year old, and planted with multipot stock), "leader browsing" was often severe, leaving a small stub clipped close to the ground. Fifty percent of the browsed trees were rated healthy, 41% were unhealthy, and 9% were dead. These plantations will remain susceptible to browsing for several more years.

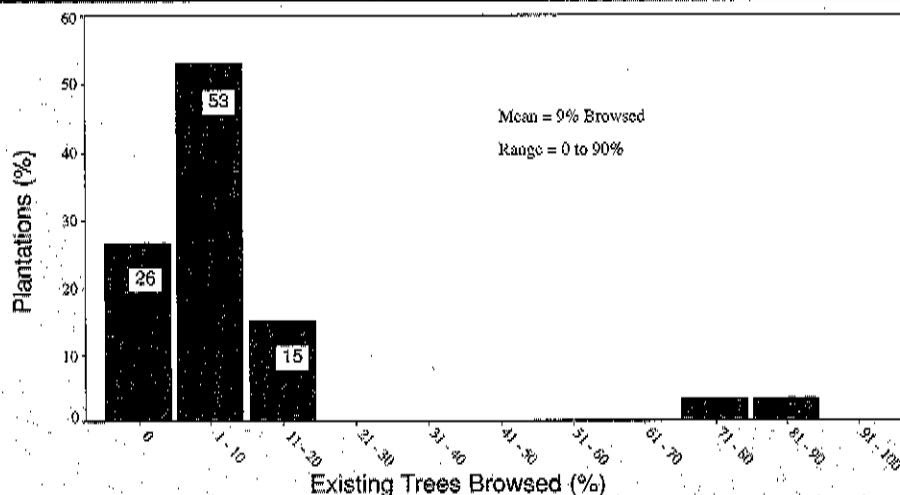


Figure 4. Percent of Plantations by Browsing Level

Site Characteristics

A strong relationship between browsing and site characteristics could not be established due to a combination of low browsing levels at most sites, and lack of deer and hare population data at the plantation level. However, the results appear to support the findings of other researchers indicating that plantations containing favourable hare habitat are vulnerable to extreme browsing damage (Bailey, 1982; Gaul, 1986; Oxenham, 1983; Parker, 1984; Radvanyi, 1987).

Heavily Browsed Plantations

Both of the heavily browsed plantations contained good hare habitat, including deciduous browse, cover, and edge. Seedlings were not planted until 4 years following stand harvest. This allowed the development of abundant deciduous vegetation and coniferous patches to become established throughout the plantation. The resulting competi-

tion (rated moderate to severe in 96% of the plots) provided deciduous browse consisting primarily of raspberry, red maple, and white birch averaging 1 m in height and 85% cover. Good hare cover was sustained by using a "strip" site preparation method, in which 2.5 m wide strips were cleared with a chain flail and alternated with untreated strips of the same width. This permitted slash and brushy vegetation to remain well distributed throughout both plantations. Edge and accessibility was enhanced by the alternating pattern of strips, which may have been valuable to both hare and deer. In these plantations 80.2% of the Norway spruce planted in the treated strips were browsed.

Lightly Browsed Plantations

Site characteristics in the lightly browsed plantations ($\leq 20\%$) were highly variable. In these plantations browsing did not seem to be affected by

either slash or vegetation levels.

Two of these plantations were site prepared using strip methods (chain flail, anchor chains) which resulted in conditions similar to those in the heavily browsed sites. In these areas only 8.1% of existing trees were browsed. The remaining plantations were either fully site prepared (chipper, crusher, brush rake/burn), or did not require site preparation (Figure 5). Vegetation levels varied, with the occurrence of moderate to severe competition ranging from 7 to 94 percent. Browsing affected 4.5% of existing trees at these sites.

Species Preferences

All 5 tree species (black, white, red, and Norway Spruce, and eastern larch) included in the survey were browsed to various degrees (Appendix I), supporting Bailey's (1982) findings that the 4 species of spruce are susceptible to browsing. Although there were some differences in browsing levels, there was insufficient evidence to indicate species preferences.

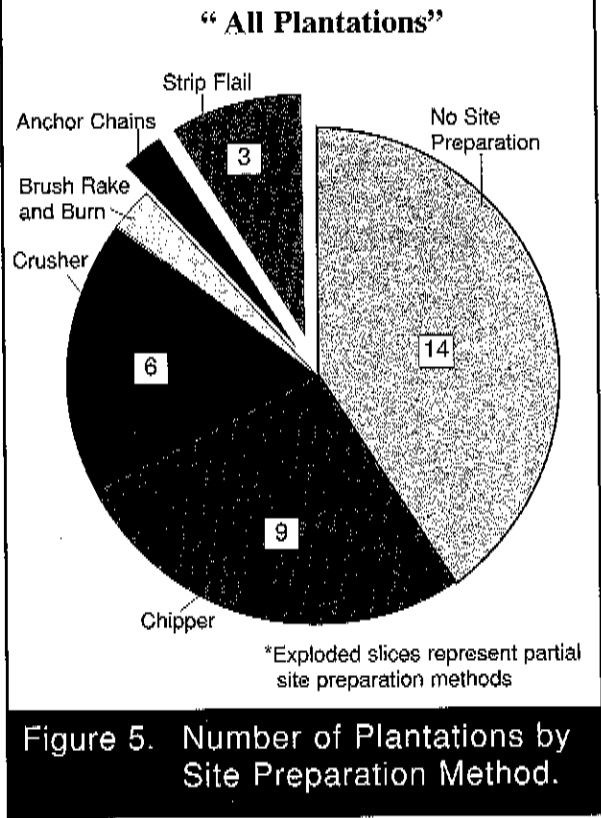


Figure 5. Number of Plantations by Site Preparation Method.

Summary

Results of a browsing survey carried out during 1994 in 34 plantations located in central and eastern Nova Scotia are summarized below. At the time of the survey, populations of white-tailed deer and snowshoe hare were both low, however hare populations have risen steadily since 1990.

1. Average browsing damage levels were light. Of all trees surveyed, 8.5% were browsed in 1993. Of these, 9% were dead, 41% were rated unhealthy, and 50% were rated healthy.
2. The majority of plantations surveyed (74%) were browsed, however only two experienced severe browsing affecting greater than

70% of trees. Eighteen had from 1 to 10% of trees browsed, five had 11 to 20% browsed, and the remaining nine plantations were unaffected by browsing.

3. All tree species surveyed (black, white, red, and Norway Spruce, and eastern larch) were browsed and are thus considered susceptible to damage.
4. Findings of other researchers have indicated that residual slash, high vegetation levels, abundant edge, and interspersed contribute to browsing hazard. The existence of these conditions in the two heavily browsed plantations support these findings.

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APPENDIX I. Summary of Plantation Statistics for 34 plantations included in browsing survey.

County	Year Plant	Area (ha)	Species	Site Prep	Competition ¹ (%)	Survival (%)	Browse (%)
Antigonish	93	14.2	B.Spruce	Chipper	70	73	1.3
Antigonish	93	3.7	B.Spruce	Crusher	86	78	8.6
Antigonish	93	5.0	B.Spruce	Crusher	58	68	0.0
Antigonish	93	3.0	B.Spruce	Rakeburn	62	60	0.0
Antigonish	93	2.4	B.Spruce	Nil	76	44	0.0
Antigonish	93	5.0	N.Spruce	Nil	90	73	0.0
Antigonish	93	2.0	N.Spruce	Nil	72	61	0.0
Antigonish	93	5.4	W.Spruce	Nil	91	66	2.1
Antigonish	93	22.1	W.Spruce	Chipper	96	32	1.8
Colchester	92	15.0	B.Spruce	Nil	64	86	1.2
Colchester	93	9.1	N.Spruce	Nil	46	86	18.5
Colchester	93	4.8	N.Spruce	Chains	82	49	12.0
Colchester	93	18.3	N.Spruce	Nil	41	58	3.2
Colchester	93	7.1	W.Spruce	Nil	85	85	10.8
Colchester	92	11.2	W.Spruce	Nil	45	86	0.0
Guysborough	93	0.5	B.Spruce	Crusher	22	98	0.0
Guysborough	93	17.1	B.Spruce	Nil	27	87	1.4
Guysborough	93	8.5	N.Spruce	Chipper	84	83	8.5
Guysborough	93	12.2	N.Spruce	Crusher	7	79	12.6
Guysborough	93	2.9	N.Spruce	Flail	96	90	78.4
"	"	"	R.Spruce ²	"	(95)	—	(25.0)
Guysborough	93	6.5	N.Spruce	Flail	96	64	90.2
"	"	"	R.Spruce ²	"	(94)	—	(72.0)
Inverness	93	6.0	B.Spruce	Chipper	16	68	20.5
Inverness	93	11.0	B.Spruce	Chipper	94	45	0.9
Inverness	93	1.2	B.Spruce	Chipper	23	90	2.1
Pictou	93	2.0	E.Larch	Nil	76	95	1.9
Pictou	93	8.5	N.Spruce	Crusher	67	94	4.3
Pictou	93	2.8	N.Spruce	Flail	74	98	5.7
"	"	"	R.Spruce ²	"	(96)	—	(9.1)
Pictou	93	1.0	R.Spruce	Crusher	21	83	0.0
Pictou	93	3.5	W.Spruce	Nil	44	88	1.4
Richmond	93	11.4	B.Spruce	Nil	72	83	3.7
Richmond	93	13.8	B.Spruce	Chipper	60	78	0.7
Richmond	93	9.5	B.Spruce	Chipper	47	73	9.2
Richmond	93	4.9	N.Spruce	Chipper	24	91	3.2
Richmond	93	0.6	W.Spruce	Nil	84	89	0.0
Mean		7.4			62	75	9.0

¹ Percentage of existing trees in moderate to severe vegetative competition.

² Fill planted in non site prepared leave strips of the plantation listed directly above. Values not included in survey totals.