Wildlife Use of Forested Corridors in Clearcuts

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Abstract

Snow surveys of wildlife tracks were done in 20 forested corridors in clearcuts between December 28th, 1993 and March 7th, 1994. Tracking was also done in adjacent clearcuts and adjacent uncut stands for comparative purposes. Average snow depth, available browse and utilized browse were also measured. Vegetative features of the corridors were measured at sample points along each corridor. Nine species of mammals and one species of bird were found to use the corridors. Abundance of tracks for all species combined was greater in corridors than either adjacent clearcut or adjacent uncut stands. This indicates wildlife are using the corridor as a travel conduit. A greater abundance of tracks were found in mixedwood and softwood corridors than in hardwood corridors. White-tailed deer (*Odocoileus virginianus*)and small mammals (*Peromyscus maniculatus, Microtus pennsylvanicus, Clethrionomys gapperi*, and *Sorex* spp. combined) were positively associated with basal area of the overstorey. Snowshoe hare (*Lepus americanus*) and all species combined were negatively associated with tree height. Exposed and riparian corridors had greater abundance and species richness than sheltered and non-riparian corridors; however, the difference was not significant.

Résumé

Pendant l'hiver, soit du 28 décembre 1993 au 7 mars 1994, des relevés de pistes d'animaux ont été effectués dans 20 couloirs boisés traversant des zones de coupe à blanc. Pour des fins de comparaison, des relevés ont également été effectués dans les zones de coupe à blanc et les peuplements adjacents. L'épaisseur moyenne de la couverture de neige ainsi que le nombre de broutilles disponibles et utilisées ont aussi été mesurés. Les caractéristiques de la végétation des couloirs ont été mesurées à certains points-échantillons dans chaque couloir. On a constaté que neuf espèces de mammifères et une espèce d'oiseau fréquentaient les couloirs. Pour toutes les espèces réunies, le nombre de pistes dans les couloirs était plus élevé que dans les zones de coupe à blanc ou les peuplements adjacents, ce qui indique que les couloirs servent au déplacement de la faune. Un plus grand nombre de pistes ont été observées dans les couloirs de bois mixte et de résineux que dans les couloirs de feuillus. Le cerf de Viginie (*Odocoileus virginianus*) et les petis mammifères (*Peromyscus maniculatus, Microtus pennsylvanicus, Clethrionomys gapperi* et *Sorex* spp. réunis) ont été associés négativement à la hauteur des arbres. L'abondance et la diversité des espèces étaient plus grandes dans les couloirs à découvert et ripariens que dans les couloirs abrités et non ripariens, mais la différence n'était pas significative.

Table of Contents

List of Tables

List of Figures

Introduction

Strips of forest in a clearcut connecting two other wooded lands has been defined as a wildlife travel corridor (Hobbs 1992). The intention of providing corridors in clearcuts is to facilitate animal movement from one habitat to another (Dmowski and Kozakiewicz 1990, Merriam and Lanoue 1990). Corridors in cuts create edge and thereby increase number and variety of wildlife species present (Nova Scotia Department of Natural Resources 1989). It has also been suggested that corridors are important in preventing isolation of populations, enhancing dispersal and gene flow and helping maintain growth rates of populations (Fahrig and Merriam 1985, Bennett 1990).

Studies have shown that wildlife use corridors (Dmowski and Kozakiewicz 1990, Hobbs 1992). However, most studies involve small sample sizes and have largely been focused on small mammals and birds. Few studies have examined use of corridors by large mammals or have shown that corridors are necessary as travel conduits for wildlife (Hobbs 1992). Even less data are available to suggest that corridors increase the number and variety of wildlife species present on a site by creating edge.

It has been suggested that the use of corridors by wildlife may be dependant on corridor characteristics. Edge-aversive species, for example, may only use corridors wide enough that interior habitat is unaffected by the edge effect. If the characteristics of the corridor are such that snow depth is less than in adjacent cuts in winter, wildlife may be more likely to use that corridor (Henein and Merriam 1990, Merriam and Lanoue 1990).

In 1989, the Nova Scotia Department of Natural Resources published the *Forest/Wildlife Guidelines and Standards for Nova Scotia.* Since that time the guidelines have been implemented on Crown lands operations and incorporated into forest management programs for private lands in Nova Scotia. One of the guidelines outlined is to provide corridors of at least 50 m width in cuts larger than 50 ha. Wildlife corridors have been used on numerous occasions since the implementation of the guidelines. They have been left on cuts larger than 50 ha as well as smaller cuts. Variation in covertype, width, length, and tree height can also be found.

This suggests several questions about the use of corridors in Nova Scotia: are corridors being used? how effective are the corridors that are currently provided? of the corridors that are being used, what habitat parameters are influencing wildlife use? To justify leaving resources in corridors, it should be known how effective they are. It should also be known how to provide the most effective corridor for wildlife.

Intensive track surveys were done between December 28th, 1993 and March 7th, 1994 to determine the extent of wildlife use of corridors in Nova Scotia and the vegetative characteristics that influence use.

Methods

Twenty sites with forested corridors in clearcuts were selected for study in seven eastern counties in Nova Scotia. Widths of selected corridors averaged 40 to 60 meters. Selected corridors were 150 m or more in length and had at least one of the adjacent cuts 10 ha or greater. Eleven sites were dominated by softwood, four sites were dominated by hardwood, and five sites were mixedwood. Although provincial guidelines allow harvest of up to 40% of merchantable volume in corridors, none of the study corridors had been selectively harvested. Clearcuts adjacent to the corridors were harvested within the last 5 years of the study.

During the selection process, interviews with regional foresters, technicians, and wildlife biologists were conducted. Comments concerning corridor placement, use, and associated problems were noted.

Transect lines from 150 to 600 m in length were placed in three locations at each site: the center of the corridor, in the center of adjacent cuts, and in adjacent uncut stands. Transect lines in adjacent uncut stands were placed 100 m in from, and parallel to, the cut edge. Average snow depths were determined for each transect at each site visit and compared between corridor cover type; and between corridor, cut and adjacent stands for each study site.

Tracks of all wildlife species within 3 m of either side of the survey line were identified and counted. Track counts were summarized for each species and standardized as number of tracks per 100 m of transect. Three surveys were completed at each site on different days. Sites were surveyed between 24 and 48 h of a snowfall. Maximum number of tracks per 100 m was used in comparison between sites. Maximum number of tracks was used because it better reflected potential use of the site, as one individual survey could easily cause a depressed average count if snow, wind, or temperature conditions severely influenced activity levels or track detectability. Tracks per 100 m for all species combined and individual species were compared between corridor, adjacent uncut, and adjacent cut.

Percent frequency of occurrence for each species was calculated by dividing the number of times a species was present at a site by the total number of times it could be present (maximum number of times a species could be present at any particular site is three; *i.e.*, each site was surveyed three times). Frequency of occurrence was compared between corridor, adjacent uncut, and adjacent cut.

Vegetative features were measured at points 25 m apart in each corridor along transect lines with a minimum of ten points per corridor. Tree species composition, tree spacing, understorey density and stocking were measured using a basal area factor 2 prism. A vegetation density was determined for each site by using a 2 m by 0.3 m fluorescent orange board. Percent cover was estimated by an observer 20 m away. Three measurements were taken at each point. Shrub layer stocking was measured by estimating the percent area covered by shrubs in a 2.1-m circular plot. Tree height, crown closure, and diameter at breast height were also measured at each sample point. Tracks/100 m for all species combined and individual species were tested for relationships against all vegetative parameters using stepwise multiple regression. Each corridor was designated as softwood (having 25% hardwood tree species by basal area), hardwood (having 75% hardwood tree species by basal area) or mixedwood (having between 25 and 75% hardwood tree species by basal area). Total tracks/100 m for all species combined was compared between corridor cover type.

All stems of available and utilized hardwood browse species were counted within 3 m of either side of the survey line for corridor, cut, and adjacent stands. Hardwood browse only, and not softwood, was counted because of the difficulty in identifying softwood stems that had been browsed. It was felt that hardwood browse would provide a suitable index of all browsed species. Available and utilized browse were standardized as stems per 100 m. A ratio of utilized to available browse was calculated for each transect. Available browse stems/100 m were compared between cover type for corridors and between corridor, adjacent uncut, and adjacent cut. The ratio of utilized browse to available browse was compared between cover type for corridors and between corridor, adjacent uncut, and adjacent cut.

From the 20 corridors selected for study, three sites were considered highly exposed (located on inland ridgetops, upper slopes, hilltops or near the coast) and four were considered sheltered (located in gullys or valleys). Tracks/100 m for all species combined were compared between these two site types.

Tracks/100 m for all species combined and species richness (number of different species found) were compared between corridors with brooks and corridors without brooks.

Paired t-tests, ANOVA and multiple regression analyses were used as appropriate for all comparisons. All statistical tests were judged with a significance level of P = 0.05. Unless otherwise stated, n = 20.

Results

Tracks

Tracks of nine species of mammals and one species of bird were found in the corridors (Appendix VI). Frequency of occurrence can be found in Table 1 and tracks/100 m for adjacent cut and uncut stands can be found in Appendices V and IV.

Total tracks for all species combined per 100 m (total tracks/100 m) were significantly greater in corridors than in either adjacent uncut stands(x = 2.34, sd = 3.75) and adjacent clearcuts (x = 4.04, sd = 3.85). Tracks/100 m were significantly higher in the corridors than adjacent clearcuts for white tailed deer (*Odocoileus virginianus*) (x = 0.93, sd = 0.84), weasel (*Mustela erminea*) (x = 0.22, sd = 0.38), snowshoe hare (*Lepus americanus*) (x = 1.92, sd = 3.03), mice (*Peromyscus maniculatus, Microtus pennsylvanicus, Clethrionomys gapperi,* and *Sorex* spp. tracks were identified as mice species and are presented as tracks/100 m for mice species combined) (x = 0.10, sd = 1.32) and red squirrel (*Tamiasciurus hudsonicus*) (x = 1.04, sd = 1.36). No significant differences for these five species were found between corridor and adjacent uncut stands. The only other species with a large enough sample size to allow testing was coyote (*Canis latrans*), and no significant difference between corridors and adjacent cut (x = 0.05, sd = 0.27) and corridors and adjacent uncut stands(x = 0.13, sd = 0.42) was found.

Species richness was not significantly different between corridors and adjacent uncut stands (x = 0.56, sd = 2.78) and corridors and adjacent cut stands (x = 3.29, sd = 2.52).

Table 1. Frequency of species occurrence by habitat type (%)

Species	Corridor	Adjacent uncut	Adjacent cut
Deer	53	28	12
Hare	42	56	4
Squirrel	49	56	0
Weasel	39	25	39
Mouse	28	42	7
Grouse	9	9	0
Coyote	19	14	5
Fox	7	7	7
Porcupine	5	4	2
Mink	5	4	0

Vegetation

Total tracks/100 m were negatively correlated with tree height (R^2 = 0.422, n = 20) (Figure 1). Tracks/100 m for hare were also negatively correlated with tree height (R^2 = 0.633, n = 20) (Figure 2). Tracks/100 m for deer (Figure 3) and mice (Figure 4) were positively correlated with basal area of the overstorey (R^2 = 0.334, n = 20; R^2 = 0.286, n = 20) while tracks/100 m for hare (Figure 4) were negatively correlated with basal area of the overstorey (R^2 = 0.633, n = 20). Tracks/100 m for weasel were positively correlated with shrub density at the P = 0.10 level (R^2 = 0.156, n = 20). No other significant correlations were found between vegetative features and track abundance.

Snow Depth

Snow depths between December 28th, 1993 and March 7th, 1994 averaged 21.0, 35.7, and 21.8 cm for corridors, adjacent uncut stands, and adjacent

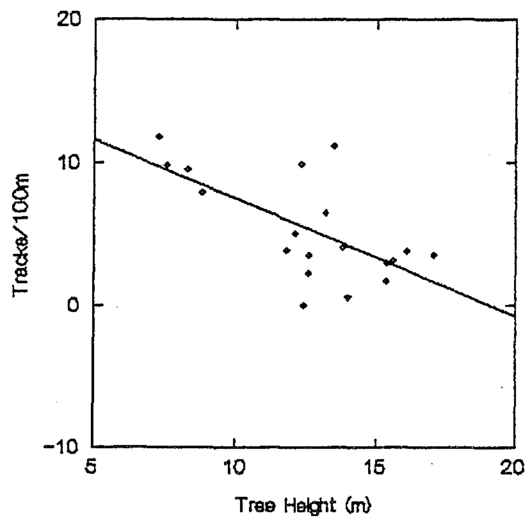

Figure 1 Tracks/100 m for all species combined by height

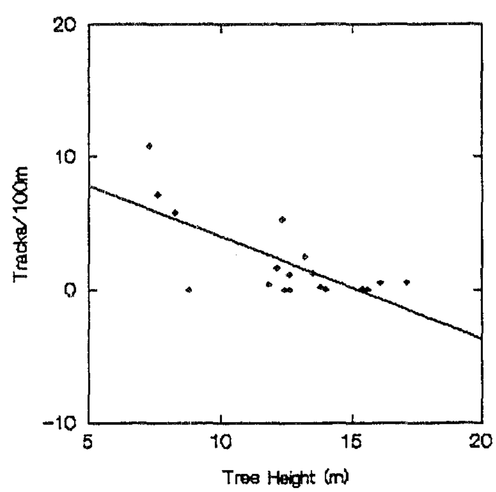

Figure 2 Hare tracks/100 m by average tree height

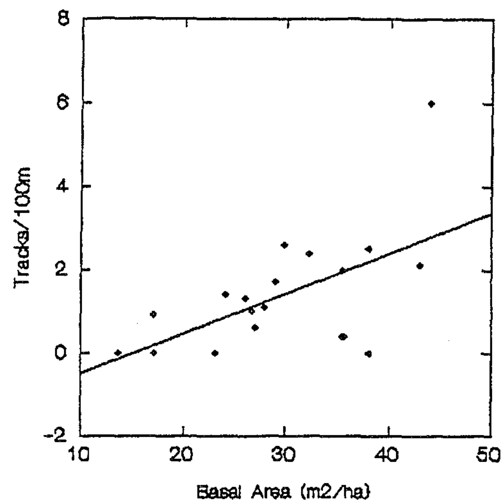

Figure 3 Deer tracks/100 m by basal area of overstorey

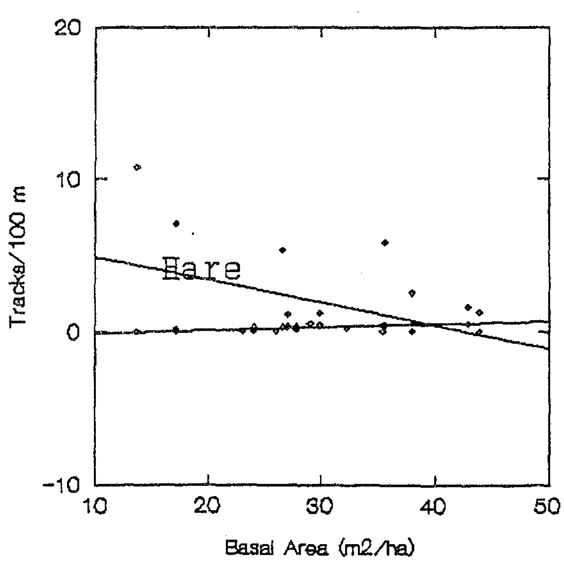

Figure 4 Mice and hare tracks/100 m by basal area of overstorey

clearcuts, respectively. Snow depth exceeded the critical level for deer of 36 cm (Blouch, 1987) 29 times out of 50 site visits. Average site snow depth was significantly less in mixedwood corridors than in adjacent uncut stands (x = 12.99, sd = 10.30, n = 15) and adjacent clearcuts (x = 7.02, sd = 10.68, n=15). Average snow depth was significantly greater in adjacent uncut stands than in hardwood (x = 20.83, sd = 14.78, n = 12) and softwood (x = 9.89, sd = 16.55, n = 29) corridors. Average snow depth was not significantly less in adjacent clearcuts than in hardwood (x = 7.2, sd = 16.86, n = 10) or softwood (x = 0.74, sd = 9.34, n = 29) corridors. Snow depth was significantly less in mixedwood corridors than hardwood (x = 4.50, sd = 14.10, n = 12) or softwood (x = 5.32, sd = 10.49, n = 15) corridors. No significant difference in snow depth was found between hardwood and softwood stands (x = 2.12, sd = 10.20, n = 12).

Cover Type

Total tracks/100 m were significantly higher in softwood (x = 8.35, sd = 3.00, n = 4) and mixedwood corridors (x = 3.88, sd = 2.34, n = 4) than in hardwood corridors. No significant difference was found between softwood and mixedwood corridors (x = 2.08, sd = 6.72, n = 5).

Table 2 Number of tracks/100 m for each species by corridor cover type

Species	Softwood	Hardwood	Mixedwood
Deer	1.9	0.3	2.4
Hare	3.3	0.0	1.6
Squirrel	1.4T0.0	0.8	
Weasel	0.4	0.1	0.0
Total	7.6	0.3	5.4

Riparian Corridors

A total of five corridors contained brooks with flowing water. Several corridors had intermittent brooks and wet areas (these were not considered in the comparison). Corridors with brooks had greater total tracks/100 m (x = 0.90, sd = 8.43, n = 5) and number of different species than corridors without brooks (x = 2.80, sd = 3.49, n = 5); however, the difference was not significant (Table 3).

Table 3 Abundance and species richness of wildlife in corridors with and without brooks

	Average number of species present	Average tracks/ 100 m for all species
Corridors with brooks	7.2	6.3
Corridors without brooks	4.0	4.6

Exposure

Three corridors of the 20 selected for study were considered exposed and four were considered sheltered. No significant difference in tracks/100 m was found between corridors that are exposed and corridors that are sheltered (x = 2.68, sd = 5.21, n = 4) (Table 4).

Table 4 Mean number of tracks/100 m for exposed and sheltered sites

Species	Exposed	Sheltered
Deer	2.6	0.5
Hare	0.5	5.1
Squirrel	1.0	1.0
Weasel	0.4	0.6
Mouse	0.5	0.2
Total Combined	5.1	7.8

Browse

Available browse was significantly higher in hardwood corridors than in mixedwood (x = 263.8, sd

= 326.0, n = 4) or softwood corridors (x = 244.0, sd = 318.8, n = 4). Available browse was greater in mixedwood corridors than softwood corridors; however, the difference was not significant (x = 0.40, sd = 46.9, n = 5) (Table 5). Adjacent clearcuts had a greater amount of available browse than corridor and adjacent uncut stands (Table 6). There was little difference between amount of available browse between corridors and adjacent uncut stands. Ratio of utilized browse to available browse was significantly higher in the corridors than in adjacent clearcuts (x=0.34, sd=0.36, n=20). No significant difference in the ratio of utilized to available browse was found between corridors and adjacent uncut stands (x = 0.17, sd = 0.30, n = 20). The ratio of utilized to available browse was significantly higher in softwood (x=0.23, sd=0.19, n=4) and mixedwood (x = 0.30, sd = 0.15, n = 4) corridors than in hardwood corridors (Table 5). No significant difference was found between softwood and mixedwood corridors (x = 0.20, sd = 0.5, n = 6).

Table 5 Average available browse stems/100 m and ratio of utilized to available browse by cover type for corridors

	Softwood	Mixedwood	Hardwood
Available	6	28	35
Utilized to available	0.57	0.47	0.01

Table 6 Average available browse stems/100 m and ratio of utilized to available browse by corridor, adjacent uncut and adjacent cut

	Corridor	Adj. Cut	Adj. Uncut
Available	16	48	12
Utilized to available	0.38	0.04	0.22

Discussion

Corridor Use by Wildlife

Corridors have been shown to be used by a variety of species of wildlife (MacClintock *et al.* 1977, Fahrig and Merriam 1985, Bennett 1990, Hobbs 1992). There are 22 species of mammals that could have left tracks in the snow (not including shrews, mice and voles). However, 12 of these 22 species were unlikely to occur. Animals such as striped skunks (*Mephitis mephitis*), raccoons (*Procyon lotor*), and black bears (*Ursus americanus*) are inactive most of the winter. Other species were uncommon due to low population levels, provincial distribution, or winter habitat use (*e.g.*, fisher, *Martes pennanti*; moose, *Alces alces*; pine marten, *Martes americana*). Therefore, of ten species likely to occur, nine were found in the corridors. White-tailed deer was the most frequent user and the second most common track. Red squirrel, snowshoe hare, and weasel were frequent users of corridors (35% of occurrence) and this was also reflected in abundance of tracks.

If corridors are used as travel conduits, they would tend to funnel wildlife in from the adjacent uncut area. This should result in a greater abundance of wildlife in the corridors. This was demonstrated in the significantly higher abundance of tracks in the corridors than in adjacent stands. It was reflected in a greater species richness of wildlife found in the corridors than the adjacent stands, although the difference was not significant.

Wegner and Merriam (1979) found that small mammals avoided travelling across openings when a vegetated corridor was present. Dmowski and Kozakiewicz (1990) found a similar trend in passerine birds. Track abundance for all species combined was significantly greater in the corridor than the cut. This trend was also found in deer, weasel, hare, and squirrel. This may suggest that wildlife are less likely to travel in openings when given a choice between an opening and a forested corridor. Another indication of greater use of corridors over cuts is the significantly higher ratio of utilized to available browse in corridors.

No significant difference between abundance of coyote tracks in the corridor and the cut was found. This was not a surprising trend in predators such as the coyote, which tend to utilize a variety of habitats, frequenting openings when hunting (Voigt and Berg 1987). One might expect a similar trend in red foxes (*Vulpes vulpes*); however, the sample size was not large enough to allow testing.

Arnold and Fritzell (1990) found that mink abundance was strongly correlated with presence of water. Of three occurrences of mink (*Mustela vison*) in corridors, two were in corridors that had brooks. Fagerstone (1987) suggested that short-tailed weasel prefer forest edge habitats, riparian woodlands, and early successional communities and are strongly associated with small rodents and lagomorphs. Corridors provide forest edge habitat often with brooks. With a strong association of animals such as hare and squirrel, corridors provide excellent habitat and foraging opportunities for weasel.

Cover type

Cover is suggested by The Nova Scotia Forest/Wildlife Guidelines as being important. Wegner and Merriam (1979) found that mammal and bird movement was less in poorly vegetated corridors than well-vegetated corridors. There was a significantly greater abundance of tracks in softwood and mixedwood corridors than in hardwood corridors. Hardwood corridors tend to have lower crown closure, and shrub and understorey density and tend to be more open than mixed or softwood corridors. If corridors are used for travelling from one area to another it may be an aspect of cover found in the softwood and mixedwood corridors that favor use by wildlife.

Vegetation

Track abundance for total species was negatively correlated with tree height. This was also found for snowshoe hare. Shorter trees tend to be younger and denser with a higher crown closure providing more cover for wildlife. However, percentage crown closure and shrub density, also factors of cover, were not significantly correlated to track abundance. Basal area, also an index of tree density, was negatively correlated with hare. The greater the density (lower basal area) the greater the abundance of hare tracks. Orr (1977 in Dodds 1987) found hare in western Nova Scotia most frequently used areas with vegetation between 3.6 and 11 m in height. Dodds (1987) indicated the importance of low thick cover for hare winter habitat.

It is possible that abundance of hare tracks would bias a correlation between tree height and track abundance for all species combined. However, a positive correlation was still found when hare tracks were not used in the comparison.

Tree height, crown closure, and basal area are the most important stand attributes in providing white-tailed deer habitat in Maine (Wiley 1988). A positive correlation between basal area and deer track abundance was found from this study suggesting that deer prefer corridors with larger trees.

DeGraaf *et al.* (1991) suggested that basal area, tree density, and ground cover could be the cause of differences in abundance of small mammals in various cover types. A positive correlation with abundance of small mammal tracks and basal area was found in this study.

Snow

Snow restricts movement of deer, covers available browse, and increases energy demands (Blouch 1984). Reduced snow depth in corridors would encourage their use by deer. Average snow depth was greater in corridors than adjacent cutovers for all cover types.

Average snow depth was not significantly different between softwood and hardwood corridors. This may indicate that wildlife were selecting softwood corridors over hardwood corridors for cover features rather than reduced snow depth. Snow condition will affect wildlife use. Murray and Boutin (1991) found that coyotes travelled areas of harder snow and used trails where sinking depths were lessened.

Towers and Milton (1990) found significantly greater mean snow depth in uncut riparian areas than in cut riparian areas in Nova Scotia. A similar trend was found in this study with average snow depth of cuts being significantly less than adjacent uncut stands. This is in contrast to findings in Maine and New Brunswick where increases in forest cover are found to decrease snow depth (Halpin and Bissonette 1988, Wiley 1988, Parker and Maxwell 1989). Towers and Milton (1990) suggest this may be attributable to mid-winter warming periods frequently experienced in Nova Scotia. Open areas such as clearcuts are exposed enough to allow snow melt, unlike adjacent uncut stands.

Exposure

There was greater abundance of wildlife tracks in corridors that were sheltered than in corridors that were exposed; however, the difference was not significant. The observed use of exposed corridors, while less than sheltered corridors, may suggest that hiding cover is more important than protective cover for wildlife when using corridors. However, it may also be an indication that wildlife will use even an exposed corridor over an open cut when travelling from one area to another.

Riparian Corridors

Both species richness and abundance of species were greater in corridors that contained a brook than corridors without, however, the difference was not significant. Riparian areas are considered highly diverse, often with a greater diversity and abundance of wildlife. This is attributed to a diversity of vegetation often not found in uplands. Riparian areas also create edge from the water to the uplands and act as travel corridors (Elliot 1988). Significant differences in vegetation were not detected between riparian and non-riparian corridors. This may be attributed to the season as certain vegetative features are not present, or cannot be measured. Edge and travel lanes were created whether a brook was present or not. Also most brooks in the corridors were snow covered or frozen during the census period. Corridors with brooks may contain a greater diversity and abundance of wildlife in summer when water is more accessible and more streamside vegetation is present.

Hobbs (1992) indicated the importance of having objectives for a given corridor and that corridors will not be entirely beneficial to all species. Corridor design will depend on objectives of the manager for the corridor. It was found that vegetative features that were favored by one wildlife species may not be favored by another species. Hare track abundance was associated with low tree heights and low basal area, while deer track abundance was associated with high basal area.

Professional Concerns

The main concern of regional wildlife biologists in corridor implementation was placement of the corridors. Several corridors were placed along ridgetops where exposure was greatest. Field staff of forest companies located the corridors along these ridges for convenience of the harvest operation. Examination of over 100 corridors during site selection indicated that only a few corridors were located in exposed areas. The majority of corridors were located along brooks, wet areas, and gullys.

Foresters and field staff of forest companies showed concern over blowdown of trees in some cases. It was felt that blowdown would make travel by wildlife in the corridor more difficult and thereby reduce its usefulness. Furthermore, blowdowns could not be harvested at a later date, an objective planned for many corridors. Personal observations by the author during the study found that sites where blowdown occurred seemed to have a higher occurrence of deer. It is the researcher's belief that trees that blow down tend to be older and are more likely to have lichen on them. This is a favourite food for deer during the winter.

Corridors left by some forest companies were much larger than recommended in the guidelines. This was to make returning to harvest wood in the corridor at a later date much more economical. It is felt by the researcher that this practice would increase the usefulness of the corridor and should be encouraged. This practice would also reduce loss of valuable wood from blowdown.

Management Recommendations*

A wide variety of mammals appear to be using corridors as travel conduits. Softwood or mixedwood corridors should be left over hardwood corridors if a choice exists. To provide maximum benefit to deer and small mammals, corridors with trees of large diameter should be left. Hare will use corridors that have low dense cover. To provide maximum benefit to a large number of species, corridors that have shorter tree heights should be left.

Wildlife will use exposed corridors but not as much as sheltered corridors. Try to establish corridors in sheltered locations along streams, gullys or low areas. Locating corridors along streams can provide benefits for wildlife and coincides with operational requirements to leave special management zones in riparian areas.

Recommendations for Further Study

This study involved winter use of corridors only. Use of corridors may significantly change with the season because of additional species being active. A study involving bird, small mammal, reptile and amphibian surveys during the spring and summer is recommended. Vegetation features measured during this study would provide most of the necessary vegetation information required for the summer study.

During the selection of corridors for study it was found that corridors were placed in cuts of varying sizes (2 to +60 ha). Also, corridors varied in width from several meters wide to several hundred meters wide. The corridors were placed on the assumption that they would be used by wildlife under these varying conditions. A winter study to examine track abundance in corridors of differing widths, lengths, and adjacent cut size would help answer these questions.

Nova Scotia Forest\Wildlife Guidelines allow removal of up to 40% of the merchantable volume in a selection cut. This practice could have significant effects on vegetative features of the corridor such as basal area and average tree height. A strong association between vegetative features and wildlife use has been demonstrated. A winter study to examine track abundance in corridors with differing amounts of merchantable volume removed would address this question.

Several species could not be tested individually because of the small sample size. Several vegetation parameters were significant at the $P = 0.10$ level or slightly less. These vegetation features are suggested in the literature as providing a significant habitat feature for many species of wildlife (*e.g.*, shrub density). Another year of snow tracking would increase sample size and may show some trends that were not shown to be significant

* Recommendations are based on winter use of corridors

in this study. One more year of snow tracking would cost less than half the original study.

Comments collected from foresters and forest technicians included concern over the usefulness of the other Forest/Wildlife Guidelines. One of the most frequently used guidelines is providing snag and cavity trees. A study to document the use of snag and cavity tree clumps in clearcuts is suggested. The study would examine frequency of use, parameters that may affect use (such as clump size or distance to cut edge), and document which wildlife species use the clumps.

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Appendix I — Vegetative Features of the Corridors

	Tree height (m)	DBH (cm)	Crown clsr (%)	Shrub density (%)	Shrub stock (%)	B.a. overstorey (m^2/ha)	B.a. understorey (m^2/ha)
Lower Harmony	15.6	21.2	40.8	37.2	27.1	24	0
Bridgeville 1	8.3	12.5	68.2	63.6	40.9	35.6	2.4
Bridgeville 2	12.6	16	89	31.4	81.7	27	1
Four Mile Brook	12.6	18	68.5	42.2	75	35.4	0
West New Annan	7.3	8.9	24	46.3	100	13.6	1.5
Marshy Hope 1	12.4	16.8	16.4	28.5	31.8	23	3
Marshy Hope 2	14.0	22.6	15	21	25	17	3
Greendale	8.8	13.3	68.5	61.3	11.5	44	0
Georgeville	12.1	17.3	77.9	51.3	2.9	43	0
West Branch Lake	13.2	15.4	52.5	54.6	8	38	2
Maple Lake 1	17.1	23.9	64.5	26	5	38	6
Maple Lake 2	15.4	18.1	22	22	0	26	0
Lanesville	16.1	18.6	50.3	35.4	31.9	29	6
Kemptown	13.5	20.1	59.8	40.3	44	29.8	1
Union 1	13.8	18.4	73.3	59.4	33.3	32.2	2
Union 2	15.4	21.2	74.1	43.6	36.1	27.8	1
MacCallum	12.3	20.7	56.7	35.7	58.3	26.6	1.2
Pictou Rd	7.6	11.6	39	49.5	42.5	17	1.2
East Mountain	11.8	16.2	75	46.3	10	35.4	1.4

Appendix II — Vegetative Features of the Corridors

	Survey length (m)	Exposure	Cover type	Brook
Lower Harmony	350	moderate	mixedwood	no
Bridgeville 1	275	moderate	softwood	no
Bridgeville 2	350	moderate	hardwood	no
Four Mile Brook	200	moderate	mixedwood	yes
West New Annan	520	sheltered	softwood	no
Marshy Hope 1	275	moderate	hardwood	no
Marshy Hope 2	450	moderate	hardwood	no
Greendale	300	exposed	softwood	no
Georgeville	425	exposed	softwood	no
West Branch Lake	200	sheltered	mixedwood	no
Maple Lake 1	200	moderate	softwood	no
Maple Lake 2	225	moderate	hardwood	no
Lanesville	600	moderate	mixedwood	yes
Kemptown	500	moderate	softwood	yes
Union 1	450	moderate	softwood	no
Union 2	725	sheltered	softwood	yes
McCallum Settlement	300	moderate	softwood	yes
Pictou Rd	225	sheltered	softwood	no
East Mountain	225	exposed	mixedwood	no

Appendix III — Average vegetative features by cover type

Vegetative Feature	Softwood	Mixedwood	Hardwood
Tree height (m)	11.6	13.9	13.6
DBH (cm)	16.8	17.9	18.4
Crown closure (%)	60.6	57.4	35.6
Shrub density (%)	47.7	43.1	25.7
Shrub stocking (%)	37.4	30.4	34.6
Basal area overstorey (m^2/ha)	30.8	32.4	23.3
Basal area understorey (m^2/ha)	1.6	1.9	1.8

Appendix IV — Number of tracks per 100 m for each species by adjacent uncut stand

Site	Deer	Hare	Squirrel	Weasel	Porcupine	Mouse	Coyote	Fox	Grouse	Mink
Lower Harmony	1.1	0.0	1.1	0.0	0.0	0.0	0.6	0.0	0.0	0.0
Bridgeville 1	0.0	7.5	2.5	0.0	0.0	0.0	0.0	0.5	0.0	0.0
Bridgeville 2	0.0	7.5	2.5	0.0	0.0	0.0	0.0	0.5	0.0	0.0
Four Mile Brook	0.0	0.0	0.8	0.0	0.0	0.0	0.8	0.0	0.0	0.0
West New Annan	0.0	5.3	0.7	0.7	0.0	0.0	0.0	0.0	0.0	0.0
Marshy Hope 1	0.0	0.0	0.8	0.3	0.0	0.0	0.8	0.0	0.0	0.3
Marshy Hope 2	0.0	0.0	0.8	0.3	0.0	0.0	0.8	0.0	0.0	0.3
Greendale	2.1	5.7	0.7	0.0	0.0	0.0	1.4	0.0	0.0	0.0
Georgeville	0.0	11.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
West Branch Lake	5.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.5
Maple Lake 1	0.0	1.0	1.5	1.5	0.0	0.0	0.0	0.3	0.0	0.0
Maple Lake 2	0.0	1.0	1.5	1.5	0.0	0.0	0.0	0.3	0.0	0.0
Lanesville	2.2	1.0	0.0	0.0	0.4	0.0	0.7	0.0	0.0	0.0
Kemptown	0.7	13.3	4.0	0.7	0.7	0.0	0.0	0.0	0.0	0.0
Union 1	0.2	1.6	0.7	0.3	0.0	0.3	0.2	0.0	0.3	0.0
Union 2	0.2	1.6	0.7	0.3	0.0	0.3	0.2	0.0	0.3	0.0
McCallum Settlement	1.0	5.1	2.2	1.1	0.0	0.0	0.0	0.4	0.0	0.0
Pictou Rd	2.5	5.0	1.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0
East Mountain	3.8	6.9	0.0	0.0	0.0	0.3	0.0	0.0	0.3	0.0

Appendix V — Number of tracks per 100 m for each species by adjacent clearcut stand

Site	Deer	Hare	Squirrel	Weasel	Porcupine	Mouse	Coyote	Fox	Grouse	Mink
Lower Harmony	0.0	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0
Bridgeville 1	0.0	0.0	0.0	0.2	0.0	0.0	0.3	0.0	0.0	0.0
Bridgeville 2	0.0	0.0	0.0	0.2	0.0	0.0	0.3	0.0	0.0	0.0
Four Mile Brook	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
West New Annan	0.0	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0
Marshy Hope 1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Marshy Hope 2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Greendale	0.0	0.0	0.0	0.5	0.0	0.5	1.0	0.0	0.0	0.0
Georgeville	3.5	0.0	0.0	0.0	0.0	6.0	0.0	0.0	0.0	0.0
West Branch Lake	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Maple Lake 1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Maple Lake 2	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Lanesville	0.5	0.3	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0
Kemptown	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.3	0.0	0.0
Union 1	0.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Union 2	1.4	0.0	0.0	0.6	0.2	0.2	0.0	0.4	0.0	0.0
McCallum Settlement	1.2	0.0	0.0	0.0	0.0	0.3	0.0	0.0	0.0	0.0
Pictou Rd	0.0	0.4	0.0	0.0	0.0	0.0	0.0	0.4	0.0	0.0
East Mountain	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Appendix VI — Number of tracks per 100 m for each species by corridor

Site	Deer	Hare	Squirrel	Weasel	Porcupine	Mouse	Coyote	Fox	Grouse	Mink
Lower	1.4	0.0	0.6	0.3	0.0	0.3	0.0	0.3	0.3	0.0
Bridgeville 1	0.4	5.8	1.5	0.4	0.0	0.4	0.4	0.0	0.7	0.0
Bridgeville 2	0.6	1.1	0.0	0.3	0.0	0.3	0.0	0.0	0.0	0.0
Four Mile Brook	2.0	0.0	0.5	0.5	0.0	0.0	0.5	0.0	0.0	0.0
West New Annan	0.0	10.8	0.8	0.0	0.0	0.0	0.2	0.0	0.0	0.0
Marshy Hope 1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Marshy Hope 2	0.0	0.0	0.0	0.2	0.0	0.2	0.2	0.0	0.0	0.0
Greendale	6.0	0.0	0.0	0.3	0.0	1.3	0.3	0.0	0.0	0.0
Georgeville	2.1	1.6	0.7	0.2	0.0	0.5	0.0	0.0	0.0	0.0
West Branch Lake	0.0	2.5	2.0	1.0	0.0	0.5	0.0	0.0	0.0	0.5
Maple Lake 1	2.5	0.5	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Maple Lake 2	1.3	0.0	0.0	0.0	0.0	0.0	0.4	0.0	0.0	0.0
Lanesville	1.7	0.5	0.3	0.2	0.0	0.5	0.2	0.2	0.2	0.0
Kemptown	2.6	1.2	5.6	0.6	0.0	0.4	0.2	0.2	0.2	0.2
Union 1	2.4	0.2	0.9	0.2	0.0	0.2	0.0	0.0	0.2	0.0
Union 2	1.1	0.1	0.4	0.3	0.3	0.3	0.3	0.1	0.0	0.1
McCallum Settlement	0.0	5.3	2.3	0.7	0.0	0.3	0.3	0.0	0.0	0.0
Pictou Rd	0.9	7.1	0.9	0.9	0.0	0.0	0.0	0.0	0.0	0.0
East Mountain	0.4	0.4	2.7	0.4	0.0	0.0	0.4	0.0	0.0	0.0