Toward an ecologically sustainable landscape: measuring aspects of habitat connectivity in commercially harvested landscapes.

Preliminary Report – December 1998

Project team:
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Within the boundary of Gros Morne National Park (GMNP), the Long Range Mountains form the spine of a body of boreal forest, rock barren, and bog-land. This habitat diversity is typical of the central-western Newfoundland landscape. While the park-lands are protected from large-scale anthropogenic development, the land adjacent to the borders of GMNP are being harvested by the pulp and paper industry. As a result, habitat within GMNP has the potential to become isolated from the larger western Newfoundland region. The ecosystem response to this isolation is unpredictable; at worst it will result in the decreased abundance, persistence, and diversity of species native to GMNP's habitat types.

Studies of habitat fragmentation have measured population and community response to habitat alteration. Negative organismal responses include the alteration of avian community structure (Schmiegelow et al. 1997), crowding of birds within habitat fragments (Bierregaard and Lovejoy, 1989), increased nest predation resulting in decreased reproductive success (Robinson et al. 1995), decreased pairing success (Villard et al. 1993), dynamic rates of parasitism (Roland and Taylor, 1997) and altered patterns of movement (Wiens et al, 1997). However, it is possible to decrease the impact of habitat alteration on resident species by designing management plans which incorporate an understanding of both the relationship between landscape structure and inhabitants, and the sensitivity of inhabitants to structure. Three components of landscape structure are pre-eminent in current studies of landscape ecology: the amount and type of resources within a given area, how those resources are positioned in space, and the ease with which organisms can move to access them (physiognomy, configuration, and connectivity respectively).

The goal of this long-term collaborative project is to maximize the ecological potential of GMNP and the surrounding western Newfoundland ecosystem, while acknowledging that a viable forest industry is crucial to the economy of this area. This project will first study how various animals respond to natural landscape structure, in particular how animals move through habitat (connectivity of habitat). From this information we will make management recommendations for forest cut patterns which maximize the ecological value of remaining standing timber in the area adjacent to GMNP, and enhance the connectivity of the Gros Morne greater ecosystem. After implementation, these cut patterns will be observed and modified to optimize their effectiveness. In the summer of 1998 we initiated the study and began to collect baseline data on presence/absence, abundance, and distribution of a variety of different species (avian and insect) throughout the park.

Methods

Sampling was performed between June 1 and August 13, 1998. Sampling sites were set up in GMNP, along the eastern boundary, and east of the park in the Main River area. In total, 15

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sites were examined. Collections of terrestrial invertebrates were obtained from all 15 sites, bird data were collected from 9 sites. Sites were placed into one of three treatments, differing by the amount of forest cover within each area (as measured from Forest Resource Inventory maps): areas with less than 33% forest cover, areas with forest cover between 33% and 66%, and areas with forest cover greater than 66%. Seven sites were located within GMNP, seven in the Main River Model Forest, and one site straddled the border of these two areas.

Sampling points (hereafter, points) within each site were arranged along two perpendicular transects, aligned to the Cardinal directions and crossing each other at the midpoint. Eleven points were placed 250m apart along each 2.5km long transect, and an additional eight points, 25m apart, were placed along the northern or western 500m of each transect. Position of points was recorded using Global Positioning Systems (GPS).

Collection of bird data was attained through standard ten minute, unlimited distance point counts. All point counts at each site were completed between dawn and 10a.m., the peak of bird song within each day. Point counts were only done during periods when wind was not strong (<Beaufort 4) and precipitation was absent or light enough to allow for clear hearing. Point counts were done at only those points separated by 250m along the transects. Due to a sharp decline in the amount of birdsong at the end of the early breeding season, point counts were not performed after July 10.

Terrestrial invertebrates were collected from June 15 until the end of the study period; cold weather hindered the collection of insects before this date. Invertebrate collections were made using pitfall traps sunk into the ground at each point along the transects, including those separated by only 25m. All pitfalls were of a standard size and were left for approximately 24 hours. Invertebrates collected using these means were preserved in alcohol for later sorting, identification and analysis.

Analysis of these data will include the use of generalized linear modeling (glm) and spatial autocorrelation. These analyses will allow patterns in distribution to be identified, teasing apart the related effects of such factors as elevation, forest cover and relative location of conspecifics. Only partial analyses have been performed to this date.

Results from 1998

Currently, only the bird data has been subject to analysis. In total, across the nine sites where bird data were collected, 39 species were observed on point counts (Table 1). White-throated Sparrow was the most widespread, being found at over 80% of the points, closely followed by Ruby-crowned Kinglet (76%) and Yellow-rumped Warbler (72%). Seven sites (Table 2, Sites 1, 2, 3, 6, 8, 9, 10) were located within the Main River Model Forest. One site (Table 2, Site 17) was located within GMNP, and one site (Table 2, Site 16) straddled the border between these two areas. Sites 2, 3, 6, and 10 were classified as a high treatment of forest cover, sites 1, 8, 9, 16, and 17 were classified as medium treatment. Overall, species richness increased with bird abundance throughout the sampling period.

Table 1. Species observed during point counts, with abundance, frequency and overall density.

Species	Frequency (number of points where present)	Proportional frequency (Frequency/total number of points)	Gross abundance (Total observed)	Mean density (total observed/total number of points)
American Crow	2	1.058201058	2	0.010582011
American Robin	58	30.68783069	67	0.354497354
Black-capped Chickadee	1	0.529100529	1	0.005291005
Blackpoll Warbler	96	50.79365079	120	0.634920635
Boreal Chickadee	17	8.994708995	20	0.105820106
Common Loon	8	4.232804233	8	0.042328042
Common Raven	2	1.058201058	2	0.010582011
Common Snipe	12	6.349206349	13	0.068783069
Common Yellowthroat	3	1.587301587	3	0.015873016
Dark-eyed Junco	79	41.7989418	100	0.529100529
Downy Woodpecker	9	4.761904762	9	0.047619048
Fox Sparrow	47	24.86772487	59	0.312169312
Gray Jay	33	17.46031746	42	0.222222222
Gray-cheeked Thrush	22	11.64021164	29	0.153439153
Greater Yellowlegs	23	12.16931217	28	0.148148148
Green-winged Teal	1	0.529100529	1	0.005291005
Hairy Woodpecker	4	2.116402116	5	0.026455026
Hermit Thrush	79	41.7989418	117	0.619047619
Herring Gull	2	1.058201058	2	0.010582011
Horned Lark	1	0.529100529	1	0.005291005
Lincoln's Sparrow	61	32.27513228	95	0.502645503
Magnolia Warbler	1	0.529100529	1	0.005291005
Northern Waterthrush	93	49.20634921	138	0.73015873
Palm Warbler	1	0.529100529	1	0.005291005
Pine Grosbeak	16	8.465608466	17	0.08994709
Pine Siskin	1	0.529100529	2	0.010582011
Purple Finch	7	3.703703704	7	0.037037037
Red Crossbill	1	0.529100529	2	0.010582011
Ruby-crowned Kinglet	143	75.66137566	219	1.158730159
Rusty Blackbird	9	4.761904762	10	0.052910053
Song Sparrow	1	0.529100529	1	0.005291005
Spruce Grouse	12	6.349206349	14	0.074074074
Swainson's Thrush	37	19.57671958	42	0.222222222
Three-toed Woodpecker	13	6.878306878	15	0.079365079
Tree Swallow	6	3.174603175	9	0.047619048
White-throated Sparrow	152	80.42328042	284	1.502645503
White-winged Crossbill	16	8.465608466	34	0.17989418
Wilson's Warbler	4	2.116402116	4	0.021164021
Yellow-bellied Flycatcher	62	32.8042328	78	0.412698413
Yellow-rumped Warbler	136	71.95767196	220	1.164021164

Table 2. Site information, including location, species richness at each site and total abundance of each bird.

Sites	Date	UTM	Richness	Abundance
1	2-Jun	21,477256,5515171	20	144
2	6-Jun	21,478701,5516633	22	185
3	7-Jun	21,478173,5520767	16	115
6	16-Jun	21,480008,5522259	23	273
8	24-Jun	21,474527,5514091	27	219
9	20-Jun, 25-Jun	21,476907,5513209	30	269
10	18-Jun	21,480341,5512014	22	232
16	1-Jul	21,466473,5512015	15	136
17	4-Jul	21,464307,5514335	21	249

Invertebrate Samples

All invertebrate (pitfall) samples have been sorted to order, and divided into morpho-species groups. Three major groups are being analyzed in more detail: the spiders, the ants and the beetles. Analysis will proceed as for the bird data above; we are interested in how patterns of spatial autocorrelation of incidence and density relates to landscape structure.

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James Taylor -

I have included the final copy of this year's report for the Gros Morne Greater Ecosystem Connectivity Project, "*Assessment of habitat use by birds and insects in the Gros Morne Greater Ecosystem: the influence of habitat structure on animal incidence and distribution*". This report fulfills the contract agreement between the Western Newfoundland Model Forest, and Meg A. Krawchuk for the year 2000/2001. A manuscript detailing this work is currently in preparation for peer review. A mutually convenient time for discussion/presentation of this work at the WNMF offices in Corner Brook could be arranged in the future if desired.

Until then,

Meg A. Krawchuk

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Please find attached a copy of the report.

Phil Taylor