Forest Sciences

Prince Rupert Forest Region

Extension Note # 37
June, 1999

Effects of Silviculture Systems on Arthropod Community Structure: Contrasting Clearcut and Patch Retention Harvests in High Elevation Forest

Research Issue Groups:

- **Forest Biology**
- **Forest Growth**
- **Soils**
- **Wildlife Habitat**
- **Silviculture**
- **Timber Harvesting**
- **Ecosystem Inventory and Classification**
- **Biodiversity**
- **Ecosystem Management**
- **Hydrology**
- **Geomorphology**
- **Extension**
- **Forest Engineering**

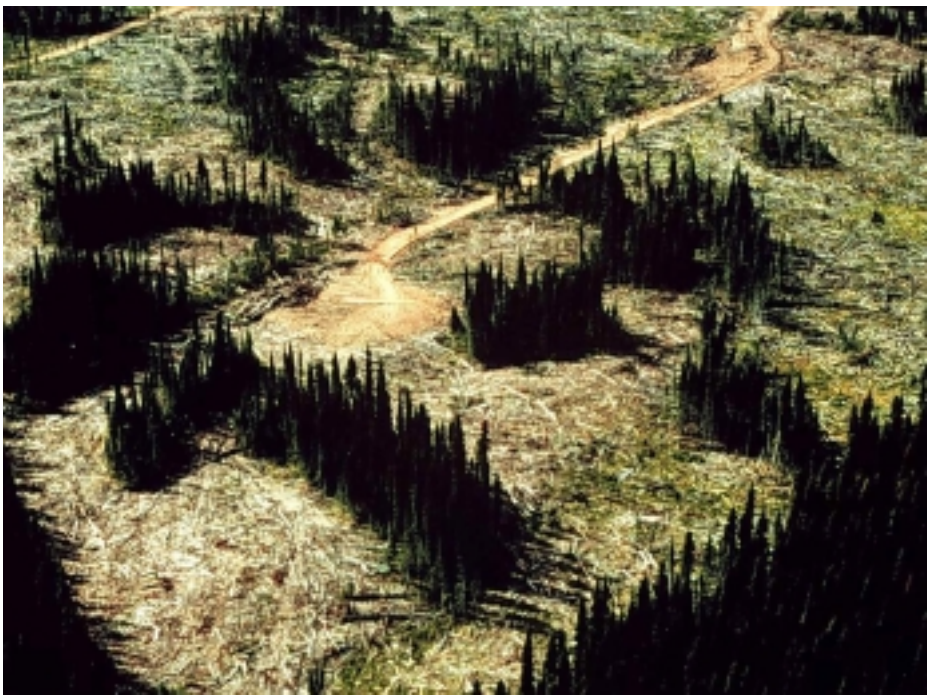

FIGURE 1. Patch retention harvesting.

Patch retention, the practice of leaving distinct patches of trees behind in clearcuts, has been promoted as a practice to help maintain wildlife habitat and biodiversity (Coates and Steventon 1994, MacKenzie and Steventon 1996). The Forest Practices Code requires that such "wildlife tree patches" be retained in clearcuts over a certain size (referred to as Clearcuts with Reserves). In this project, we compared the occurrence and relative abundance of some forest floor arthropods (insects and spiders) in uncut forest, clearcuts without patches, and clearcuts with patches. We were interested in assessing whether patch retention made any

Forest Sciences, Prince Rupert Forest Region
Bag 5000, Smithers, BC V0J 2N0 847-7500 (FAX 847-7217)

difference to arthropod communities in the first few years after logging. We also examined the influence of site series on species occurrence. The study sites (3 clearcuts, 3 patch retention cuts, and adjacent uncut forest) were all located in the ESSFwv biogeoclimatic subzone of the Copper Landscape Unit, Bulkley Forest District, in west central B.C. The project was funded by Forest Renewal B.C., and conducted with the cooperation of the Forest Sciences Section, Prince Rupert Forest Region, and the Bulkley Forest District.

Ground Beetles (Coleoptera: Carabidae)

Response to Clear-cut and Patch Retention Harvesting

Pitfall traps were placed in sample clusters (details in Lemieux 1998) in five treatment types:

1) open areas in clearcuts
2) open areas in patch-retention sites
3) interior patch habitats in patch retention sites
4) interior habitats of undisturbed forest adjacent to both types of harvest
5) areas at the edge of patch retention harvests (in 1996 only).

Twenty-eight species of Carabidae in 17 genera were captured in 2 years of trapping (46,451 trap days). Total carabid catch (all species pooled) was unaffected by treatment, with 4 species comprising 92% of the catch. *Scaphinotus angusticollis* was the single most frequently caught species. Several species were caught in incidental numbers only (<10 individuals).

Individual carabid species at our study site could be classified into the following response categories:

1) those with no response;
2) those that decrease with increasing logging disturbance;
3) those that increase with increasing logging disturbance;
4) disturbance specialists; and
5) edge/patch specialists.

The species composition of the catch in retention patches was most similar to the catch in uncut forest, and that of clearcuts was least similar to uncut forest in both years (Table 1, column 2). The open areas of patch retention blocks were also more similar in catch composition to uncut forest than to clearcuts. No species were restricted to the Forested, Patch or Edge locations, but eight species caught in very low numbers were found only in harvested areas. There were few meadow specialist carabids (*Amara* spp. and *Harpalus* spp.) in our sample.

Our study area has only recently been developed for timber harvesting, and thus had large tracts of relatively undisturbed mature forest surrounding the harvested blocks. The ESSFwv biogeoclimatic zone has historically had a low rate of stand-initiating disturbance (Steventon 1997) and thus relatively little open, early seral habitat. The low abundance of open habitat specialists in the harvest blocks may be due to isolation from source populations. The lack of competition by open habitat specialists may also explain the continued use of the harvested blocks by species common in the undisturbed forest.

With continued harvesting in the landscape, there may eventually be a shift in dominance towards open habitat specialists. The potential for such landscape scale effects is illustrated by Spence *et al.* (1996). They hypothesized that the failure of forest specialists like *Scaphinotus marginatus* Fisch. to recolonize recovering habitat 27 years post-harvest was due to diminished source populations in the landscape, a function of habitat loss and isolation. Future monitoring in the Copper River Landscape Unit may help test the validity of this hypothesis.

Further detail on the carabid beetle results can be found in Lemieux (1998).

Site series and its relationship to ground beetle assemblages

Species assemblages from the two seasons of trapping were compared among four common site series: 01, 03, 05 (including one 07 site), and 09 (including three 06 sites) (Banner et al. 1993), found in mature forest and forest patches. Catches from harvested areas could not be used because we had difficulty

TABLE 1. Similarity of carabid (ground beetle) communities sampled by pitfall traps in 4 treatments. Categories refer to harvesting treatments. A higher number indicates greater similarity between treatments.

	Edge	Forest	Patch	Open
Unlogged Forest	66			
In Patches, Patch Retention Blocks	72	67		
In Open, Patch Retention Blocks	42	50	61	
In Open, Clearcuts	26	36	40	68

determining site series after disturbance.

The beetle community in the hygric 09 and 06 site series was clearly distinct from the drier site series, mostly due to a high abundance of *Calathus advena* Lec. With further sampling, we believe other site-related differences would be evident. Other habitat features such as woody debris, which are not incorporated in the classification, are also likely to be important in predicting beetle occurrence or abundance.

Rove Beetles (Coleoptera: Staphylinidae)

A total of 14,802 rove beetles from the 1996 pitfall trap samples were examined (Dr. Jan Klimaszewski, Canadian Forest Service, St. Foy, Quebec). Due to time constraints, most were identified to genus or tribe rather than species.

The data from this group yielded similar results to the carabid data. Cluster analysis and Bray-Curtis similarity index showed that the retention patches had an effect on the species assemblage found, and ANOVA found significant results for five of 22 taxa. Patches were most similar to Edges, and both Patches and Edges were more similar to the intact forest than to open areas. We did not find any genus or tribe of Rove beetles, however, that occurred only in the undisturbed forest. Site specific concentrations of beetles occurred in clearcuts for *Oxypoda* sp. 1 and *Quedius* spp., indicating that some unmeasured habitat feature at particular trap clusters may have been highly favourable for those beetles.

Spiders (Araneae)

Spider identification was restricted to family due to time constraints. Interestingly, even at this level spiders showed high habitat-specificity. This was evident from the ANOVA, in which all but one analysis yielded significant results. For example, Linyphiidae were found under a forest canopy, while the nomadic wolf spiders (Lycosidae, primarily *Pardosa dorsuncata*) were open-habitat specialists. Our results suggested that the Gnaphosidae, another free-living (non-web forming) group, are also an open-habitat group, but this could be due to differential activity patterns in the warmer open areas compared to the cool interior forests. Initially, these spiders were caught primarily in the open areas while later in the season they appeared to be more or less ubiquitous.

Cluster analysis clearly separates open areas from forested areas. Thus, spiders appear highly habitat-specific relative to the beetles, at least based on the types of spiders that can be sampled using pitfall traps. Nomadic or free-living species generally favour open areas, whereas species using webs appear to favour the structure of a forest.

Implications for Patch Retention Harvesting

We detected differences in carabid beetle, rove beetle, and spider communities in harvest blocks with retention patches vs. blocks without retention patches. Thus we conclude that patch retention has value to conserving arthropod diversity.

The effectiveness of patch retention may, however, depend on maintaining sufficient older forest in the surrounding landscape to provide abundant source populations of forest specialists, and to limit source populations of open-habitat specialists that may displace them.

Contact:

Dr. B. Staffan Lindgren,
Associate Professer
Faculty of Natural Resources and Environmental Studies,
University of Northern British Columbia.
e-mail: lindgren@unbc.ca

Jeffrey P. Lemieux,
Doctoral Candidate
Dept. Entomology, Oregon State University
2046 Cordley Hall, Corvallis, OR, USA 97331-2907
e-mail: lemieuxj@bcc.orst.edu

Doug Steventon,
Research Wildlife Habitat Ecologist,
Prince Rupert Forest Region
e-mail:
Doug.Steventon@GEMS3.gov.bc.ca

References:

Banner, A.B., W. MacKenzie, S. Haeussler, S. Thomson, J. Pojar, and R. Trowbridge. 1993. A field guide to site indentification and interpretation for the Prince Rupert Forest Region. B.C. Ministry of Forests, Land Management Handbook Num. 26, B.C. Ministry of Forests, Victoria, B.C.

Barber, H.S. 1931. Traps for cave-inhabiting insects. J. Elisha Mitchell Sci. Soc. 46: 259-266.

Coates, D., and D. Steventon. 1994. Principles of patch retention harvesting. Forest Sciences Extension Note # 2, B.C. Ministry of Forests, Smithers, B.C..

Bray, J.R., and C.T. Curtis. 1957. An ordination of the upland forest communities of southern Wisconsin. Ecol. Monogr. 27: 325-349.

Lemieux, J.P. 1998. Species and assemblage responses of Carabidae (Coleoptera) to forest harvesting: contrasting clearcut and patch retention removals in high elevation forests of central British Columbia. M.Sc. thesis, Faculty of Natural Resources and Environmental Studies, University of Northern British Columbia, 124 pp.

MacKenzie, K.L. and J.D. Steventon. 1996. Bird use of a patch retention treatment in SBSmc forests. Forest Sciences Extension Note # 16, B.C. Ministry of Forests, Smithers, B.C..

Nordlander, G. 1987. Amethod for trapping Hylobius abietis (L.) with a standardized bait and its potential for forecasting seedling damage. Scand. J. For. Res. 2: 199-213.

Spence, J.R., D.W. Langor, J.K. Niemella, H.A. Carcamo, and C.R. Currie. 1996. Northern forestry and carabids: the case for concern about old-growth species. Ann. Zool. Fenn. 33: 173-184.

Steventon, J.D. 1997. Historic disturbance rates for interior biogeoclimatic subzones of the Prince Rupert Forest Region. Forest Sciences Extension Note # 26, B.C. Ministry of Forests, Smithers, B.C..