Forest Sciences

Prince Rupert Forest Region

Extension Note # 02
August 1994

Principles of Patch Retention Harvesting

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

BACKGROUND

The use of patch retention harvesting as a habitat/biodiversity management strategy is increasing in the Prince Rupert Forest Region, and operational personnel have been requesting more direction on how to apply this treatment. This Note explains the concept of patch retention (also called "clear-cutting with reserves"), and provides general guidance in application.

The guidelines are probably not as specific as many would prefer, but represent our current level of understanding. Successful application will depend on professional judgement and application of the principles in a site- and landscape-specific context. We expect, through a process of learning from experience, that more specific guidelines will evolve. To that end, we will be undertaking a project to document the present use of patch retention, and its

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

ecological and operational implications.

What is Patch Retention ?

Patch Retention, as applied to-date, calls for retaining approximately 10% of a harvested unit in discrete patches of mature and/or immature trees. Clear-cut silviculture with prompt reforestation is practiced on the remaining ±90% of the harvested unit. It is not a "Silvicultural System" in the traditional sense, but rather a modification of even-aged silviculture to maintain structural diversity within second-growth stands. Although application has been mostly in the Sub-Boreal Spruce biogeoclimatic zone, it has potential for use in all zones.

Why Patch Retention ?

In general, modern plantation forestry reduces the structural complexity of forest stands. Its greatest impact is on the abundance and distribution of large live trees, snags, wildlife trees, and coarse woody debris (downed logs). These structural features are important habitat for a wide variety of forest wildlife and other organisms, which in turn play many roles in forest ecosystems. Maintaining biodiversity in managed stands may prove to be important for ensuring long-term ecosystem resilience and forest productivity.

Conventional harvesting schedules usually operate on a three- or four- pass system, at the end of which all operable timber within a given landscape will have been harvested. Unless specifically planned for, snags, large/old trees and coarse woody debris would be much reduced in such landscapes. Patch retention is a method for retaining these structural features in second-growth forests, while minimizing safety concerns and operational complexity.

Patches of standing timber retained in harvested units also provides immediate post-harvest habitat for many plants, wildlife, insects, and micro-organisms. For example, a patch retention unit near Smithers was found to support a much higher diversity of birds immediately post-logging than adjacent clearcuts.

Patch retention also better simulates natural disturbances such as wildfires, which typically leave patches of unburned, or lightly burned timber. Another use of patch retention is in meeting visual quality objectives.

GUIDELINES FOR PATCH RETENTION

We can provide some general guidance in the application of this technique, but the best results require site-specific professional judgement rather than rigid rules of application.

Biodiversity, and Wildlife Tree Considerations

Patch retention should be considered whenever the benefits of greater structural diversity are desired in the stand. Since the potential benefits of patch retention for wildlife habitat and biodiversity are considerable, we suggest foresters make use of any opportunity to apply some form of retention. Some stands, however, are more amenable to patch retention than others and, from a wildlife habitat perspective, the urgency to retain structure varies between landscapes (see Landscape Considerations to follow).

Generally, 5-20% by area is the range of retention to be considered. This is similar to what is found as survivor patches in wildfires, and should meet stand level wildlife tree and biodiversity objectives. Any patch size is acceptable, but most will be between 0.1 ha and 2.0 ha. Both the amount and pattern of retention appropriate in the harvest unit will vary with the type of forest and surrounding landscape. In a large uniform area of lodgepole pine, a few, large patches may be appropriate. On a more diverse unit, smaller, more frequent patches may better fit the terrain and diversity of forest types.

Any patch composition, even an individual tree, will have habitat value. To maximize structural diversity, however, patches with a variety of tree species, sizes and decay condition are generally favoured over patches of uniform tree species, size and condition. Emphasis should be given to rare features such as wetland edges, patches of less common tree species (including deciduous), or existing or future large snags.

Silvicultural/Operational Considerations

The presence of unharvested patches within harvest units should not generally impede operations within the unit, except possibly broadcast burning or aerial herbicide application. Indeed, this is one of the benefits of patch retention over individual stem retention. With larger harvest units there will be more flexibility in patch size and location, and better opportunity to utilize terrain features.

By concentrating patches around wet areas, gullies, deciduous or other difficult to harvest or regenerate locations, the loss of merchantable timber is minimized and logging or silvicultural cost potentially reduced. Patches with advance regeneration or trees suitable for release can provide structural diversity while also providing immediate silvicultural and future growth and yield benefits.

The added cost of designing patch retention has been a concern. We believe that in most cases it is not necessary to make design a complicated procedure. Initial assessment can be made from air-photos and during site reconnaissance for PHSP preparation. Successful examples of patch retention have been accomplished where logging personnel were able to adjust the treatment as they proceeded, after being advised of the purpose and principles to follow. As foresters and logging personnel gain experience and feedback on their efforts, cost effectiveness should increase.

Pest and disease implications should be considered when planning patch retention. For example, stands, or portions of stands, heavily infected with mistletoe are poor candidates. Fewer, large patches with selective removal of tall infected trees within patches would reduce the risk of mistletoe spreading into the new stand.

One of the most frequently voiced concerns is the potential for windthrow. Patches should be selected and designed to minimize the risk of windthrow, but some loss can be expected to occur. This is acceptable, even desirable, for future recruitment of downed logs. In cases of extreme windthrow (especially of spruce where spruce bark beetle hazard is of concern) salvage may be considered.

Large patches provide greater opportunities for maintaining existing snags within the patch without compromising safety during silvicultural activities adjacent to the patch. Under existing safety regulations, workers are not permitted within the potential danger zone of snags left in patches. Large patches allow snags to be retained in the central portion of the patch and are usually more wind firm as well. As an alternative to large patches, “no-work zones” can be established around patches or individual dead trees assessed for safety[1] .

If patches are to provide habitat and stand structure in the second growth forest, they have to remain for at least the length of the rotation, or until replacement patches develop suitable characteristics. Some stem removal within patches is acceptable provided close to “typical” levels of dead and declining trees remain, along with enough green stems for future recruitment. If the patches are heavily harvested, then a greater area of retention should be considered to compensate. For example, if a patch is set aside to help meet wildlife tree needs, but is thinned to half typical densities, then twice the area would be needed to provide equivalent habitat value.

---

[1] WCB regulations, see Wildlife/ Danger Tree Assessors Manual.

Table 1. Some Criteria for Selecting Patches and Stands

Biodiversity/Wildlife Considerations	Silvicultural/Operational Considerations
- adjacent to wetlands and riparian areas - rock outcrops/bluffs - diverse tree species and canopy layers - less common tree species - large snags, or potential snags - evidence of present wildlife use (e.g. nests, feeding activity) - unusual or rare plant communities	- advanced regeneration or trees suitable for release and further growth - suitable seed-trees for natural regeneration - gullies or other difficult terrain - deciduous and/or brush patches - windfirmness - visual screening is desired - low disease/pest spread potential - broadcast burning not prescribed

Landscape Level Considerations

The need for patch retention should be considered in terms of the overall landscape. As discussed above, some portions of the landscape are more suited for applying retention then others. The same considerations for selecting patches (Table 1) apply to assessing stands within a landscape. However, it is important to ensure a good representation of sites, tree species and sizes across the landscape.

Patch retention should be considered as part of a comprehensive management strategy that includes reserves outside of harvest units, patches and individual stems left within harvest units, or a combination of approaches. There is less urgency for retention within the harvest units themselves if very little of a landscape is to be developed, harvesting is only beginning, or there is a greater use of reserves (ecosystem networks, riparian buffers).

One approach to assessing the priority for patch retention is to divide the landscape (BEC subzone within a landscape planning unit) into cells (such as the UTM grid of 100ha cells). The amount of retention in each cell is based on the percentage of the over-all landscape to eventually be harvested, and the proportion of the harvesting completed at any given time (Table 2). The result is a greater emphasis on retention in landscapes that are, or will be, more intensively managed. Retention is not necessarily applied in each harvest unit, but rather is applied to each landscape cell. Retention can be planned within harvest units or outside harvest units, so long as the objective is met in the cell.

This approach is intended to provide operational flexibility in designing harvesting operations, while ensuring structural retention across the landscape. A 100 hectare cell size is suggested as reasonable for allowing dispersal of smaller organisms into the second growth stand, for ensuring sufficient numbers and dispersion of wildlife nesting opportunities, while still providing operational flexibility. This approach will work best when applied in a plan that specifies where harvest and retention will occur at each development pass.

Table 2: Patch Retention Objective For Each Landscape Cell

Minimum area (%) in retention for the cells in which development is occurring at any given time. Note that if cells are re-entered at a later date, a new objective applies. Can be calculated from formula: % Retention in cell = (% of the landscape available for harvest + % of the available area harvested to-date) /10. The numbers given here are preliminary recommendations to illustrate the concept (concept developed by H. Armleder, W. Klenner, D. Seip, D. Steventon).

	% Landscape Available for Harvest									
% Harvested	100	90	80	70	60	50	40	30	20	10
10	11	**10**	09	08	07	06	**05**	04	03	02
20	12	11	**10**	09	08	07	06	**05**	04	03
30	13	12	11	**10**	09	08	07	06	**05**	04
40	14	13	12	11	**10**	09	08	07	06	**05**
50	**15**	14	13	12	11	**10**	09	08	07	06
60	16	**15**	14	13	12	11	**10**	09	08	07
70	17	16	**15**	14	13	12	11	**10**	09	08
80	18	17	16	**15**	14	13	12	11	**10**	09
90	19	18	17	16	**15**	14	13	12	11	**10**
100	**20**	19	18	17	16	**15**	14	13	12	11

Example: 60% of the landscape is available for harvest. When only 10% of the available area has been harvested, the minimum retention objective in a cell is 7%, when 90% harvested the retention objective is 15%.

In summary, patch retention is a technique to maintain structural diversity in managed forests.

Maintaining structural diversity within individual forest stands and across landscapes will help achieve wildlife habitat, biodiversity and ecosystem management goals.

CONTACTS

Dave Coates, Research Silviculturist

Doug Steventon, Research Wildife Habitat Ecologist

References and Suggested Reading

Hopwood, D. 1991. Principles and practices of new forestry. B.C. Min. For., Victoria B.C., Land Management Report No. 71. 95 p.

Hunter, M.L. 1990. Wildlife, forests, and forestry - principles of managing forests for biological diversity, Prentice-Hall, Englewood Cliffs, N.J.

Spies, T.A., J. Tappeiner, J. Pojar, and D. Coates. 1991. Trends in ecosystem management at the stand level. Trans. 56th N.A. Wildl. & Nat. Res. Conf., Wildlife Management Institute: 628-639.

Steventon, J.D. 1994. Biodiversity and forest management in the Prince Rupert Forest Region: A discussion paper, B.C. Min. For. Land Management Report No. 82. 30p.