Silvicultural Systems Program
TO THE FIELD NOTES

THE RETENTION SYSTEM:
MAINTAINING FOREST ECOSYSTEM DIVERSITY

INTRODUCTION

The ***retention system*** is a stand-level approach to sustainable ecosystem management. Unlike typical silvicultural systems, where the focus is on the primary method of promoting regeneration, the emphasis of the retention system is on retaining structural elements of the original stand in a cutblock in order to maintain long-term ecological diversity and meet local management objectives.

BACKGROUND

The term ***variable retention*** was first introduced in British Columbia by the Clayoquot Scientific Panel in 1995, and was later described in more detail in a paper by Franklin et al. (1997).[1] Variable retention was developed as an alternative to conventional

Definition:

The ***retention system*** is a silvicultural system that is designed to:

- retain individual trees or groups of trees to maintain structural diversity over the area of the cutblock for at least one rotation, and
- leave more than half the total area of the cutblock within one tree height from the base of a tree or group of trees, whether or not the tree or group of trees is inside the cutblock.

Examples of the retention system.

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[1] Franklin, J.F., D.R. Berg, D.A. Thornburgh, and J.C. Tappeiner. 1997. Alternative silvicultural approaches to timber harvesting: variable retention harvest systems. *In* Creating a Forestry for the 21st Century: The Science of Ecosystem Management. K.A. Kohn and J. F. Franklin (eds.), Island Press, Washington, D.C. pp. 111–139.

silvicultural systems to address a wide variety of forest management issues, including ecosystem processes, habitat connectivity and long-term forest structure. The term was originally applied at both the landscape and stand levels, which led to some confusion. To resolve this terminology issue, the forestry faculty at UBC suggested using *variable retention* to describe the overall landscape approach, and introduced the term *retention system* to refer to the actual silvicultural system.

Principles Behind Variable Retention and the Retention System

Variable retention recognizes the role of structural complexity in maintaining forest ecosystem function and biodiversity by retaining part of the original forest after harvesting. This approach can utilize a broad spectrum of retention strategies, with varying amounts, types and spatial patterns of living and dead trees.

To achieve variable retention over the landscape, the retention system can be combined with conventional silvicultural systems, such as uniform shelterwood with group reserves. The broader focus of retaining structure within the stand results in the maintenance of a much wider variety of forest values, including wildlife habitat and aesthetics. In short, the retention system shifts the management focus from what can be removed to what can be retained.

Fire on a landscape scale tends to leave a mixture of large patches, small groups and single trees across a landscape. This variety leads to a greater amount of biodiversity values being sustained.

Fire can leave large patches, small patches and single trees behind to initiate a new stand and act as "refugia" for a variety of organisms. This is an example of dispersed and aggregate retention at a block- level scale.

Under the retention system, trees can be retained singly, in patches or in some combination of the two to meet stated management objectives. The emphasis is on the degree and pattern of retention. Retention areas should be designed to retain the natural range of stand and forest structures, maintain natural ecosystem functioning and biodiversity, provide habitat connectivity over the landscape, and supply natural refuges for the survival and dispersal of species after harvesting (e.g., wildlife tree reserves).

This 50+ ha area of blowdown is an example of nature providing dispersed retention in initiating a new stand.

Forest Influence

To be considered a retention system, residual trees within and adjacent to the cutblock must *influence* more than half the cutblock area. In his classic textbook, Kittredge (1948)[2] defines ***forest influence*** "as including all effects resulting from the presence of forest or brush upon climate, soil, water, runoff, stream flow, floods, erosion, and soil productivity."

Forest influence is considered to "extend the distance of one tree height away from the base of the retained structure." This is reflected in the retention system definition where it states that more than 50% of the opening must be within one tree height from the base of a tree or group of trees. The distribution of forest influence within a cutblock can vary depending on the location of the retained trees, and the type of retention used—single-tree, group or a combination of both.

Area under forest influence.

The Retention System Versus Other Silvicultural Systems

The retention system is an even-aged silvicultural system, where harvesting can occur in one, two, or more preparatory or intermediate cuts to establish windfirm reserves. Regeneration is established by natural seed-in or through planting ecologically suited species.

On the ground, the retention system can resemble several other silvicultural systems. In some cases, it may look fairly open, similar to the seed tree silvicultural system. In other situations, it may have a relatively intact canopy, similar to single-tree selection or the shelterwood system.

The retention system can also appear somewhat similar to the clearcut with reserves system; however, there are two major differences. The retention system requires individual trees or groups of trees to be distributed over the entire area of the cutblock.

Example of the retention system – retained trees are distributed over the entire cutblock and influence over 50% of the cutblock area. Retained trees can be dispersed, in patches or a combination of the two.

[2] Kittredge, Joseph. 1948. Forest influences: the effects of woody vegetation on climate, water, and soil with applications to the conservation of water and the control of floods and erosion. McGraw-Hill, New York, N.Y.

Example of the clearcut with reserves system, with dispersed trees and patches. While this example may resemble the retention system in appearance, the retained trees are not distributed over the entire cutblock and they do not influence over 50% of the cutblock area.

Typically, the clearcut with reserves system is not concerned with the distribution of the retained trees. The other main difference is the retention system requirement that more than half the total area of the cutblock must be under the influence of standing trees. This is not a requirement under the clearcut with reserves system.

Applying the Retention System

The process for selecting the retention system is largely the same as for other silvicultural systems. It includes assessing higher level plans, forest resource objectives, landscape and stand structural objectives, stand-level objectives, and site-specific soil, terrain, forest health issues, visuals and other factors. A major difference, however, is that emphasis is placed on what will be retained rather than removed. Retention objectives will be unique for each site, and can include biodiversity, wildlife habitat, visual quality or other values.

Retaining individual trees and/or small groups of trees not only increases the structural diversity of the regenerating stand, but also retains patches of undisturbed mature forest to help maintain biodiversity and wildlife habitat. "This structural diversity retains some later seral conditions such as a multi-layered canopy, provides a future supply of large snags and down logs, and may increase microsite variability for a more diverse understorey."[3]

In addition, "Maintaining the natural size- and age-class distributions of trees helps to retain the natural functioning of the forest dwelling biota."[4] Dead standing and down trees provide valuable habitat for cavity-using birds and mammals. The retention of groups of trees can provide critical thermal, protective and foraging cover for a number of species ranging from voles to ungulates. Retention strategies (i.e., single trees and patches of various sizes) can allow a broad spectrum of species to meet their overall needs for food, shelter, protection and reproduction.

The retention system can also be used to meet visual quality objectives (VQOs). By applying spatial patterns of dispersed trees and/or patches, along with other visual quality management techniques, the visual impact of cutblocks can be greatly reduced.

A number of other issues, such as hydrological values, special and or unique features, or sensitive areas, can also be addressed by the retention system. For example, on Vancouver Island, the retention system is being utilized for reserves and management zones around significant surface karst features such as sinkholes and cave entrances.

Any time trees or groups of trees are retained during harvesting, issues regarding values and forest health may become a concern. The type of trees to retain depends primarily on the management objectives for the stand (e.g., wildlife habitat, regeneration, visual quality). For example, if wildlife habitat is a priority, trees of lower economic value with broken tops, deformities, disease and possibly insect infestations may be appropriate for retention, as long as it does not place an unacceptable forest health risk on the regenerating stand and the surrounding forest. The key is to establish clear measurable objectives for the site, and select a retention strategy that best meets those objectives.

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3 Sullivan, T.P., D.S. Sullivan, and P.M.F. Lindgren. 2000. Small mammals and stand structure in young pine, seed-tree, and old-growth forests, southwest Canada. Ecol. Applica. 10:1367–1383.

4 Clayoquot Sound Scientific Panel, Sustainable Ecosystem Management in Clayoquot Sound: Planning and Practices, Report 5, 1995.

Windthrow potential is another important factor to consider when establishing retention strategies. Tree species alone is not a good indicator of susceptibility to windthrow. Each site and the proposed leave trees must be assessed in terms of site hazards, biophysical hazards, windthrow risk, endemic winds and potential impacts. For a full description of the windthrow assessment process, refer to Strathers et al. (1994).[5]

This photo is an example of a coastal shelterwood system. It illustrates similarities between the shelterwood and the retention system. In this case, the major difference between the two systems is that the trees will be retained for only a short period of time (e.g., 10 years) with the shelterwood system, whereas the retention system would retain the trees for at least one rotation or longer.

Example of the retention system in southeastern B.C., utilizing dispersed single trees and patches.

Panoramic view of a retention system cutblock, utilizing patch distribution.

[5] Strathers, R.J., T.P. Rollerson, and S.J. Mitchell. 1994. Windthrow handbook for British Columbia forests. B.C. Min. For. Victoria, B.C. Working Paper 9401.

Conclusion

As our knowledge of the art and science of forest management evolves, it becomes increasingly clear that the trees we leave behind are as important as those we harvest. The use of the retention system, together with other silvicultural systems, will create a mosaic of habitats across the landscape that will help maintain forest ecosystem functions and biodiversity over both the short and long term.

For additional information on the retention system, please contact John Harkema at:

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For assistance in designing cutblocks to meet specific VQOs, the *Visual Impact Assessment Guidebook* is available from the Queens Printer or printable on demand at:

http://www.for.gov.bc.ca/tasb/legsregs/fpc/fpcguide/visual/httoc.htm

Various guidebooks for dealing with forest health issues are available from the Queens Printer or printable on demand at:

http://www.for.gov.bc.ca/tasb/legsregs/fpc/fpcguide/guidetoc.htm.

Field forms (FS 712 – 1, 2, 3, 4 HFP98/05) to assist with windthrow assessments are available from the Queens Printer or printable on demand at:

http://www.for.gov.bc.ca/pscripts/isb/forms/forms.asp

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