

Refining definitions of old growth to aid in locating old-growth forest reserves

TOM BRAUMANDL* AND RACHEL HOLT†

INTRODUCTION

Retaining certain levels of old forest is a cornerstone of the provincial government's biodiversity management strategy. The work we describe involves implementing old-growth retention on the ground with guidance from science. We propose a methodology that consists of two parts:

- a coarse-scale methodology for identification of old forest based on appropriate stand structural attributes (using an aerial inventory); and
- a fine-scale scorecard approach to ranking controversial patches based on an index of "old-growthness," assessed on the ground.

Here we deal primarily with the derivation of the fine-scale index (details of this project are presented in Holt et al. 1999).

The task of laying out old-growth reserves starts with answering the basic question: What is old growth? Definitions of old-growth forest range from those based solely on forest age estimates (B.C. Ministry of Forests and B.C. Ministry of Environment, Lands and Parks 1995) to those derived from principles of forest stand development (Oliver and Larson 1990). Several authors endorse the use of definitions grounded on multiple structural attributes because these structures represent some of the functional aspects of old-growth forests (Spies and Franklin 1988; Franklin and Spies 1991; Marcot et al. 1991; Kneeshaw and Burton 1998; Wells et al. 1998). Attributes used in some ecological old-growth definitions include: large old trees, a multilayered canopy, numerous large snags and logs, diverse tree community, great age of some trees, canopy gaps, hummocky microtopography, complex structure, wider tree spacing, and increased understorey production (from Kneeshaw and Burton 1998; see also Franklin and Spies 1991; Holt and Steeger 1998).

The definition of old growth currently employed by forest planners in British Columbia is based on stand age taken from forest cover maps. This allows the use of provincial forest inventory information without having to incur ground-sampling costs. However, this simple working definition does not evaluate stand structural attributes. Defining old growth without assessment of structure may consequently fail to identify the most biologically important areas of forest.

To supplement the definition of old-growth forest derived solely from mapped stand age, we first suggest a coarse check of potential reserve value. Candidate reserves are viewed from the air. The presence of stand attributes (e.g., appropriate trees, snags, veteran trees, etc.) and landscape-level features (e.g., size, shape, position, landscape context, etc.) are noted for each patch. This approach allows for the checking of map typing. The potential biodiversity value of each patch can then be ranked superficially

CITATION —

Braumandl, T.F. and R.F. Holt. 2000. Refining definitions of old growth to aid in locating old-growth forest reserves. *In* Proceedings, From science to management and back: a science forum for southern interior ecosystems of British Columbia. C. Hollstedt, K. Sutherland, and T. Innes (editors). Southern Interior Forest Extension and Research Partnership, Kamloops, B.C., pp. 41–4.

in relation to other patches available in the area. However, in some cases (e.g., where disputes exist, or where biodiversity values are not clearly determined from the air) ground checking will be necessary.

Ecological definitions of old growth can take the form of minimum criteria, or indices. Although minimum criteria may be easier to develop, many authors support the use of continuous indices. These are thought to better account for the inherent variability of old-growth stands, and can provide a relative ranking of stands (Wells et al. 1998). Thus, stands are not dismissed because they “fail to meet old-growth standards,” but are instead given a relative ranking based on the abundance of a number of attributes.

METHODS

Thirty-six stands were chosen in the Arrow and Kootenay Lake forest districts within the Interior Cedar–Hemlock (ICH) biogeoclimatic zone. Eighteen stands were selected in each of ICHdw and the ICHmw2 variants. Stands, with a minimum size of 10 ha, represented a range of stand ages from 100 to greater than 250 years. Three circular 0.1-ha (17.8 m radius) plots were sampled per stand. The following variables were assessed:

- number of trees > 50 cm DBH
- largest tree diameter
- number of snags in 12.5–25, 25–50, > 50 cm DBH classes
- largest diameter snag
- % of trees > 50 cm DBH with pathological indicator
- multiple canopy layer presence
- number of tree species
- cover and modal height of shrubs and herbs
- % of trees > 50 cm DBH with dead or broken top
- mean and modal LFH thickness
- density of trees in the DBH classes < 12.5 cm; 12.5–40 cm; 40–50 cm, and < 1.3 m tall
- relative abundance and size of canopy gaps
- arboreal lichen abundance

The number of pieces of downed logs greater than 30 cm in diameter were tallied along line-intersect transects. Age was measured on dominant or codominant trees and the largest trees in the stand.

Principal component analysis (PCA) was used to ordinate data collected from plots within stands. Our objective was to find a set of structural attributes that best described the main relationships between plots. Analyses were conducted separately for each BEC (biogeoclimatic ecosystem classification) variant. Only results for the ICHmw2 variant are discussed here.

RESULTS AND DISCUSSION

Two major plot groups were obvious from looking at the ordination (an “old” and a “not-old” group). While not as clearly apparent as the first two groups, the ordination helped identify plots within the “not old” group that contained the most “old” attributes—that is, the recruitment class. The recruitment class was important to define because many landscape units do not contain sufficient old forest to meet policy targets, and hence old-growth reserves must be “recruited” from younger forest in the shortest time possible.

To provide an index for “old-growthness” from our limited pilot study data, we decided to use an approach that does not attempt to weight attributes. Our approach was to use the groups of plots generated by the PCA for each BEC variant to produce a table of threshold values for each attribute that clearly distinguished our structural classes (see Table 1).

To implement this procedure, a surveyor establishes three plots per stand and scores the stand according to the threshold values. This procedure takes about 3 hours. Given present budget constraints,

TABLE 1 *Threshold values for attributes in the ICHmw2, per hectare*

Attribute/Score	Threshold		
	← Not old 1	Recruitment 2	Threshold Old ⇒ 3
Mean age	147	286	
Mean maximum age	204	411	
Density trees > 50 cm DBH	25	84	
Largest DBH	57	74	
Percent big trees with broken/deadtops	13	28	
Percent big trees with pathogens	18	36	
Snags > 50 cm DBH	11	18	
Snags 10–25cm DBH	78	44	

this procedure would most likely be used for contentious stands (e.g., a licensee proposes an alternative candidate reserve to those proposed by government). Both coarse- and fine-scale processes should provide an objective ranking of stand quality in an operationally feasible way. By providing a functionally based definition of old growth, a more effective conservation network could be designated. In addition, management's mandate to maintain a certain amount of old forest would be delivered in a scientifically defensible manner.

In our introduction, we intimated that defining old growth is only the first step in designing an old-growth reserve network. There are numerous landscape (e.g., location, size of individual reserves, historic levels of old growth, biodiversity issues within the working forest) and social issues (timber impact) that also must be taken into account. We (managers and scientists) continue on our quest for the perfect conservation network.

REFERENCES

- B.C. Ministry of Forests and B.C. Ministry of Environment, Lands and Parks. 1995. Biodiversity guidebook. Forest Practices Code, Victoria, B.C.
- Franklin, J.F. and T.A. Spies. 1991. Ecological definitions of old-growth Douglas-fir forests. *In* Wildlife and vegetation of unmanaged Douglas-fir forests. L.F. Ruggiero, K.B. Aubry, A.B. Carey, and M.H. Huff (technical coordinators). U.S. Department of Agriculture, Forest Service, Portland, Oreg. General Technical Report PNW-285.
- Holt, R.F. and C. Steeger 1998. An ecological methodology for old seral identification, assessment and ranking at a landscape scale, in the Nelson Forest Region: Phase II. Kootenay Boundary Land Use Implementation Task Force, Nelson Forest Region, Nelson, B.C. Final report.
- Holt, R.F., T.F. Braumandl, and D. Mackillop. 1999. An index of old-growthness for two BEC variants in the Nelson Forest Region. Inter-agency Management Committee Land Use Coordination Office, B.C. Ministry of Environment, Lands and Parks, Nelson, B.C. Unpublished Report.
- Kneeshaw, D.D. and P.J. Burton. 1998. Assessment of functional old-growth status: a case study in the Sub-boreal Spruce Zone of British Columbia, Canada. *Natural Areas Journal* 18:293–308.

- Marcot, B.G., R.S. Holthausen, J. Teply, and W.D. Carrier. 1991. Old-growth inventories: status, definitions, and visions for the future. *In* Wildlife and vegetation of unmanaged Douglas-fir forests. L.F. Ruggiero, K.B. Aubry, A.B. Carey, and M.H. Huff (technical coordinators). U.S. Department of Agriculture, Forest Service, Portland, Oreg. General Technical Report PNW-285.
- Oliver, C.D. and B.C. Larson. 1990. Forest stand dynamics. McGraw-Hill, New York, N.Y.
- Spies, T.A. and J.F. Franklin. 1988. Old-growth and forest dynamics in the Douglas-fir region of western Oregon and Washington. *Natural Areas Journal* 8:190–201.
- Wells, R., K.P. Lertzman, and S.C. Saunders. 1998. Old-growth definitions for the forests of British Columbia, Canada. *Natural Areas Journal* 18:279–92.

AUTHORS

* **Correspondence to:** Tom F. Braumandl, B.C. Forest Service, 518 Lake St., Nelson, BC V1L 4C6.

E-mail: tom.braumandl@gems5.gov.bc.ca

† Pandion Ecological Research Ltd., Nelson, B.C.