Cariboo-Chilcotin
Land-Use Plan

Regional Biodiversity Conservation Strategy

UPDATE NOTE #1

Key Assumptions and Recommendations For Use of the Inventory Adjustment Factor in the Cariboo Forest Region

Prepared by:
Biodiversity Conservation Strategy Committee

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Biodiversity Conservation Strategy Update Notes are prepared by the Cariboo-Chilcotin Biodiversity Conservation Strategy Committee for purposes of technical clarification or technical additions to the Biodiversity Conservation Strategy report, submitted to the Cariboo-Mid Coast Interagency Management Committee in July 1996. These notes are prepared in response to issues and questions presented to the Biodiversity Committee or recognized by the members of the Committee.

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Key Assumptions and Recommendations For Use of the Inventory Adjustment Factor in the Cariboo Forest Region

Introduction

The inventory adjustment factor was developed by the Biodiversity Strategy Committee to address apparent inaccuracies in the forest inventory regarding the total area of old forest on the landscape. The adjustment reapportions the combined area of mature and old forest into a new mature area and new old area. The Committee intended it to be a one-time only adjustment that would be used for CCLUP integration analyses as a first estimate of the total area of mature forests and old forests. However, since completion of integration analyses, the inventory adjustment has been frequently applied to a variety of strategic and operational issues and has sometimes been used in ways that are not consistent with principal assumptions underlying its use. Where this is the case, its use is not technically defensible and is open to serious criticism. The objective of this note is to describe key assumptions and limitations of the inventory adjustment in order that inappropriate uses will be avoided.

Landscape Model Used to Derive Inventory Adjustment

The inventory adjustment is based on the same landscape-level model that was used for developing seral stage targets in the FPC Biodiversity Guidebook, except for Douglas-fir forests of the IDF[1]. For both the biodiversity guidebook targets and the inventory adjustment, this model was used to describe age profiles on forested landscapes where the principal disturbance agent is wildfire. It was not used to model effects of logging on age profiles. The model predicts the cumulative proportion of forest age classes on a landscape based on the mean interval between disturbance cycles on the landscape. That is, it predicts the rate at which parts of the landscape will be missed by stand destroying disturbances (primarily wildfire) and thus the proportion of the landscape that will survive to reach a given stand age[2]. For purposes of the inventory adjustment, the model was used to predict the proportion of the landscape that would reach old seral stage under a natural disturbance regime with a given mean disturbance interval.

The mean disturbance interval is the mean length of time required for stand initiating disturbances to impact an area equal to that of the entire landscape. Since some parts of the landscape are disturbed two or more times before other areas are disturbed once, some parts of the landscape may have forests considerably older than the mean disturbance interval[3].

Principal Assumptions for Valid Application of the Inventory Adjustment

Appropriate use of the landscape model and the inventory adjustment requires that several assumptions be met. Some of these (the first four below) are assumptions required specifically by the landscape model used to derive the inventory adjustment. Others (the remaining three) are more specific to the inventory adjustment as it was applied in this region. Some of the assumptions (those in italics) contribute important background understanding for use the model but may not need to be understood in

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[1] In the biodiversity guidebook the model is written as: $A(t) = \exp(-[t/b])$, where $A(t)$ is the percentage of the landscape greater than age t and b is the mean disturbance return interval. A variation on this model was used for Douglas-fir forests of the IDF in order to allow old forests to be less susceptible than young forests to stand initiating fires.

[2] Johnson, E.A., K. Miyanishi, and J.M.H. Wier. 1995. Old-growth, disturbance, and ecosystem management. Can. J. Bot. 73: 918-926.

[3] Age profiles of unlogged Cariboo-Chilcotin landscapes were fit to the model and verified that disturbance intervals given in the biodiversity guidebook fit the forests of this region reasonably well.

detail for subsequent use of the inventory adjustment. Other assumptions (bolded) should be evaluated by anyone considering further application of the inventory adjustment.

1. **The forest area to which the model is applied is sufficiently large that natural disturbances (wildfire) of typical extent would affect only a small portion of the area. That is, the landscape is large enough to contain a range of dates of stand destroying disturbances**.

   Comments: The model and inventory adjustment can only be validly applied over large areas at the strategic level, generally areas that are several times larger than the size of a large natural disturbance. It cannot predict age distributions within small areas where single disturbance events can affect a large proportion of the area. The Biodiversity Strategy Committee considers the absolute minimum contiguous area for application of the model and the inventory adjustment to be 5,000 ha. To be reasonably confident in the validity of the inventory adjustment, it should not be applied to any area smaller than an NDT-BEC unit within a landscape unit. Confidence in the validity of the adjustment increases as the area to which it is applied increases.

2. *The mean disturbance interval has not changed appreciably over the time represented by age of oldest forests on the landscape.*

   Comments: The Biodiversity Strategy Committee included a factor estimating the effects of fire suppression on area of old forest to deal with this assumption. Since the inventory adjustment was applied only to mature and old stands, the effects of fire suppression on the area of young stands was not considered to be an issue.

   Some researchers have detected a significant decrease in mean fire return interval over the last 500 years in southeastern B.C., especially in the national parks. No evidence of an appreciable change has been described for the Cariboo-Chilcotin. However, if there has been a significant decrease in fire frequency within the last 500 years, the inventory adjustment may be invalid. The Biodiversity Strategy Committee believes that the small area of old in the inventory is due more to sampling and interpretation of stand ages than it is to a decrease in wildfire frequency.

   As logging increases within a landscape, the effects of natural disturbance regimes on age structure is increasingly replaced by effects of logging. As a result, the validity of the inventory adjustment decreases as the area of logging increases.

3. **All age classes of forests within the landscape are equally susceptible to stand initiating disturbances.**

   Comments: Mature and old forests are clearly more susceptible to logging than are younger forests. However this may not affect the validity of the inventory adjustment since it applies only to the area of mature and old forests in the forest inventory and does not predict the area of these forests relative to younger forests. However, the model also assumes that old forests are not preferentially selected over mature forests for logging and that any one age class within mature forests is not preferentially selected over another for logging.

   If old stands are preferentially selected over mature stands for logging, then the validity of the model and inventory adjustment decreases significantly. The Biodiversity Strategy Committee felt that, although there may be some preferential selection of old stands over mature stands, this bias has not been sufficient to invalidate the initial application of the model. Of greater concern may be the selection of stands of older mature seral stage over those of younger mature seral stage. In the IDF, the inventory adjustment was applied only to age class 8 and 9 Douglas-fir stands rather than to all mature and old Douglas-fir stands. This was done in part to avoid effects of timber harvesting bias for age class 8 and 9 stands over age class 6 and 7 stands. However, it

was not felt that this was necessary in other NDT-BEC units since it was not felt that bias has been sufficient to affect initial application of the model.

If there is some bias, even though small, in the selection for logging of old versus mature stands or different age classes within mature seral stage, then the validity of the model decreases as the extent of logging increases.

4. **All sites within the landscape are equally susceptible to stand initiating disturbances.**

   Comments: For a natural landscape, the validity of this assumption can be challenged since some types of sites may have burned more frequently than other types. However, the Biodiversity Strategy Committee assumed that this issue would not substantially affect interpretations of the inventory adjustment. As the area of logging increases, however, this assumption makes application of the adjustment increasingly invalid since logging is more likely to disturb some types of sites than others.

5. **The inventory adjustment is equally valid for all forested landscapes of the region.**

   Comments: Apparent inaccuracies in the inventory area of old forests are most evident in biogeoclimatic units where old is defined as greater than 250 years. In other biogeoclimatic units, where old is defined as older than 140 years, needs for an inventory adjustment are less evident. In some of these latter biogeoclimatic units, the area of old forests in the inventory may be very similar to actual area. Application of the inventory adjustment in these areas may obscure the correct area, if the actual distribution does not conform to that assumed by the landscape model. The Biodiversity Committee considered that the overall effects on validity of the inventory adjustment from this concern is likely small and, for consistency sake, applied the inventory adjustment to all forested landscapes of the region. However, landscape planners need to recognize this concern when evaluating the area of old forests estimated by the inventory adjustment.

6. **The inventory data for the region accurately reflects logging disturbance history.**

   Comments: The validity of this assumption is of particular concern in the IDF. The inventory adjustment identifies a portion of the total area of age class 8 stands as old based, in part, on the observation that many of these stands have attributes that would likely qualify them as old. This assumption requires that these stands have not been substantially affected by logging. However, it is clear that many of these stands have been affected by logging (especially salvage logging) even though not indicated on the forest inventory. The implications of this are of concern but not yet clear.

7. **The inventory adjustment would be a once-only application replaced over time by more reliable data.**

   Comments: Due to significant concerns regarding application of the inventory adjustment, the Biodiversity Committee assumed the adjustment would be a once-only initial estimate of the relative proportion of mature and old forests within a landscape unit. Over time as new seral stage assessments were required, the Biodiversity Committee considered that these assessments would be modifications to the initial (1996) assessment based on on-site data (age or attribute-based seral stage classifications) collected prior to and after harvesting. Modifications would also include the increased projected ages of unharvested stands. Further inventory adjustments are increasingly invalid.

Recommendations

The following recommendations are provided in order to ensure that any post-1996 applications of the inventory adjustment reasonably satisfy the above assumptions and are therefore reasonably valid and technically defensible.

1. The minimum area to which the inventory adjustment should be applied is 5,000 ha. In general, it should not be applied to any area less than an entire NDT-BEC unit within a landscape unit. Confidence in the validity of the adjustment increases as the area to which it is applied increases. Although 5,000 ha should be considered an absolute minimum area, applications to any area less than several times the size of large natural disturbance events must be interpreted with caution. Natural disturbance events in NDT 3 were often much larger than 1,000 ha.

2. The inventory adjustment should not, in general, be applied to a subset of ecosystems, such as scattered riparian reserves, within an NDT-BEC unit. It is very unlikely that this application would satisfy the following assumptions:
   - the subset of ecosystems is randomly distributed throughout the landscape;
   - the frequency and probability of disturbance has been the same for the subset of ecosystems as for the entire landscape in which they are embedded; and
   - the subset of ecosystems encompasses a reasonably large proportion (generally > 10%) of the entire area of the landscape.

3. The inventory adjustment should not be applied to an inventory data base more recent than 1996. The inventory adjustment should not be applied to an inventory more recent than 1996 since, as the area of logging increases, the age structure of the landscape becomes less natural and the inventory adjustment less valid. If landscape unit boundaries have changed from those assessed for purposes of the integration analyses, the inventory adjustment should be applied to the retrieved 1996 inventory for the revised area, and the assessment of seral stages updated based on harvesting and road building subsequent to 1996. That is, the inventory adjustment should be applied prior to rather than after inventory updates. Updates should be based on on-site data (stand ages or other seral stage attributes) collected prior to and following logging (consistent with the approach described in Section 4.4 of the 1996 Biodiversity Conservation Strategy report) and on increases in the projected age of unharvested stands.

   The Biodiversity Committee recognizes that the inventory adjustment factor is being widely applied to current (post-1996) inventories. If this approach is used for landscapes with active harvesting, it must be recognized that the validity of the inventory adjustment decreases for each subsequent year that it is applied, especially if the rate of timber harvest is high. Over a few years of harvesting, validity of the adjustment decreases substantially.

4. Changes in the area of seral stages after the initial 1996 application of the inventory adjustment should be based on either:
   a) known ages before and after logging or other disturbance,
   b) attribute-based seral stage classifications, or
   c) projected age of polygons.

   For example, if a 100 ha forest is determined to be mature seral stage from on-site age measurements and is clearcut, changes to seral stage proportions would include a 100 ha increase in early and a 100 ha decrease in mature seral stage. If a mature forest is partially harvested, changes to seral stage proportions should be based on residual seral stage attributes. Substantial changes in areas of seral stages will result from annual increases in projected age of unlogged polygons.