Temporal assessment of recreation activities and opportunities in British Columbia: Examining the possible effects of future timber harvesting on outdoor recreation

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INTRODUCTION

Sustainable forest management (SFM) has been recognized in British Columbia as a necessary and desirable means of achieving multiple forest management objectives in a manner that seeks to maintain and balance the integrity of a variety of forest landscape values (e.g., ecological, social, and economic). In 1999, the major timber licensees in the Arrow Forest District in the east Kootenays were awarded an Innovative Forest Practices Agreement (IFPA) by the B.C. Ministry Forests to explore alternative approaches to forest management that addressed area ecological, social, and economic concerns. The goal of the Arrow IFPA was: "…to work towards a scientifically defensible, data-driven, hierarchical approach to developing a sustainable forest management framework for British Columbia."

In an effort to examine alternative forest management approaches, an interdisciplinary group of researchers at the University of British Columbia (UBC) developed and integrated a suite of decision-support tools that permitted the testing of hypothetical forest management scenarios for the Lemon Landscape Unit within the Arrow Forest District. The integration of decision-support tools, which assessed ecological, social, and economic management outcomes, represented an inexpensive method of testing, at various spatial and temporal scales, future forest management scenarios that explicitly recognized and incorporated social values (e.g., opportunities for outdoor recreation) into SFM . The development and assessment of these scenarios can provide explicit guidance and direction for the achievement of multiple management goals (i.e., SFM), and can be a useful heuristic exercise.

As part of this process, a set of criteria and indicators was developed for the Arrow Forest District for use in both decision support and long-term monitoring. This process was based on the criteria and indicators developed by the Canadian Council of Foreign Ministers (CCFM 1997), but adapted locally with input from the public and stakeholders (Meitner et al. 2001). One main criterion that helped to guide the achievement of social objectives was: "Forest management sustains ongoing opportunities for a range of quality of life benefits." One of the indicators for this criterion, "Resources and recreation opportunities (including quality of experience) are maintained and enhanced," was derived in part from a standard mail-out survey sent to area residents. Among a series of potential management objectives which survey respondents were asked to evaluate, this objective (indicator) received the priority ranking for outdoor recreation values (Meitner et al. 2001).

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The purpose of this study, therefore, was to develop and undertake initial testing of a method of quantifying impacts of alternative forest management scenarios on recreation activities, opportunities, and experiences, based on the uses of existing, widely available data sets. The following sections focus on the context and methodology developed for such an initial analysis.

Development of Forest Management Scenarios

Three hypothetical forest management scenarios were developed by the UBC research team to compare different planning assumptions, and the spatial and temporal configurations of forest values. One scenario was based on rules derived from the British Columbia Forest Practices Code (FPC) and represented the status quo for forest management at the time. Another scenario was based on a zoning concept, where timber harvesting was concentrated on productive forestland, and higher elevation and backcountry areas were reserved for wildlife and other values. Outdoor recreation was not an explicit management objective in either of these scenarios. A third scenario was based on a range of key criteria and indicators representing important local values, and on the results of the technical analysis of the FPC and zoning scenarios; this third scenario, dubbed the "Tactical Plan," gave priority to non-timber values, including outdoor recreation.

Assessment of Outdoor Recreation Values Required

To address and track the outdoor recreation indicator across all three scenarios, a decision-support tool was required that considered the relationship between outdoor recreation and timber harvesting in SFM over time. This tool had to be inexpensive to initiate, and be compatible with existing data and models. The method of examining the relationships between outdoor recreation and timber harvesting across spatial and temporal scales that was developed is called Recreation Impact Assessment (RIA).

RECREATION IMPACT ANALYSIS

An objective of this project was that the decision tools be inexpensive to implement; this made the use of existing data a de facto requirement. The British Columbia Forest Service maintains the Recreation Resources Inventory, which catalogues recreation resource-specific information in four distinct inventories. Two of these inventories provided the baseline data for the consideration of outdoor recreation opportunities and activities: the Recreation Opportunity Spectrum (ROS) and the Recreation Features Inventory (RFI). The Recreation Opportunity Spectrum delineates outdoor recreation opportunities along a seven-point continuum (Figure 1) based on a number of factors, including the degree of remoteness and naturalness that an area exhibits, and the social experiences that can be expected (B.C. Ministry of Forests 1998a). The Recreation Features Inventory identifies discrete polygons, called Recreation Feature Polygons (RFPs), based on significant landscape features. Among other recreation resource characteristics, this features inventory identifies the spatial configuration of existing and potential outdoor recreation activities for each polygon (B.C. Ministry of Forests 1998b). Activity mapping is based in part on field observation of actual recreation use in the area, as well as suitability of landscape conditions (including access and setting) for different recreation pursuits (British Columbia Resources Inventory Committee1999).

The harvest polygons and harvesting scheduling information for the management scenarios was provided by the Forest Planning Studio Atlas (FPS-Atlas), ". . . a spatial, forest-level planning model . . . [that is] a time-step, rule-based simulation model designed to schedule [timber] harvest units according to a wide variety of spatial and temporal constraints" (Nelson 1998:5)

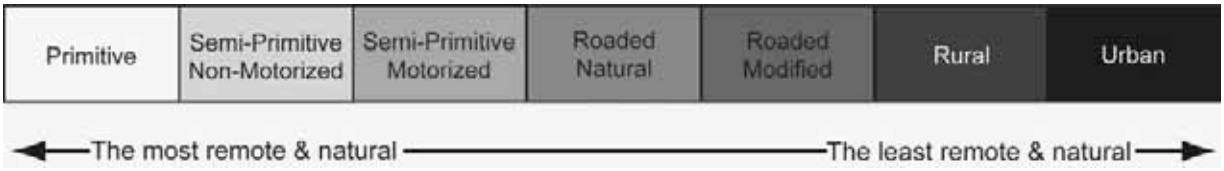

FIGURE 1 *The Recreation Opportunity Spectrum delineates outdoor recreation opportunities along a seven-point continuum.*

The harvest polygons and harvest schedule information projected by FPS-Atlas were incorporated into the SIMFOR model for the generation of forest stand age class maps. SIMFOR is a decision-support tool that helps to evaluate the effects of forest harvesting on landscape and habitat indicators. This model can be used to estimate spatial and temporal indicator trends (Wells and Moy 2002).

The use of models is becoming an accepted means of assessing future forest management scenarios across temporal scales. They allow for examination of trade-offs among multiple forest values at any time-stage and permit the refinement of management thresholds and objectives. FPS-Atlas generates the harvesting scheduling information for discrete polygons from forest cover data, which is readily available from the B.C. Forest Service. The heart of recreation impact assessment is the incorporation of outdoor recreation activity and opportunity data with models that can project harvest and ecosystem information over multiple temporal and spatial scales.

To identify the potential direct effects of forest harvesting activities on the recreation experience, a RIA is based on a overlay of important outdoor recreation polygons with planned timber harvesting activities scheduled over time by FPS-Atlas. ArcView 3.2a, a commercially available geographic information system (GIS) (ESRI 1996), was used for all spatial calculations and manipulations in this analysis. Activities that take place within the boundaries of Kokanee Glacier Provincial Park were not considered in the analysis, as these activities are outside the jurisdiction of Crown land management. Overlay analysis was completed for each scenario.

Data Preparation

The forest stand age class polygons from the SIMFOR model, and the Recreation Features Inventory outdoor recreation activity polygons were manipulated in ArcView 3.2a. Polygons that represented non-Crown land (i.e., outside of the study's jurisdiction) were removed, as they are generally not directly affected by commercial harvesting. FPSAtlas provided harvest schedule information for six harvest entries for all three scenarios: Year 0 (the initial harvest entry), years 5, 25, 55, 105, and 215.

Areas of current importance for outdoor recreation activities were identified from the recreation activity polygons taken from the 1997 Recreation Features Inventory (B.C. Ministry of Forests 1997a). While this inventory identifies up to eight significant existing or potential recreation activities for any given area, only the three most significant outdoor recreation activities for each recreation feature polygon were considered for this study.

The attribute data of the recreation feature polygons were used to establish baseline area calculations for individual recreation activities. The three most significant recreation activities were isolated from each polygon so that the resultant polygons represented the spatial extent of recreation activity occurrence on the landscape for each significance level (e.g., Hiking_1, Hiking_2, Hiking_3) (Figure 2). These polygons were then merged by activity to create a new, generalized polygon that identified the spatial configuration of the activities; the total area of activity occurrence was then calculated. The occurrence of the significant recreation activity polygons was calculated as a proportion of the Lemon Landscape Unit less the area of Kokanee Glacier Provincial Park. These area calculations only take into account that

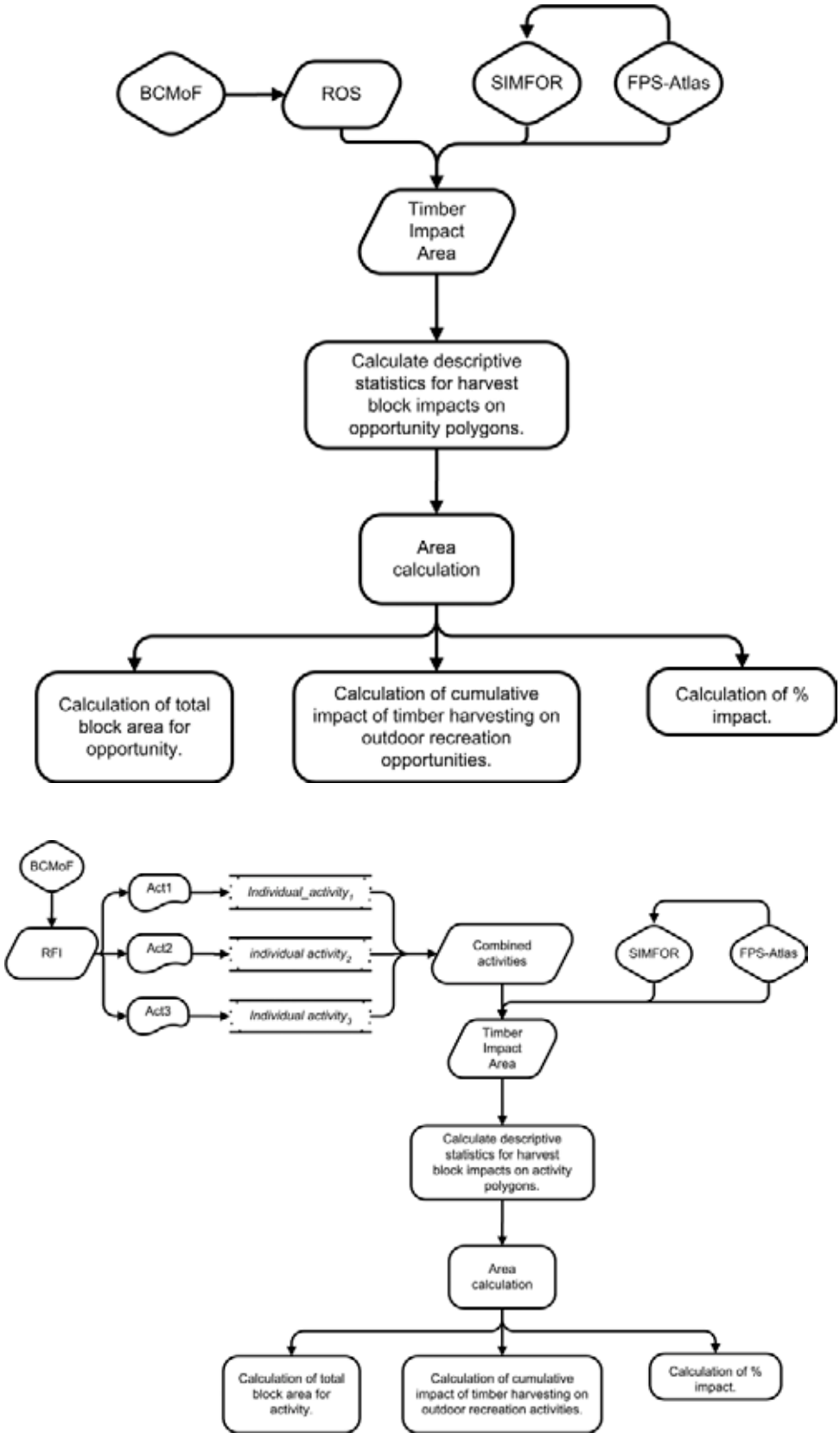

FIGURE 2 *Spatial extent of recreation activity occurrence on the landscape for each significance level*

part of the forest land base on which the outdoor recreation activity has been identified as significant (i.e., the resultant polygons themselves); viewsheds, or buffers outside the outdoor recreation polygons, were not considered.

The stage at which reforestation efforts are typically visually acceptable to visitors (called visually effective green-up or VEG) in Arrow Forest District has been calculated as 28 years after harvest (B.C. Ministry of Forests 2000). For the purposes of recreation impact assessments, once VEG has been achieved, it is reasoned that the effect of timber harvesting on the outdoor recreation experience will be mitigated by visual conditions. Forest age class information from SIMFOR for years 0–28 were selected, combined, and isolated for each harvest entry period that was modelled in FPS-Atlas. Year 0 indicates the harvest year, year 28 indicates the last year that major aesthetic signs of timber harvest activity would be evident from the harvest entry period being examined.

The resulting harvest schedule polygons were used to calculate the effect of timber harvest on recreation activities and on recreation opportunities. Recreation opportunity spectrum polygons were derived from the 1997 recreation resource inventory data (B.C. Ministry of Forests 1997b), and were confirmed by the Arrow Forest District Recreation Officer. These polygons were isolated based on classification, and baseline area calculations for primitive and semi-primitive areas were identified. Although the data was taken from recent inventory data, the polygons are not necessarily current; as a result, existing recreation opportunity spectrum zones may be overestimated. It ought to be noted that a more conservative interpretation of the affected area should be taken for visual effects on opportunity spectrum designation than was taken for outdoor recreation activities. The opportunity spectrum is based on remoteness, naturalness, and social experience factors. As the "Evidence of Humans" element of the "Semi-Primitive Non-Motorized" and "Semi-Primitive Motorized" designation is fairly strict (B.C. Ministry of Forests 1998b), this notion was carried over into this analysis. Because the regenerating stand is noticeably different from the adjacent natural stands, evidence of commercial/industrial use is still apparent in the first 28 years after timber harvesting. Therefore, a full rotation period (e.g., 105 years in the Arrow Forest District) is the suggested temporal scale for estimates of the effects of the harvesting scenarios on semi-primitive non-motorized areas.

Data Analysis

The timber harvest blocks and forest stand information that were derived from FPS-Atlas and SIMFOR were overlaid on the consolidated recreation activity and opportunity spectrum polygons to identify the area of recreation activity and opportunities that would be directly affected by timber harvesting; this represents a best case (minimum impact) assumption as no offsite (e.g., viewshed) effects were built into the assessment. However, not all recreation activities would be equally affected by onsite harvesting activities: while the recreation experience of most activities may be adversely affected during the period of the actual harvesting, some recreation activities might be less affected and possibly even enhanced by timber harvesting activities and increased access over time (e.g., hunting and snowmobiling in clearcuts). The total impact of timber harvesting on a recreation activity was calculated for each timber harvest period by summing the areas of overlaid polygons. The percent of timber harvest impact for each harvest period was calculated for each recreation activity and recreation opportunity. The cumulative area and percent of timber harvest impact on recreation activities by management scenario was calculated by summing the area and percent impact for all harvest entry years (i.e., 0, 5, 25, 55, 105, 215) for each forest management scenario. The mean timber harvest impact of the management scenarios over the planning horizon (by area and percentage) was calculated by summing the timber harvesting impact on a particular recreation activity for each year and dividing by the number of harvest entries. The minimum and maximum timber harvest block sizes were also examined. These calculations were done for each recreation activity for all management scenarios.

The results allowed the research team to evaluate the recreational impacts by time, location, activity, and setting. The performance of the FPC and zoning scenarios in meeting outdoor recreation management objectives (as determined by the indicator and methods described above) was not as satisfactory as expected. The assessment identified areas where timber harvesting effects were highest, and recreation activities and opportunities that were affected the most. The estimates derived by this method formed a defensible basis for an overall assessment of the sustainability of the three scenarios at various time stages over the first hundred years, as defined by interpretations of not only the amount of areas with different recreation opportunities maintained, but also the potential impact on the experience of recreation activities within the Lemon Landscape Unit.

RECREATION IMPACT ASSESSMENT AND SCENARIO DEVELOPMENT

In addition to the impact assessment reported above, the methodology proved useful in designing modified scenarios. The procedure for the development of the third scenario, the Tactical Plan, was different from the other two scenarios, as outdoor recreation management objectives were integrated explicitly into scenario design. The previous analyses identifying trouble spots for certain recreational activities and opportunity spectrum areas led to proposed management strategies that sought solutions where outdoor recreation and timber objectives would be compatible. These strategies were incorporated for testing in the Tactical Plan, and focused, in part, on two activities that were thought to benefit from increased access and timber harvesting, namely snowmobiling and backcountry skiing. Three specific outdoor recreation objectives were identified:

- 40% in-stand retention to be applied to the backcountry ski area in the southern portion of the Lemon Landscape Unit to create ski trails from alpine areas to valley bottoms;
- 20% in-stand retention to be applied to the backcountry snowmobile area in the southern portion of the Lemon Landscape Unit to create improved access and trails that will allow for alpine access from valley bottoms; and
- 100% in-stand retention to be applied to a valley-bottom area adjacent to Kokanee Glacier Provincial Park to provide a future semi-primitive non-motorized recreation opportunity area, to increase the diversity of recreation opportunities in this opportunity spectrum class, and to link existing fragmented areas with semi-primitive settings.

CONCLUSION

This initial implementation of RIA was a "proof of concept" exercise to develop a useful methodology. The use of RIA in the Arrow IFPA Project suggests that the quality of outdoor recreation opportunities and activities, as influenced by proposed timber harvesting activities, can be systematically predicted over space and time in conjunction with other forestry planning models. Further, the use of these relatively simple quantitative methods can provide meaningful and important interpretations of management assumptions, such as the scarcity of certain recreation opportunity spectrum classes or relative vulnerability of recreation activities to timber harvesting. It also demonstrated ways in which the analysis can help to incorporate outdoor recreation opportunities and activities as explicit management objectives in forest management scenario development.

This method of impact assessment is also transferable to other forest districts and ecosystems: RIA is being incorporated (and refined) into another research project examining sustainable forest management in northeastern British Columbia (Dawson Creek Forest District). Current and future work will focus on moving the method towards a more realistic assessment of the impacts to outdoor recreation.

However, the desire for increased sophistication of this assessment must be balanced with the need to keep the method as simple and transparent as possible. Two refinements are planned for RIA: a shift to the evaluation of cumulative recreation impacts, rather than impact relative to baseline status; and the incorporation of the temporal and spatial activation and deactivation of roads, which would be useful for re-evaluating more precisely the recreation opportunity spectrum classifications after harvest entries. At more detailed or operational scales of planning, additional consideration of viewsheds and buffers around vulnerable recreation areas should be contemplated.

The need for a method of assessing timber harvesting impacts on other forest values will likely increase in forest management as forest certification that considers social values and non-timber products become necessary for doing business. It is anticipated that RIA will be able to contribute to a better understanding of the relationships between outdoor recreation and other forest values.

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