INTEGRATING ABORIGINAL VALUES INTO STRATEGIC-LEVEL FOREST PLANNING ON THE JOHN PRINCE RESEARCH FOREST, CENTRAL INTERIOR, BRITISH COLUMBIA

by

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Abstract

Defining and implementing sustainable forest management has bewildered many managers and policy makers. The implementation of "top-down" management strategies can impose inappropriate, generalized solutions to local management problems. Avoiding this problem requires improved methods of eliciting and integrating local knowledge and values into forest management. Recognition of Aboriginal rights to land and resource decision-making is an increasingly important component of sustainability, and Aboriginal communities are a valuable source of local knowledge. However, differences in management approaches and inappropriately structured planning processes present barriers to Aboriginal participation in developing forest management strategies. This is a particularly contentious topic in British Columbia where treaty settlements in most of the province are still under negotiation.

The purpose of this study was to address some of the major challenges surrounding indigenous participation in decision-making for sustainable forest management. Using the co-managed John Prince Research Forest as a case study, an analytical, scenario planning approach was used: to develop a procedure to elicit, translate and incorporate local Aboriginal values, uses and knowledge into the planning process; to generate criteria, indicators and scenarios that would communicate an Aboriginal perspective on forest management; and to demonstrate how an analytical forest planning tool can be used to facilitate the integration of Aboriginal and Western approaches to forest management.

A framework termed the Aboriginal Forest Planning Process was developed to generate forest management criteria and indicators from community archival information. A procedure was developed for codifying this information involving summarization, compilation and categorization of information from interview transcripts. Spatial, quantitative and qualitative criteria and indicators are considered. Spatial criteria are reflected in resource management zones representing past, current, and future uses of the forest, as well as with protective buffer zones for values that are sensitive to forest harvesting.

Four criteria themes and eighteen sub-themes were identified from archives and interviews but few measurable indicators were revealed. A community scenario advisory team was used to review and discuss these results and to identify possible management scenarios. Scenarios representing five possible riparian management strategies were developed in response to community-identified concerns.

Selected indicators representing community-defined criteria were incorporated into the input files of an analytical forest planning tool along with conventional technical indicators. Hypothetical 'what if' questions were generated to demonstrate the use of community indicators in tradeoff analyses and scenario comparisons.

This study revealed that:

- methods can be developed to translate Aboriginal forest values, uses and knowledge into criteria and indicators;
- archived traditional use documents provide a valuable, preliminary source of information for identifying criteria and indicators;

- criteria and indicators facilitate the communication of culturally and locally unique perspectives on sustainable forest management; and
- suitable analytical planning tools can facilitate the development of and communication between local and technical forest management objectives.

In addition to providing an example of participatory, strategic-level planning on the John Prince Research Forest, this research demonstrates that a closer examination of Aboriginal perceptions of proper forest stewardship may clarify myths about diverging approaches to sustainable forest management.

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Acknowledgements

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Most of all, I am indebted to my family, and to Chris, Steve, Erin, and Michelle for giving me the support I needed, when I needed it.

Dedication

To my mother, Sirkka Cecilia Karjala (1931-2001).

Thank God for my mother, for all that I am and ever hope to be I owe to her.

Abraham Lincoln

Preface

This study was part of a larger project entitled "Evaluation of the 'Echo' System for Sustainable Forest Management", headed by Dr. Wini Kessler (principal investigator), Dr. Stephen Dewhurst and Dr. Annie Booth, (co-investigators), and funded by the Sustainable Forest Management Network. While the material contained in Chapters 3 and 4 is tentatively slated for publication under multiple authorship, Melanie Karjala is primarily responsible for the conceptual, analytical, organizational and written work described herein.

Chapter 1:Thesis Introduction

Indigenous societies form a distinct group among resource users. In Canada, Indigenous peoples have an inherent and legal right to use and manage land and resources. This right is based on an extensive history of building cultures, religions, and resource management systems centred on an intimate connection with the land (Notzke 1994; National Aboriginal Forestry Association 1995). Aboriginal societies, however, were severely impacted by colonization. Since the mid-19th century, Aboriginal peoples in Canada have experienced the erosion and marginalisation of their influence over land use, and their access to resources (Fisher 1992; Notzke 1994; Sherry 1999). This shift favoured Western, scientific approaches to natural resource management over Aboriginal systems (Duerden and Kuhn 1998), placing Aboriginal peoples in a peripheral role with few decision-making powers.

Over the past decade, international policies (e.g., World Commission on Environment and Development 1987; Canadian Forest Service 1995), national agreements (e.g., Province of Quebec 1976; Sherry 1999) and court decisions (e.g., Calder [1973], Sparrow [1990] and Delgammukw [1997]) have renewed interest in Aboriginal knowledge as a valid source of information (Bombay 1992; Notzke 1994; Duerden and Kuhn 1998; Smith 1998). Some now suggest that Western and Aboriginal systems of knowledge acquisition and application are complementary, and could lead to a superior approach to natural resource management (Duerden and Kuhn 1998; Berkes 1999).

Consequently, indigenous rights and knowledge are now recognized in Canada's National Forest Strategy:

> *Aboriginal peoples have an important and integral role in forest policy development, planning and management. Forest management in Canada, therefore, must recognize and make provisions for Aboriginal and Treaty rights and responsibilities, and respect the values and traditions of Aboriginal peoples regarding the forests for their livelihood, community and cultural identity.* (Canadian Council of Forest Ministers 1998)

Such policies indicate a change in attitude regarding the Aboriginal role in natural resource decision-making. They are not, however, widely accepted or implemented. Aboriginal communities still rely on high profile protests to influence land use and natural resource decision-making in Canada. This is illustrated by recent conflicts such as the Oka Crisis in 1990; British Columbia's 1994 Gitxan blockade in Hazelton, and 1999 Westbank protest; and the New Brunswick conflict over Mi'maq lobster fishing rights in the summers of 2000 and 2001.

The failure to develop a suitable framework for collaboration is a significant obstacle to improving this situation. Conventional public participation approaches, such as multi-stakeholder processes, are inadequate for meeting the needs of Aboriginal communities (NAFA 1997). Current protocols for incorporating traditional use information into planning processes fall short of Aboriginal expectations, forcing communities into a reactive, defensive position (Pinkerton 1998; Robinson and Ross 1997). This problem is illustrated in a Gitxan Treaty Office document (GTO 1994, p.9), which states:

> *Thirty days' notice to 'respond or accept the results' doesn't cut it. Neither does seven days. Real decisions regarding use of Gitxan traditional lands are made in advance, at the strategic planning level.*

For sustainable forest management in Canada, the challenge is develop appropriate decision-making processes that link international and national Western policies with local Aboriginal perspectives and put them into practice.

Research Purpose and Objectives

The purpose of this study is to address some of the major challenges surrounding indigenous participation in decision-making for sustainable forest management. This thesis presents a case study on the integration of Aboriginal forest values, uses, and traditional environmental knowledge (TEK) into strategic-level forest management planning. Within a co-management context, an analytical planning approach was used to address the following research questions:

1) Can procedures be developed and used to elicit, identify, translate, and incorporate Aboriginal information into an analytical approach to forest management planning?
2) How can an Aboriginal perspective on forest management be communicated using these procedures?
3) How can an analytical forest planning model be used to facilitate the integration of Aboriginal and Western perspectives on forest management?

The objectives of this research were to:

1) Translate Aboriginal community values into forest management criteria and indicators;

2) Use these criteria and indicators and a set of forest management scenarios to characterize an Aboriginal community's forest management approach;
3) Incorporate community-defined criteria, indicators, and scenarios into the analytical planning process; and
4) Document the process.

Case Study

The co-managed John Prince Research Forest (JPRF) was used as the research setting to address these questions and objectives. Established in 1999, the JPRF is a 13,032 hectare working forest jointly managed by Tl'azt'en Nation and the University of Northern British Columbia. The JPRF is located within the Prince George Forest Region, approximately 50 km northwest of the town of Fort St. James, British Columbia (Figure 1). The forest is located in the Sub-Boreal Spruce biogeoclimatic zone (Meidinger and Pojar 1991), and is situated between two large lakes. In its current state, the JPRF represents ecological, historical and cultural characteristics that are common throughout the region. For instance, the research forest:

- is comprised of a diverse forested landscape including natural stands of interior Douglas-fir (*Psuedotsuga mensiezii*) at the northern extent of its range; and
- has a sixty-year history of commercial forest management (JPRF 1999).

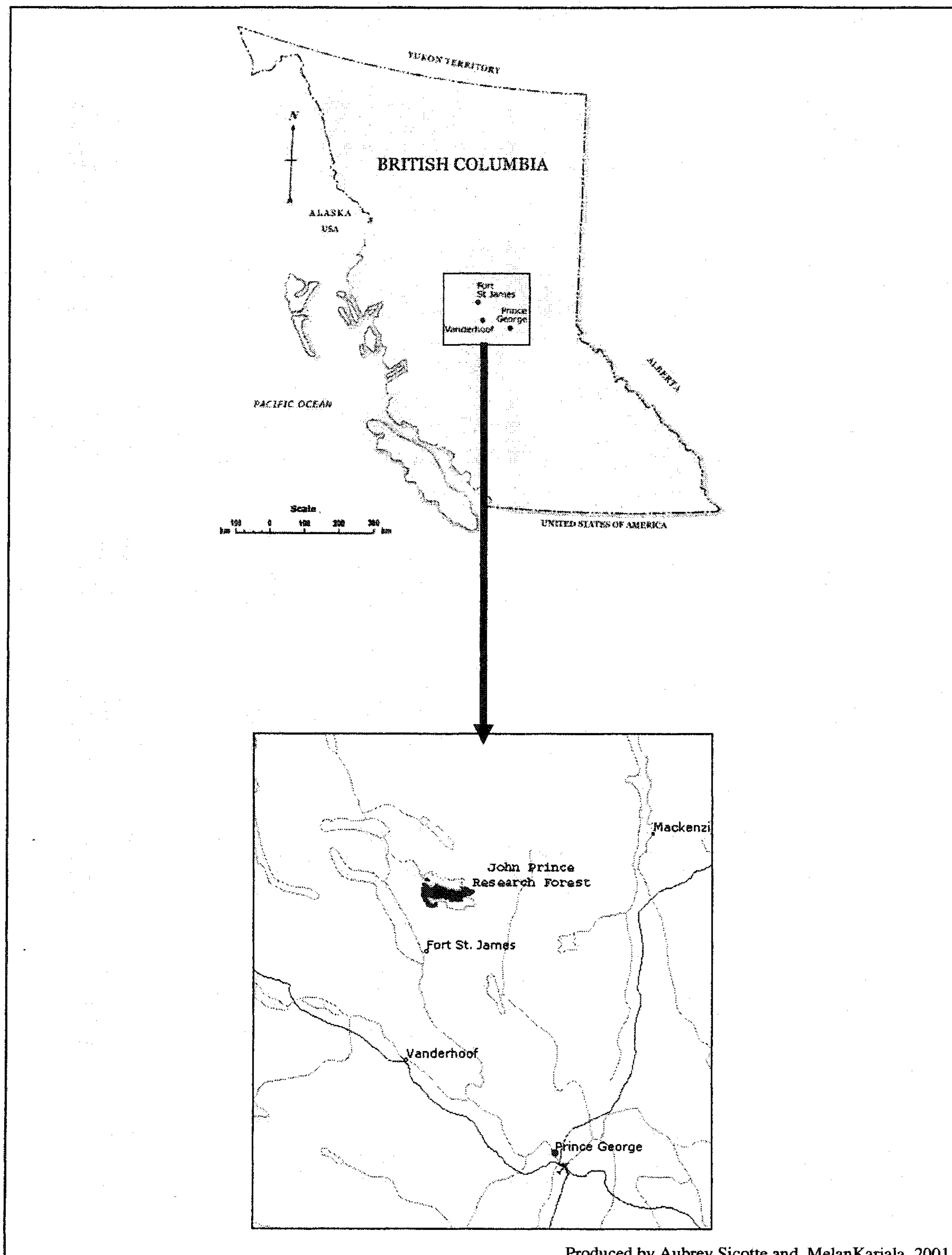

Figure 1. John Prince Reseach Forest location.

The JPRF occupies 0.2% of Tl'azt'en traditional territory (Figure 2) and includes portions of three "Keyohs" (KAY-ohs), which are traditional family territories that are used for subsistence purposes. These territories are currently defined by government-delineated traplines. The JPRF also contains culturally sensitive spiritual and archeological sites. A Tl'azt'en traditional use inventory reveals a history of significant subsistence use in the research forest, including fishing, hunting, and gathering sites. In addition to traditional use, the JPRF currently supports commercial timber extraction, forest management research, as well as recreational activities such as hunting, fishing, hiking and snowmobiling. The JPRF management board has adopted a mandate to combine and improve traditional and scientific methods of understanding human relationships with the land through research, education, and training (JPRF 1999).

Community Profile

Tl'azt'en Nation is comprised of five villages (Morris 1999), supporting a population of approximately 550 people (Indian and Northern Affairs Canada 2001). Thirty-five reserves, ranging between 0.4 and 817 ha in size, are scattered throughout Tl'azt'en's 651,600 ha traditional territory (Morris 1999). Tache (Figure 2) is the administrative centre of Tl'azt'en Nation and is the most populated reserve with 415 residents[1], 55% of which are under the age of 25. In 1995, the total average income in Tache was $13 106 (British Columbia average was $26 295), and in 1996, the unemployment rate was 25% (British Columbia rate was 9.6%). In 1996, 19% of Tache

[1] Demographic information based on Statistics Canada 1996 census (Statistics Canada 2001).

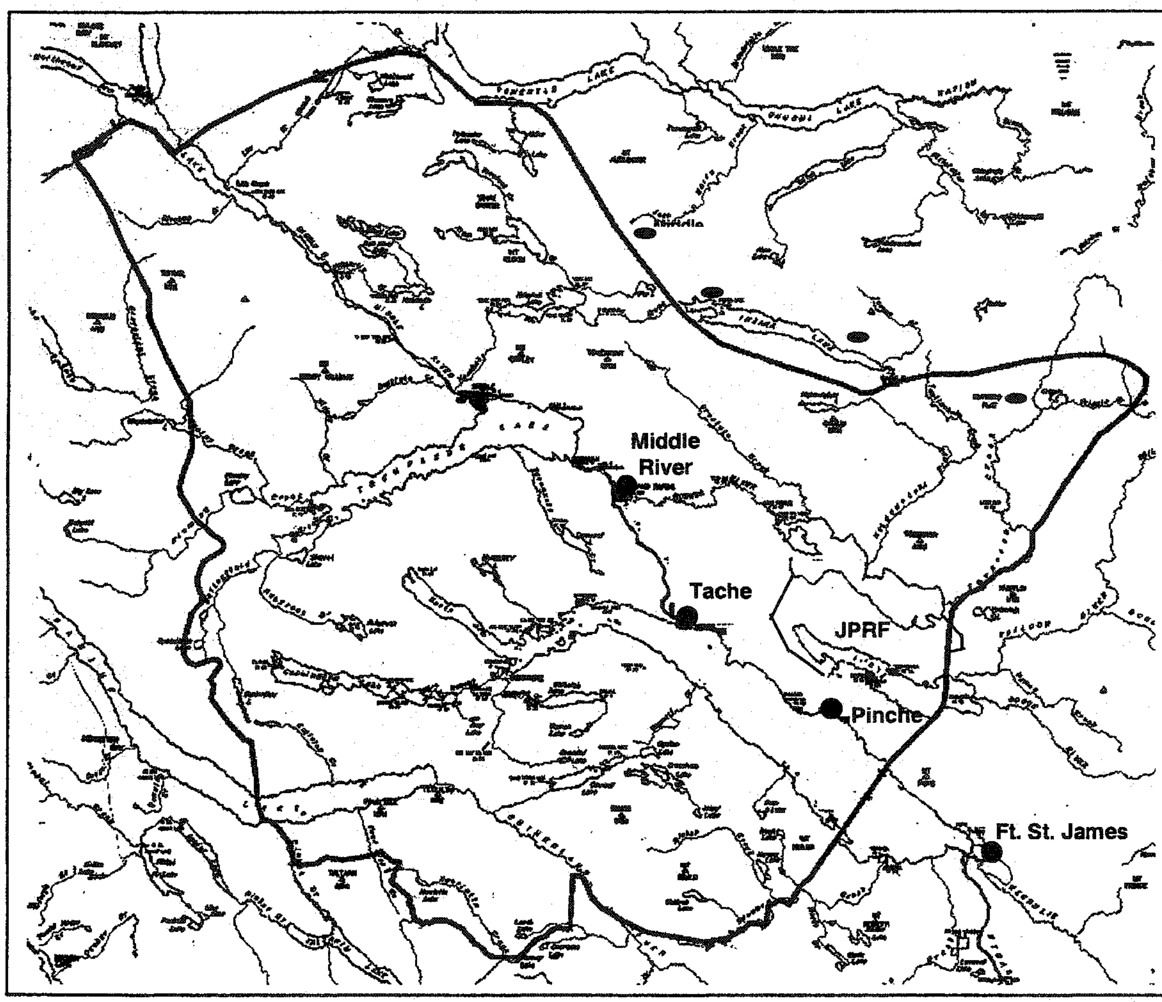

Figure 2. Tl'azt'en traditional territory (approximate boundaries shown by the thick dark line) with the JPRF located along the eastern boundary. Adapted from Tl'azt'en Nation (1999b)

residents 25 years or older had a high school education or higher (British Columbia rate was 71%).

Tl'azt'en reserve lands are under federal jurisdiction, and are administered by Tl'azt'en Nation (INAC 2001). The non-reserve portions of Tl'azt'en territory, and its resources, are still under provincial jurisdiction, as land claim settlements between Tl'azt'en Nation, the provincial, and federal governments are currently under negotiation. Consequently, the majority of the traditional territory is still under tenure to industrial forest companies, with the exception of the JPRF and one tree farm licence (TFL 42) which was granted in 1982 to Tanizul Timber, a Tl'azt'en-owned operation.

Despite the opportunity to implement Aboriginal forestry on TFL 42, Tl'azt'en Nation has faced many challenges in successfully incorporating community interests into its decision-making (Kosek 1993). One barrier involves the strict provincial standards regulating forest licensee operations, which have limited the Tl'azt'en's capacity to adequately address the community's management objectives (Kosek 1993; Nathan 1993; Booth 1998). In contrast, the JPRF operates under a "Special Use" Permit, with a research mandate, providing a flexible environment where Tl'azt'en traditional management approaches can be better explored and implemented.

Tl'azt'en Participation in JPRF Management

The current JPRF management plan (1999) incorporates strategies to address cultural resources identified from the Tl'azt'en Nation Traditional Use Study Report (1999a). These resources include archeological and spiritual sites, as well as forest habitats to support hunting, trapping, and plant gathering activities. Protection zones are the primary management strategy used to address these values. Under the current plan, these protection zones amount to approximately 1,941 ha or 15% of the forest (JPRF 1999). Other management objectives include protection of riparian management zones, restoring natural tree species distribution and composition, maintaining access to plant gathering sites, and implementing a 'no herbicides' policy (JPRF 1999).

Although the research forest management board has equal representation from Tl'azt'en Nation and UNBC, involving the broader Tl'azt'en community in decision-making is an essential part of planning long and short-term forest activities. One of the identified objectives for management plan renewal in 2004 is to enhance the integration of Tl'azt'en traditional use information into the management plan (JPRF 1999). Another objective is to engage the Tl'azt'en community in the technical aspects of forest management planning[2], which will include increased community input into identifying management objectives and strategies, as well as analyzing and interpreting management options.

Approach

From an applied point of view, this research was part of the effort to initiate Tl'azt'en community collaboration, interest, trust, and a sense of ownership of the JPRF. Three key tools define the analytical approach used to

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[2] Interview with Susan Grainger, John Prince Research Forest manager (March 2000). Source: UNBC/Tl'azt'en Nation research project "Evaluation of the 'Echo' system for sustainable forest management" (W. Kessler, PI; A. Booth and S. Dewhurst). Interviewers: A. Booth and B. Bird.

accomplish this task: criteria and indicators, scenario planning, and an analytical forest planning tool.

Criteria and Indicators (C&I)

According to the Canadian Council of Forest Ministers (1995), criteria and indicators (C&I) provide a basis for producing innovative forest management approaches, and serve as a tool for monitoring sustainable forest management goals. A **criterion** is defined as

> *a category of conditions or processes by which sustainable forest management may be assessed. A criterion is characterized by a set of related indicators, which are monitored periodically to assess change,*

and an **indicator** is

> *a measure (measurement) of an aspect of a criterion. A quantitative or qualitative variable which can be measured or described and which, when observed periodically, demonstrates trends.* (CCFM 1995, p.5).

C&I are used as a tool to define the essential elements for sustainable forest management. International (e.g., CFS 1995) and national initiatives (e.g., CCFM 1995), and certification bodies (e.g. Forest Stewardship Council, Canadian Standards Association) use C&I as frameworks to monitor and assess forest sustainability.

C&I that address Aboriginal interests in forest management are included in many of these initiatives, however, their effectiveness is uncertain. For example, in Canada's National level C&I framework, criterion 6 (Accepting Society's Responsibility for Sustainable Development) includes the recognition of Aboriginal rights and participation as a sustainability measure (CCFM 1995). Although Canada's National Aboriginal

Forestry Association (NAFA) acknowledges that this as an improvement over past policies, NAFA indicates that Canada's C&I need to be more specific regarding Aboriginal participation in forest management decision-making. This means that Aboriginal participation should be a *criterion* for sustainable forest management, rather than an indicator (NAFA 1997).

As for forest certification, Smith (1998) concluded that although FSC and CSA standards provide an incentive for sustainable forest management on reserve lands, increased expense, management complexities, and the capacity required to implement these systems may present barriers for Aboriginal communities (Smith 1999). In situations where non-Aboriginal tenure holders are seeking certification, Aboriginal communities must inform themselves of the selected certification system to ensure that their input into forest management is adequate (Smith 1998).

Despite the questionable utility of these C&I initiatives for improving Aboriginal participation in forest management, some suggest that this tool can still benefit Aboriginal communities. For instance, Smith (1998) noted that local-level C&I would have more meaning for Aboriginal communities. Consequently, one of NAFA's research priorities is to identify local, Aboriginal indicators of sustainable forest management (Bombay 1999). In order to be effective, however, a framework for incorporating Aboriginal C&I into forest management must be in place.

The current function of C&I, within a Western context, is to provide a common "language" for defining and communicating forest sustainability across international, national, and sub-national forest management scales and jurisdictions. Given this, they should be useful for communicating locally-defined forest sustainability as well.

Additionally, local C&I can be used to direct landscape level forest management strategies and practices. In a participatory planning process, C&I can potentially:

- Clarify diverse perspectives of good forest stewardship;
- Build collaborative relationships between groups in forest-dependent communities; and
- Prepare Aboriginal communities for the demands of forest certification.

Model-based Scenario Planning

Scenario planning involves addressing complex problems by examining a range of possible futures, and by presenting them as narratives or "stories" (Shoemaker 1995). In the context of forest management, scenario planning assists participants by helping to identify and understand value trade-offs, and the impact of the “large-scale forces and actions that most profoundly influence future landscape conditions” (Dewhurst and Kessler 1999, p. 44). This process involves selecting key forest management indicators which establich a baseline for comparison (MacLean et al. 1999; Dewhurst and Kessler 1999). The scenario planning approach promotes learning, stimulates thought, and fosters creativity with respect to forest management problems and yields the possible strategies available to solve them (Dewhurst and Kessler 1999). Moreover, the scenario planning approach produces a broader range of possibilities by forcing participants to consider options they would otherwise ignore (Shoemaker 1995), and allows them to direct the process by identifying the nature and scope of alternatives to be explored.

The “Lurch” forest planning system was designed to support the scenario planning approach by using C&I to model scenario implementation and facilitate quantitative, comparative, and interpretative analysis (Dewhurst 2001; Dewhurst in prep).

Decision support tools such as Lurch can be used to promote learning about and understanding complex problems and the relationship between the variables involved. Theoretically, this and similar tools can simulate the implications of various forest management strategies on locally relevant indicators thereby facilitating the integration of local values into the planning process.

Thesis Structure

This thesis documents the process of incorporating Tl'azt'en forest values, uses and traditional knowledge into the analytical, scenario planning approach. Chapter 2 contains a review of the literature on sustainable resource management, public participation planning processes, Aboriginal land stewardship, and the relationship between Aboriginal and Western approaches to natural resource management.

Chapter 3 describes the procedure that was developed and used to elicit, identify and transform Tl'azt'en information into C&I. Chapter 4 presents the results of this analysis in the form of Tl'azt'en criteria and scenarios for the JPRF. Chapter 5 demonstrates how quantitative and spatial indicators can be used to represent Tl’azt’en criteria in the Lurch forest planning system. Chapter 6 provides a summary, recommendations, and concluding comments.

Chapter 2: Literature Review

Introduction

Although "sustainability " is a common goal for most forest management plans, the term has often caused confusion over how to interpret and implement its principles (e.g., Callicott and Mumford 1997; Rattray 1999). While this has limited improvements to land use and natural resource planning efforts in the past (Wilson et al. 1996; Holling et al. 1998), national initiatives continue to pursue a sustainable forest management strategy (e.g., CCFM 1998). The following literature review addresses the question of sustainability and how it relates to forest management practices in a social context.

Defining "Sustainable Forest Management"

Uncertainty over sustainable forest management has resulted from a change in society's definition of sustainability (Wilson et al. 1996; Blouin 1998; Holling et al. 1998). In the past, a *sustained-yield* approach was emphasized. This involved management for long-term commercial wood production, where the rate of harvest and the rate of forest growth are balanced to ensure a steady or even flow of timber (Leuschner 1990; Holling et al. 1998).

Sustained-yield management was associated with equilibrium theories in ecology. This implied that regulated forest management would maintain a stabilized ecosystem (Berkes 1999). Consequently, policies such as fire suppression and salvage harvest of insect infestations were implemented (see Baskerville 1995). Although sustained-yield management predominated in Canada in the 1950s and 60s, these policies still influence management today (Blouin 1998; Berkes 1999).

The modern approach to sustainability is often associated with the World Commission on Environment and Development report, *Our Common Future* (WCED 1987). *Sustainable development* requires balancing social, economic, and ecological "values" in such a way that future generations are able to meet their resource needs (Berkes and Folke 1998). This approach requires balance between a broader set of forest uses than is the case with a sustained-yield approach. The term, however, suggests a paradox, implying change and stability at the same time leaving practitioners with a vague direction for setting management objectives (Holling 1995; Toman and Ashton 1996).

Ecosystem Management, Adaptive Management and Resilience

Accompanying the new sustainability paradigm are several concepts that attempt to clarify its application. *Ecosystem management* is management that is ecologically viable, socially desirable, and economically feasible (Salwasser et al. 1993; Maser et al. 1994). Its key principles include complexity, connectivity, change, multiple scales, diversity, humans as part of nature, uncertainty, and adapting to and learning from change (Noss 1993; Salwasser et. al. 1993; Maser et. al. 1994; Gunderson et. al. 1995). There are some discrepancies, however, over how these principles influence management. Gordon (1993) described ecosystem management as a tool to strike a balance between the social and ecological aspects of natural resource management, while Salwasser et al. (1993) suggested that it is more of a process or way of thinking, rather than a set of practices.

Adaptive management is another key component of sustainability (Holling 1978; Walters 1986). It embodies the idea that management practices and policies should be designed to foster learning about the interaction between ecosystems and human activities (Walters and Holling 1990; Gunderson et. al. 1995; Kessler 1999). Knowing that complexity, connectivity and change are inherent in ecosystem management, adaptive management involves the recognition that uncertainty, surprise, and crises must be viewed as opportunities to acquire and use new knowledge (Holling 1995).

Another element of the new sustainability paradigm is *resilience* to change (Duinker et al. 1991; Maser et al. 1994; Kimmins 1995; Holling, Berkes and Folke 1998; Berkes and Folke 1998). Social resilience is maintained through economic diversification and stability (Duinker et al. 1991). This is achieved by retaining local identity and autonomy over natural resource decisions (Sancar 1994). Similarly, biological diversity ensures ecological resilience (Noss 1993; Franklin 1993). Bonnicksen (1985) suggested that social systems are more resilient because they adapt quickly to new situations, while ecological systems are less resistant because they adjust slowly. Social and ecological systems interact and adapt to each other (Bonnicksen 1985). Therefore, to maintain resilience in both, management must consider social and ecological systems simultaneously (Maser et al. 1995; Holling et al. 1998; Berkes and Folke 1998).

Failure to implement these wholistic approaches in forest management has had social, economic, and ecological repercussions. Holling (1995) observed that successful management of one ecological variable (e.g., forest insects) causes slow changes in other characteristics within the ecosystem. This has resulted in landscape level homogeneity, economic dependence on sustained production, and ultimately the loss of ecological and social resilience (Holling 1995). Another major implication of implementing a narrow management focus is conflict over values (Westman 1990; Salwasser et al. 1993).

Addressing Values in Sustainable Forest Management

Values are an important consideration in resource management because they directly influence and shape forest management strategies and policies (Henning and Mangun 1989). Beckley et al. (1999) discussed the distinction between *held* and *assigned* values. Held values are abstract beliefs, norms, and morals that are internalized by individuals or a group, while assigned values refer to a measurable level of worth attached to a good or service (Beckley et al. 1999).

While held values are a product of community and culture, the connection between values, attitudes, and behaviour is still not understood (Beckley et al. 1999; Kusel 2001). Despite this uncertainty, assigned values are often considered as manifestations of held values in the context of forest management (e.g., Robinson et al. 1997; Kusel 2001). Therefore, values that are assigned to certain components of the natural environment are human constructs, and are communicated based on human/nature interactions (Robinson et al. 1997). It is these assigned values that are most readily available to guide and develop sustainable forest management, by revealing those forest resources and services that are important or meaningful to people, and also by prioritizing them. These values can be expressed in quantitative or qualitative form.

Social Forestry

Determining the appropriate balance between values is at the crux of sustainable management. While management strategies are often based upon scientific knowledge, our current understanding of ecosystems is incomplete. Therefore, decisions must include the identification of, and consensus over sets of values (Franklin 1993; Romm 1993). It is generally accepted that balancing values for resource management and planning should be determined democratically, by the public, not by scientists and professionals (Franklin 1993; Maser et al. 1994; Renn et. al. 1995; Callicott and Mumford 1997; Blouin 1998).

Social forestry involves management that considers social costs and benefits, and involves the public in decision-making (Kimmins 1995). Jobs, quality of life, and the health of resource-dependent communities are examples of social and economic values that require consideration in forest management (Duinker et al. 1991; CCFM 1998). Social forestry is sustainable because it "aims to become more resilient to the vagaries of external economic forces" (Duinker et al. 1991, p.131). The community forest concept, for instance, exhibits many characteristics of social forestry (Duinker et al. 1991; Brendler and Carey 1998):

- communities receive a portion of the benefits (usually economic) derived from the forest;
- residents are involved in decision-making;
- forest development plans are based on protection and multiple resource management; and
- community members are satisfied with the benefits and their involvement in making decisions.

Social forestry suggests that another feature of sustainable management is de-centralized decision-making. Forest management policies and strategies that are developed at the national or sub-national levels often do not meet the needs of forest-dependent communities that are ecologically and socially diverse. Sancar (1994) and

Lautenschlager et al. (2000) argue that such "top-down" sustainability objectives are too generalized, with little relevance to problems that are "experiential and situational".

Human worldviews, perceptions, values and knowledge are a construct of their environment, and vice versa (Tuan 1990, Sancar 1994). Therefore, by de-centralizing forest management decisions, local expertise (available through participatory public planning processes) can be used to provide specific and useful information for developing and implementing sustainable forest management (Lautenschlager et al. 2000). Management decisions made otherwise can result in conflicts between global and national values with values that are regional and local.

Public Participation in Sustainable Forest Planning

Public participation processes are used to elicit and apply local values and knowledge to develop plans. Renn et al. (1995, p.2) defined public participation processes as,

> *Forums for exchange that are organized for the purpose of facilitating communication between government, citizens, stakeholders and interest groups, and businesses regarding a specific decision or problem.*

Public involvement in forest management decision-making has several benefits, including (Blouin 1998):

- decisions that reflect a broader range of values,
- reducing or eliminating conflict,

- educating participants, and
- lending credibility to planning processes.

Public participation is an opportunity to link global ideals with local realities (Sancar 1994), and also to connect decision-makers and managers with knowledge holders (Westley 1995).

From this, participatory forest planning can be described as a tool that is used to:

- identify common values amongst individuals or groups of stakeholders;
- identify conflicting values between individuals or groups of stakeholders;
- incorporate current scientific and local knowledge into the decision-making framework;
- establish a framework for locally defined, sustainable management;
- establish strategies for forest management; and
- achieve consensus between stakeholders.

In practice, most natural resource management planning processes have failed to adequately involve citizens in decision-making. Interest groups or stakeholders that hold the most power often have the greatest influence over decisions generated from planning processes (Sancar 1994). These groups emphasize generalized, scientific observations, while anecdotal and local knowledge is excluded, resulting in decisions that are "incompetent, irrelevant, or simply unworkable" (Renn et. al. 1995, p.1). Alvarez and

Deimer (1998, p. 58) noted, "part of the problem is a general lack of understanding of how to involve the non-scientific community".

Successfully integrating knowledge into the planning process depends on the level of influence of the knowledge-holders, and the form in which the information is presented. Because most planning processes are generalized, problems arise when new types and forms of information are introduced (Westley 1995). Consequently, the ability to observe, interpret and adapt to change (new information) is impeded when managers attempt to implement the plan (Westley 1995). The subsequent decisions often lack public support and alienate both citizens and practitioners (Renn et. al. 1995; Westley 1995).

To minimize such problems, Blouin (1998) proposed four cornerstones for effective public participation processes:

1) equitable representation,
2) access to information,
3) acceptance of the process, and
4) informed participants.

One example of a large-scale public planning process is the Land and Resource Management Planning (LRMP) process initiated by the Province of British Columbia in the 1990s. This process is described as (Land Use Coordination Office 1996):

An integrated, sub-regional, consensus building process that produces a Land and Resource Management Plan for review and approval by *government. The plan establishes direction for land use and specifies broad resource management objectives and strategies.*

Case study evaluations conducted by Tamblyn and Day (1998) and Hawkins (1997) have used the achievement of consensus as a primary indication of LRMP success. Other criteria include public involvement participation incentives, methods of selecting participants, level of involvement, process management, and process mechanics (Tamblyn and Day 1998; Hawkins 1997). Although encouraging Aboriginal involvement was among the LRMP guiding principles (LUCO 1996), it is not among the evaluation criteria in LRMP assessments (e.g., Tamblyn and Day 1998; Hawkins 1997). Officially, Aboriginal representatives did not engage in the decision making process in most LRMP tables because (Liu 1994; Tamblyn and Day 1998; J. Davis, pers. comm.):

- the process was not structured to address the legal question of who should possess rights to land and resources. Therefore, with the land question unanswered, Aboriginal groups chose to direct their limited resources toward treaty negotiations;
- it was unclear in the early stages if this participation in the LRMP would compromise treaty negotiations, and so many groups opted out; and
- because the process involved working towards consensus solutions, there was potential for conflict between the firm political position of some local Aboriginal leaders and the flexibility required from their Aboriginal representatives at the table.

Aboriginal groups did, however, contribute to the process informally in order that their legitimate interests and relationships with non-Aboriginal stakeholders were recognized and maintained as much as possible (A. Artz, pers. comm.; J. Davis, pers. comm.). Although more recent LRMP tables have active involvement of Aboriginal groups in the process, and are attempting to develop ways of overcoming the barriers to their participation (J. Davis, pers. comm.), treaty issues are still a high priority for most First Nations, and neither forum (treaty negotiations nor LRMPs) appear to be suitable for Aboriginal participation in natural resource decision-making.

Aboriginal Knowledge Systems and Natural Resource Management

Knowledge generated within Aboriginal societies is recognized as being distinct from Western knowledge in its acquisition, communication, application and dissemination. Also referred to as traditional ecological knowledge, indigenous knowledge, local knowledge, and ethnoecology (Johnson 1992), the Aboriginal knowledge system is defined by Berkes (1999, p. 8) as:

> *A cumulative body of knowledge, practice, and belief, evolving by adaptive processes and handed down through generations by cultural transmission, about the relationship of living beings (including humans) with one another and with their environment,*

and similarly defined by Johnson (1992, p. 4) as,

> *A body of knowledge built up by a group of people through generations of living in close contact with nature. It includes a system of classification, a set of empirical observations about the local environment, and a system of self-management that governs resource use.*

Although there is some debate over whether using the word "traditional" is appropriate for knowledge that evolves over time (Berkes 1999), the most commonly used term, traditional environmental knowledge (TEK) will be used here and includes both past and current Aboriginal knowledge. Further discussion on terminology can be found in Berkes (1999).

Berkes (1999) presented three primary components of TEK; *knowledge* of the environment; *practice* of land-based activities and; *belief* of the human role in the environment. TEK is adaptive, dynamic, and cumulative, and includes the spiritual, cultural, social and ethical aspects that govern the interpretation, implementation and transfer of knowledge (Berkes 1988; 1999). This knowledge-practice-belief system manifests itself in four interacting and often indiscernible levels (Berkes 1999):

1) *Local knowledge* of plants and animals;
2) *Resource management systems* that include an appropriate set of practices, tools and techniques. This requires an understanding of functional relationships and ecological processes;
3) *Social institutions* that establish rules and codes for social relationships; and
4) *A worldview* that shapes perceptions and provides meaning to observations.

Like most ecosystems, traditional management systems are adaptive and resilient (Feit 1988; Berkes 1999). When one component or level of the knowledge-practice-belief system undergoes change, the other components adjust accordingly (Berkes 1999).

Berkes (1999) observed this adaptive approach amongst the Chisasibi Cree in northern Quebec. After 80 years of low caribou populations, the community relied on the Elders (social institution) to transfer historical information (local knowledge), and manage the caribou hunt (practice) by re-instating respect for the animal and ensuring their return (worldview). This flexibility is a result of self-management, where the resource users are also managers (Feit 1988). Information exchange and decision-making are more efficient and effective within self-managed systems. As a result, they have the capacity to adapt to cycles of disruption and renewal (Feit 1988; Berkes 1999).

Aboriginal and Western Management Systems

Integrating Western and indigenous management approaches can provide several benefits, and poses as many challenges. Indigenous communities foresee several advantages to developing this relationship (Fast and Berkes 1994; NAFA 1997):

- the meaningful participation of Aboriginal people in resource management will confirm the legitimacy of Aboriginal title and rights to land and resources;
- having influence over management decisions would help to address the social and environmental concerns of Aboriginal communities;
- the relationship provides the opportunity to foster the maintenance and implementation of traditional knowledge by participating in resource management activities; and

- incorporating TEK into management can provide unique interpretations to environmental signals, and fills gaps in scientific knowledge of ecosystems.

Despite these benefits, there are several barriers preventing the integration of Aboriginal and Western management systems. One challenge involves archiving the information for future generations (Johnson 1992; Robinson and Ross 1997). The exercise of documenting traditional land uses benefits Aboriginal communities by generating human and technical capacity through participatory research methods (Robinson and Ross 1997). However, in cases where this information is available, it is inadequately integrated into forest management planning processes (Robinson and Ross 1997).

Another challenge is in reconciling Western and indigenous worldviews. The Western worldview is typically characterized as reductionist, generalized, “objective”, and quantitative, and has often rejected Aboriginal approaches because of TEK’s intuitive, spiritual and religious aspects (Johnson 1992; Berkes 1999). Aboriginal worldviews and ethics attach a significant amount of cultural and personal history to the land. As Berkes (1999, p. 6) stated,

> *Stories and legends are part of culture and indigenous knowledge because they signify meaning. Such meaning and values are rooted in the land and closely related to a 'sense of place'*.

Cultural differences present another barrier (Johnson 1992). Traditional environmental knowledge is embedded in cultural meaning, therefore cultural awareness is a prerequisite for people involved in gathering and interpreting such information (Johnson 1992). Researchers from outside the community must be familiar with the local culture, and take an interdisciplinary approach to data collection (Johnson 1992). This means elements of both the natural and social sciences must be present in the research team, the methodologies used, and in the analytical aspects of the study. Institutions that accept TEK as a valid contribution to the management of resources must be present to effectively implement the knowledge (Johnson 1992). This requires a shift in authority that allows indigenous groups more influence over decision-making.

Co-management arrangements have allowed Aboriginal groups to regain influence over decision-making, resulting in greater acceptance of TEK's contribution to natural resource management (Osherenko 1988). However, much of the literature addressing co-management in Canada is focused on the circumpolar north and on wildlife management (e.g., Freeman and Carbyn 1988; Johnson 1992; Fast and Berkes 1994), or fails to go beyond broad principles for applying indigenous approaches in forest management. It is not until recently that investigators have begun to consider the characteristics of Aboriginal forest management (e.g., Kosek 1993; Robinson and Ross 1997; Booth 1998; Smith 1998).

Although fundamental differences exist between Western and Aboriginal theories to collecting, processing, interpreting and using knowledge, recent changes in both societies have brought their management philosophies closer together (Berkes 1999). The current ecosystem and adaptive management approaches parallel traditional systems (Holling et al. 1998; Berkes 1999). According to Berkes (1999), these "new" management ideologies provide an opportunity to allow Western and Aboriginal management systems to complement each other; an opportunity that was not available in the past.

Chapter 3: Criteria and Indicators for Sustainable Forest Planning: A Framework for Recording Aboriginal Resource and Social Values[3]

Introduction

Elders, who have the earliest memories of life on the land, and who have comprehensively learned and used the skills necessary to subsist from the land, are the primary source of TEK. Indigenous societies, however, are experiencing the loss of TEK, as Elders pass on without communicating this knowledge to younger generations, and as Western society continues to influence Aboriginal culture (Johnson 1992). This problem has generated initiatives such as Traditional Use Studies (TUS)[4] which have enabled indigenous communities to develop technical and research capacity to collect and document local culture, language, uses, knowledge, and skills related to land and resource use (Johnson 1992; Robinson and Ross 1997).

Although TUS would be a logical source of information to initiate the integration of Aboriginal values into land and resource management, most communities are reluctant to share TEK with "outsiders" who could potentially exploit or misuse it for profit or political gain. This guardedness encompasses intellectual property issues including:

- knowledge of natural medicines which may be of interest to the pharmaceutical industry;
- locations of spiritual or archeological sites of interest to the tourism industry; and
- evidence of the extent of historical land use by Aboriginal groups of interest to government for negotiating land claims.

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[3] A version of this chapter will be submitted for publication under the following authorship: Melanie K. Karjala, Erin E. Sherry and Stephen M. Dewhurst.
[4] This refers to studies in B.C.; in Alberta, they are known as Traditional Land-use and Occupancy Studies (TLOUS) (Robinson and Ross 1997).

Academia has also exploited Aboriginal knowledge. Until recently, TEK was considered to be public information, and was commonly used by researchers without acknowledging, or seeking validation from their Aboriginal sources (Berkes 1999). Moreover, attempts to translate and filter TEK through Western cultural biases and standards have compromised the integrity of the source information (Duerden and Kuhn 1998). Alternatively, TUS involves community-based documentation of TEK allowing Aboriginal groups to retain ownership of the information, and to record it in a culturally appropriate form (Berkes 1999).

If sustainable forest management necessitates the integration of Aboriginal and Western knowledge, a common framework for information sharing is required to overcome mistrust as well as existing ideological, cultural and communication barriers which prevent Western and indigenous societies from building constructive resource management relationships (Johnson 1992; Pálsson 1998). Otherwise, implementing current national forest policies involving sustainable management will not be possible (e.g., CCFM 1998). There is a need for processes and tools that:

- meaningfully involve Aboriginals as participants in the decision-making process at the community level;
- draw upon the strengths of both Western and Aboriginal management approaches;
- protect sensitive and confidential information;
- preserve the integrity of TEK; and

- are adaptable to a diversity of cultures, ecosystems and resource management situations.

Due to the political and legal barriers related to Aboriginal land title in British Columbia, opportunities to access TUS information and develop planning processes that meet the requirements listed above are rare. The John Prince Research Forest (JPRF), however, provides an excellent opportunity to address these concerns. This chapter describes the Aboriginal Forest Planning Process (AFPP), an information management framework designed specifically for integrating Tl'azt'en's archived TEK into the analytical scenario planning process.

The Aboriginal Forest Planning Process (AFPP)

The AFPP procedure is based on the idea that local land uses, priorities, issues and concerns provide a foundation for developing appropriate sustainability indicators and for directing planning processes (Williams and Matejko 1985; Lautenschlager 1998). Sancar (1995) and Lautenschlager et al. (1998) argue that decisions based on these "bottom-up" methods are the most relevant for achieving sustainable management.

In order to generate information for this analytical planning approach, a Tl'azt'en forest management perspective had to be identified. Before interviews and focus groups were conducted, existing community archives were used to acquire preliminary information. The AFPP was developed to provide a framework for selecting, classifying and organizing Tl'azt'en information into C&I for sustainable forest management.

Tl'azt'en Nation granted access to archives stored in their Natural Resource and Administration offices. This information included:

1) FRBC research interviews. This source included a set of transcripts from a collaborative project between UNBC and Tl'azt'en Nation[5] conducted between 1997 and 1999. These included semi-structured interviews involving a range of participants including Tl'azt'en youth, Elders, forestry workers, and administrators.
2) TUS documentation consisted of traditional land use maps that were coded and cross-referenced with a database containing source information, an explanation of each site usage or significance, and, if applicable, flora and fauna used for subsistence purposes.
3) Elders' interviews included transcripts of individual interviews and focus groups with Elders conducted between 1978 and 1995. These interviews were carried out by Tl'azt'en researchers to expand the community's archives. The interview questions were not transcribed, but appeared to be semi-structured and open-ended given the responses recorded. The subject matter generally involved Aboriginal life before 1950.
4) Secondary sources including reports and publications on local Aboriginal history, anthropology, and ethnobotany.

Tl'azt'en values, uses and knowledge were extracted from these sources using a three-stage content analysis approach: summarization, compilation, and categorization.

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[5] These interviews originate from a project titled *Linking Forestry and Community in the Tl'azt'en Nation: Lessons for Aboriginal Forestry* (June 1997-May 1999), funded by a Forest Renewal British Columbia (FRBC) Research Grant. The project team members were Dr. Annie Booth (UNBC), Principal Investigator; Dr. Gail Fondahl (UNBC) and Umit Kitzilan (Tl'azt'en Nation), Co-Investigators.

Stage 1: Summarization

This first stage of the analysis involved reviewing the interview transcripts, secondary sources and databases to identify information related to forest management. For each interview or document, source information was recorded. For interviews, this included: an interview number; the date, time and place of the interview; identification of the corresponding interview recording; and names of the interviewer(s), interviewee(s), and the transcriber. For secondary sources, a full reference and archival location was recorded. This reference information facilitates validation with source data.

The information was then condensed into direct quotations and/or point-form notes. Summaries were necessary because the sources were not directed specifically at identifying forest management values. In the process of reviewing interviews, the investigators sought information that could be equated with possible management objectives and criteria. Three questions were used to guide the analysis:

- What is important to people in this community?
- What are their concerns?
- What ideas emerge as solutions to some of their resource and social problems?

The scope of values collected was kept broad in order to capture a complete picture of Tl'azt'en concerns that may be directly or indirectly related to forest management. The selected information included: subsistence resource uses and lifestyles; ecological and social change resulting from forest management; and recommendations or expectations for local forest management, community and economic development. TEK, including management practices, oral histories, legends, and ideologies, was also extracted.

In all, four criteria themes (after Kearney et al. 1998) and fifteen sub-themes were identified from the archived sources. These were used to condense and classify the summarized information into tables for each interview (Table 1). A statement or description of the value, concern or priority expressed in the interview was included for

Table 1. Criteria themes and sub-themes used to organize interview information.

Criteria themes and sub-themes	
Criteria themes	**Criteria sub-themes**
Human factors	Education
	Community
	Employment
Economics	Economic development
	Bush/subsistence economy
Land management	Current approaches
	Alternative approaches
	Traditional approaches & philosophies
	Knowledge and research
	Communication
Resource/Environmental concerns	Wildlife
	Fish
	Trees & plants
	Water quality
	Access

each sub-theme. These descriptions provided additional information on the context, perspective, or in the case of a specific resource, function of the criterion. An example of the summary format is provided in Table 2.

Stage 2: Compilation

For each archival source, interview summaries were compiled into a table according to criteria themes, sub-themes and descriptions (Table 3). Each entry was labeled with

Table 2. Example of a summarized interview transcript and table.

Interview summary

9. **Source:** Tl'azt'en Nation Elders Files
Type: Tape 11-A
Date: June 6 1978
Location: N/A
Interviewers: Unknown
Interviewee: M. Hinman[a]
Transcriber: Unknown

• "Long ago there were no stores to buy food from. We planted our gardens and dried fish and meat for winter use. This is what our children and ourselves lived on. Now-a-days it is all different. ... We used to eat wild rhubarb and fireweed. We ate the rhubarb before it gets hard, because when it gets hard it is no more good to eat. We also ate sap from *chundo*. Women used to go out in large groups to get these saps. Wherever there was pine trees they used to dry this sap for the winter use."

• "They used moss [for diapers for babies] that grows only in the swamps. The babies are wrapped in this along with their cloths. This is what they used for diapers. It was very good because they didn't have to wash the diaper."

• "The way we lived long time ago was good. That is why we lived long. Now, everyone dying at very young ages."

• "When someone had a sore back they would place rocks in the ground and heat them until they were real hot. Then, they would place red willows over it. Person would lie down and be covered with blankets. It was real good cure for sore back. ... The people used to make sticks – some small, some big. The sticks they used in different games they played. Now-a-days they don't play these games."

Criteria Themes		**Description**	**Management actions/indicators**
Resource/ Environmental concerns	Trees/plants	Wild rhubarb, fireweed, red willow, swamp moss, pine.	*Not identified*
Human factors	Community	Community health/ life expectancy	*Not identified*
		Traditional games	*Not identified*

[a] Names have been changed to maintain confidentiality.

Table 3. Example of compiled interview table and information. By documenting the interviewee name and transcript number in the "source" column, criteria and descriptions can be traced back to the original records.

Compiled Criteria
A reference guide to the Tl'azt'en Elders' transcripts

Criteria themes		Description	Source
Human factors	Education	Younger generations need to understand proper relationship with the environment	J.Adams (2)
		Must teach language to the youth	A.Mathews (18),
	Community	Self-sufficiency; clans controlled political and social life	J.Adams(2)
		Traditional lifestyle was healthy	M.Hinman(9),
	Bush economy	Self-sufficiency; lived on animals from the bush; made own clothes/tools	F. Denny (6), M.Hank (9), P. Johnson (13),)
		Made money trapping before government allowances started	B.Robson (24)
Land management	Current approach	Cannot replace the resources that we exhaust	J.Adams (2)
		Trapline boundaries are compromised because of too many roads	Z. Walter (30),
	Alternative approach	Need government that recognizes native history and beliefs	J.Adams (2)
		Logging should respect trapline boundaries	A. Sam (21)
	Traditional approach	Hunting areas had clear boundaries; members agreed on who hunted where.	J.Adams (2)
		Don't kill/cut trees needlessly; leave something behind	F. Denny (5), M. Jack (14), P. Johnson (15)
Resource/Environmental concerns	Wildlife	more wolves now than before; due to access; affecting deer	M. Johnson (12), A. Sam (29)
	Trees/plants	berries are scarce because of logging and insecticide	P. Johnson (17)

the interviewee's name and transcript number ("Source" column), and entries with the same or similar descriptions were grouped together. This table provided a comprehensive list of local needs, issues and concerns; an indication of common values held within the community; and the different perspectives among cohorts within the community.

TUS maps were also assembled at this stage. This spatial information provided the basis for developing location-specific objectives on the JPRF. Four map themes were generated: wildlife, hunting and trapping areas; fishing sites; cultural, spiritual and archeological sites; and plant gathering areas.

Stage 3: Categorization

To facilitate data management for the forest planning analysis, summary information was divided into three C&I categories: spatial, quantitative and qualitative. These categories represent possible approaches for addressing specific forest management criteria based on design features of emerging analytical planning tools.

Spatial

The recent trend toward spatially-explicit decision support tools (e.g., McCarter et. al. 1998; Dewhurst et al. 1999; Varma et al. 2000; Kurz et al. 2000; Dewhurst, 2001) has implications for managing resource information. Values associated with a static location on the landscape are often addressed by segmenting the area into parcels, and developing appropriate forest management treatments for each one (e.g., Sahajanan 1996). Consequently, it was necessary to identify Tl'azt'en criteria that were associated with a particular place or feature, and which could be addressed using spatial indicators. The spatial indicators generated for the Tl'azt'en criteria were in the form of zones and buffers.

Zoning involves partitioning the landscape into units that are reserved for a particular purpose. The four TUS maps were combined with maps showing biogeoclimatic zones, contours, hydrologic features, recreation areas and trapline boundaries on the JPRF were used to delineate resource management zones (RMZs) based on a combination of human use and natural boundaries (Figure 3). Each zone was assigned a management emphasis based on information revealed in community interviews and the TUS database.

A buffer zone is an area designated to separate sensitive, location-specific resources from potentially damaging activities. Buffers were designated to protect spiritual and archeological sites, and bodies of water (such as streams, lakes, and wetlands) that require protection from forest management activities.

These spatial indicators are important for assessing plan sustainability. For example, the criterion concerning water quality would be indicated by the amount of area protected in riparian buffers, while criteria that require the conservation of subsistence and traditional education opportunities are evaluated based on the percentage of forest zoned with a traditional use emphasis, such as hunting or plant gathering.

Quantitative

Quantitative indicators relate to: biophysical forest conditions; forest practices or yields such as leading tree species and age class distributions; habitat types; silvicultural systems; and harvest volumes. These can be used to monitor or set targets for measurable forest criteria. A broad range of Tl'azt'en criteria can be addressed through forest conditions, including: habitat for key wildlife and plant species; yields, such as forestry-related

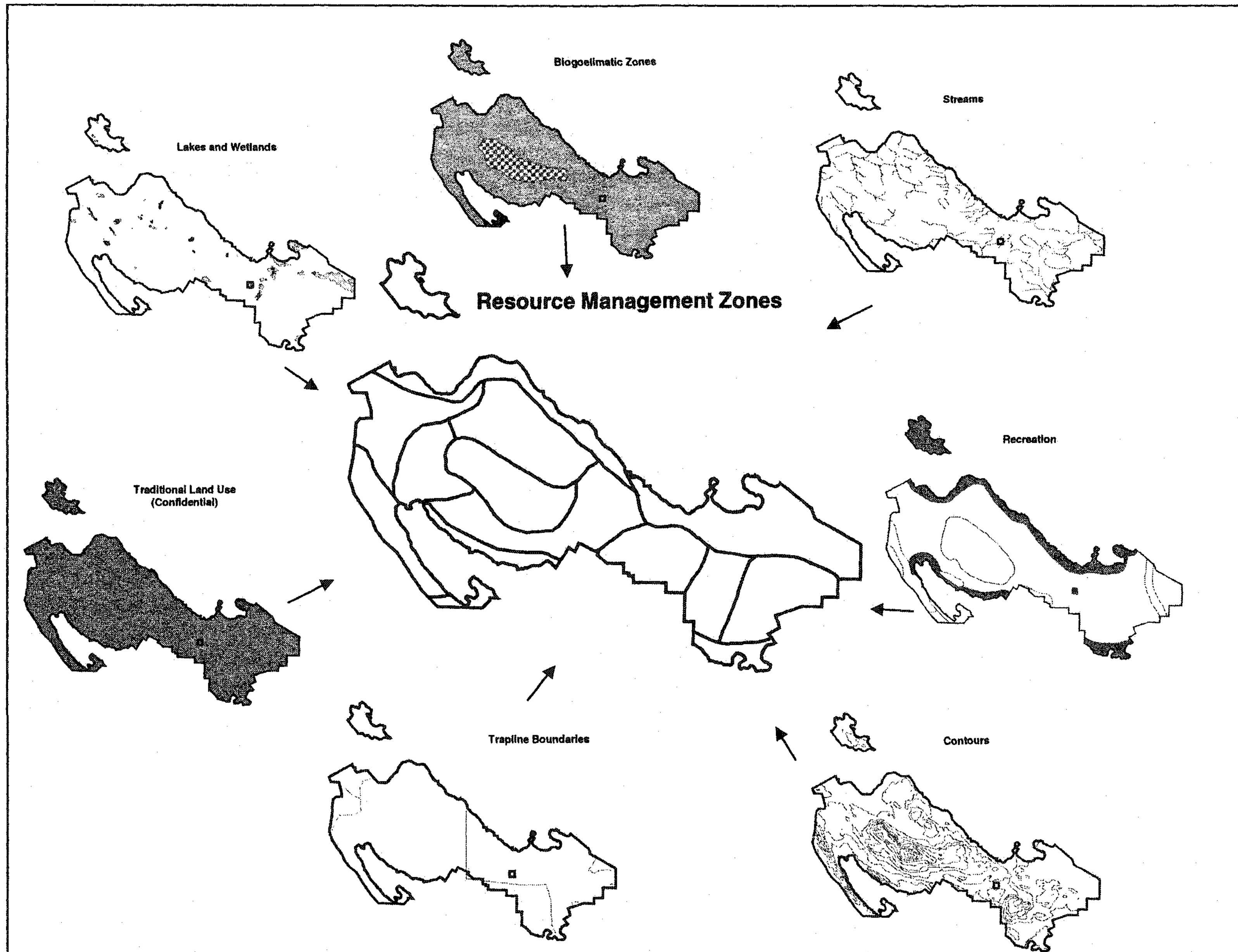

Figure 3. Multiple map-based data sources were used to generate resource management zones.

employment and training opportunities; or practices, such as the use of low impact silvicultural systems.

Qualitative

Selecting streamlined, quantitative, objective, scientifically-based indicators are emphasized in recent discussions and work on C&I development (e.g., Prabhu et al. 1999; Smith et al. 1999). Throughout the development of the AFPP approach, however, it has become apparent that Aboriginal community participation in sustainable forest management must include the application of intuitive, experiential knowledge through qualitative, subjective assessment. Qualitative C&I are often intangible because they are embedded in traditional worldviews, philosophies, ethics, beliefs and rules of proper conduct on the land, but they may also include indicators of community benefit from forest management (Sue Grainger pers. comm.). Subjecting the results of technical forest planning to this qualitative assessment by Aboriginal participants, and incorporating it into the planning process, is a critical component of forest planning that truly integrates TEK with Western management systems.

These information categories were divided into tables (see Tables 4-6). In total, 66 interview transcripts, 37 TUS database entries and 7 secondary sources were analyzed, and four tables (summary, spatial, quantitative and qualitative) were produced from each archival source.

Table 4. Example of a table listing spatial criteria and indicators identified from archives.

Spatial Criteria and Indicators
A reference guide to the FRBC interviews[a]

Criteria themes		Feature	Description	Management indicator/action	Source
Resource/ environmental concerns	Wildlife	Corridors and reserves	Habitat: need to provide diversity	Should be at least ½ mile wide	A. Daniels (15)[b]
	Fish	Rivers, lakes and creeks	Protection: high quality habitat; inadequate buffers have negative effects on rainbow trout	Larger buffers	J. Price (1); A. Daniels(15); L. Dunns (17); women Elders [c] (43)

[a] Refers to the archival source.

[b] Refers to interviewee and summary sources.

[c] Refers to a focus group.

Table 5. Example of quantitative criteria and indicators identified from archives.

Quantitative Criteria and Indicators
A reference guide to the Elders interviews

Criteria themes		Attribute	Description	Management Indicator/action	Source
Resource/ environmental concerns	Trees/Plants	Cottonwood	Transportation: canoes Oral history	*Amount of area in cottonwood stands*[a]	H. Jenson (10); R. Stuart (25); M. Dunns (32)
		Blueberries	Bush economy: food	Grow in pine stands	J. Price (1); A. Daniels(15); L. Dunns (17); women Elders [c] (43)

[a] Italicized entries refer to information derived from sources other than the archives.

Table 6. Example of qualitative criteria and indicators identified from archives.

Qualitative Criteria and Indicators
A reference guide to the Tl'azt'en interviews[a]

Criteria themes		**Issue**	**Description**	**Management indicator/action**	Source
Human factors	Employment	Sheep grazing and spraying of herbicides and pesticides	Takes away jobs	Replace with manual brushing	W. Quinn (40);
Land management	Current management approach	Logging/Access	Logging has affected trapping species	*None identified*	C. Richard (25),
Resource/ Environmental concerns	Wildlife	Spraying of herbicides and pesticides	Displaces moose and deer - herbicide kills their preferred browse	Replace with selective, manual brushing around trees - leaving browse, food and medicinal plants	H. Price (11); L. Price (7); R. Stuart (25); W. Quinn (40).; M. Jared (10);
	Trees/plants		Destroys berries, and other food and medicine plants		
		Sheep grazing	Domestic animals in forest may introduce diseases	Replace with manual brushing	W. Quinn (40);

[a] Examples are from both FRBC and Elders interviews.

Additional Information Sources

Additional interviews and focus groups were conducted to elicit community resource and management perspectives explicitly for the JPRF (Kessler et al. 2001). The resulting transcripts and maps were analysed using the AFPP framework. This supplementary information allowed a validation of the AFPP analysis results, and afforded an opportunity to solicit additional C&I.

Two field excursions with Elders were conducted in June 2000 to identify suitable buffering indicators for various sites. Visits were made to archaeological and spiritual sites; medicinal plant gathering areas; and various riparian sites (rivers, creeks and wetlands). Appropriate buffering distances were measured at these sites based on the Elders' judgements. Field notes were taken on buffer sizes and on other relevant information shared by the Elders.

A Scenario Advisory Team (SAT) was assembled, consisting of 10-15 community members from a cross-section of Tl'azt'en society including administrators, Elders, keyoh-holders, youth, and educators (Kessler et al. 2001). The SAT provided feedback, comment and additional information on the analyses. Qualitative information from these meetings was also recorded as field notes.

Discussion

The AFPP demonstrates a bottom-up approach to generating C&I for landscape level analytical forest planning. The flow chart in Figure 4 illustrates this point. Basic community information is aggregated to generate criteria, objectives and goals, and to guide the identification of management indicators. Given that TEK is embedded in local

The AFPP as an Information Management Process

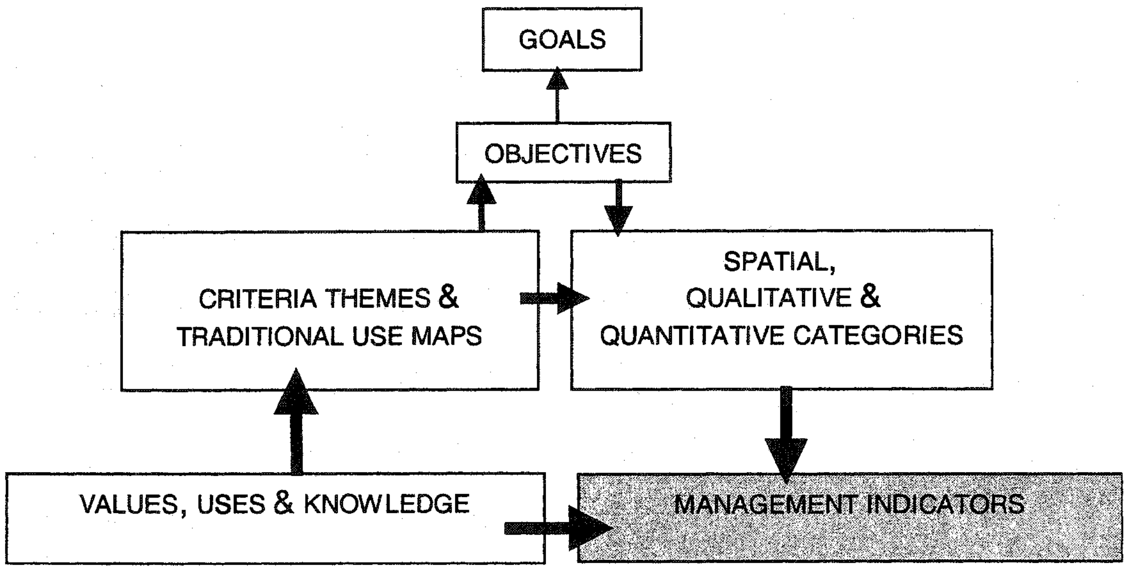

Figure 4. Flowchart demonstrating the AFPP information management process. The final step of identifying management indicators is shaded because the use of archival sources revealed few indicators.

Aboriginal culture and sense of place (Berkes 1999), the AFPP approach is well suited for incorporating TEK into forest management planning. The following discussion outlines the key features contributing to the efficacy of this management approach, namely, elicitation, management and the application of local information.

Information Elicitation

The AFPP approach to eliciting Aboriginal information using archival sources strays considerably from conventional processes such as public meetings and workshops where participants interact and engage in discourse and negotiation (e.g., Renn et al.

Technique (NGT) as described by Delbeqc et al. (1975). NGT addresses problem solving by identifying individual perspectives and ideas to produce a satisfactory course of action (Delbeqc et al. 1975). As with NGT, the AFPP focuses on bringing individual ideas together without discussion or mathematical evaluation. Delbeqc et al. (1975) argue that this approach enhances the development of creative solutions, ensures that all participants contribute equally to establishing the frame of reference, and avoids the risk of prematurely prioritizing issues.

Quantitatively prioritizing issues is a typical stage in participation processes, including NGT, and has been the focus of recent work by Prabhu et al. (1999) and Mendoza and Prabhu (2000) in the context of identifying C&I for sustainable forest management. AFPP intentionally avoids this stage for three reasons.

1) This approach is focused on strategic-level planning rather than monitoring. Consequently, the C&I selected are indirect measures of forest values (e.g. moose habitat vs. moose populations) that represent a coarse-filter approach to management. As a result, fewer C&I are used and thus there is less need to prioritize values.
2) Given that TEK is inherently wholistic with regard to managing human resource use (Berkes 1999), prioritizing one value or issue over another is inconsistent with the view that everything is important across the entire landscape. In other words, the intent here is to identify C&I that are inclusive and representative, rather than those that are most efficient.

3) The AFPP presents one component of the planning exercise. Therefore, to initiate the process, developing a comprehensive community perspective is a necessary task. Prioritizing issues, if necessary, may occur in later stages of the planning process, after the initial scenarios are produced, examined, and assessed by community members.

In addition to establishing a foundation for the planning process, eliciting information from archival sources provided several other benefits. The investigators were able to incorporate perspectives from a larger sample of community members with less time and cost to the researchers and the community than by conducting only individual interviews exclusively. The archival analysis also provided important background information, enhancing the investigators' knowledge, sensitivity, awareness, and appreciation for the Tl'azt'en people, their culture, history, and lifestyles. This enabled the investigators to better understand and interpret the community's primary concerns, needs, values and their underlying rationales. Reviewing the documents also allowed the investigators to identify key community members for future interviews, discern information gaps and to develop directed interview questions to elicit additional information. For example, TUS maps and transcripts were excellent sources for broad forest management criteria; but were sources for local, quantitative indicators. Consequently, identifying quantitative indicators was a primary focus for subsequent interviews.

A possible disadvantage of using archival interviews is that they often include interviews of people who are deceased. This information may or may not be desirable for the planning process. Although it could be useful for observing changes in intergenerational values within the community, incorporating some of this information into the planning process may not be compatible with current realities.

Another issue is that, as non-Aboriginals, the investigators' cultural biases might influence the outcome of selecting and translating the archival information. Some ways in which biases may present themselves include: information selected for the interview summaries; interpretation of interview transcripts and consequently, the themes used to group the information; and the placement of zone boundaries. Furthermore, unlike the NGT approach, the researchers' use of archives did not allow the "participants" to qualify or explain their comments. For these reasons, a mechanism for validating the results of the analysis should be included before implementation. For this project, AFPP results were presented to the SAT for review, comment and feedback.

Information Management

To facilitate evaluation, the AFPP was designed with transparency as a primary concern. Public participation processes must demonstrate the connection between public concerns and planning decisions (Renn et al. 1995). Providing this link builds social capital, which is the level of trust and confidence that exists between community members and those who are representing their interests. Salamon et al. (1998) indicated that strong social capital within small communities was an essential component of successful locally-led planning initiatives. Enabling participants to track the outcomes of the planning process is particularly important when cultural information is being interpreted and re-organized from archival sources. Source information and criteria descriptions must be explicit so that misinterpretation can be easily identified and corrected.

There are several existing hierarchical formats for organizing C&I. For example, the Centre for International Forestry Research (CIFOR), and the Land Unit C&I Development (LUCID) project initiated by the U.S. Forest Service, both use a principle-criteria-indicator structure (CIFOR 1999; LUCID 2001). Conventionally, this structure involves dividing criteria into socio-economic and ecological principles (e.g., CIFOR 1999; LUCID 2001) or categories (e.g., CCFM 1995; CFS 1995).

In this research, criteria represent values that need to be addressed in scenario plan development. Rather than adopting or modifying an existing C&I framework, an attempt was made to stay true to the way community members express their values, and to group those values accordingly. Therefore, criteria are not stated as phrases, but instead, are divided into themes or areas of concern that represent Tl'azt'en forest values. This produces information that is more specific than some existing C&I templates, while still general enough to protect sensitive information.

In this context, criteria serve an important function within the AFPP framework. Criteria, used with appropriate landscape zoning, may have the potential to "codify" Aboriginal knowledge and values such that details regarding "who", "what', and "where" remain confidential. For instance, management guidelines associated with zones on a map can be shared without providing specific information on the nature of the place-value. Likewise, criteria sub-themes and descriptions provide the basis for developing forest management goals and objectives.

Application

In addition to linking Aboriginal and Western forms of forest management, the AFPP's C&I format can contribute to broader forest sustainability initiatives such as certification, and national-level monitoring. International reporting may be an important tool for ensuring continual improvement of Aboriginal influence over resource development (Smith 1998). Therefore, identifying, monitoring and managing for locally-defined C&I is a valuable exercise at all levels of forest management. For strategic forest planning, C&I provide direction for setting management targets and strategies to strive for landscape-level objectives, and can be used to simulate the effects of forest management policies using analytical tools.

Grouping criteria themes according to spatial, quantitative and qualitative categories converts descriptive, site-specific information into substantive guidance for forest management planning. C&I may also provide a common template where forest management values and concerns can be compared and examined for similarities and differences across spatial, temporal and cultural boundaries. Given these benefits, it becomes evident that C&I might have utility, not only in Aboriginal forest planning, but also for engaging non-Aboriginal involvement in local forest management decision-making.

Conclusion

The AFPP is a method of eliciting and managing community information to develop a set of C&I used to link local Aboriginal knowledge and values with Western analytical approaches. Placing community values into a C&I framework may sufficiently address involvement, integration and confidentiality issues, although further investigation is needed to evaluate if the AFPP approach is in fact a culturally suitable and effective tool for forest planning on Aboriginal traditional land. As a result of the co-management arrangement of the John Prince Research Forest, access to community resources for the purposes of this research was provided under unique circumstances. AFPP is not a tool for researchers and non-Aboriginal decision-makers to gain access to community archives, nor is it a panacea for improving relationships between indigenous and other resource users. Rather, it is a starting point from which Aboriginal communities might engage their own members in participatory, analytical decision-making for sustainably managing commercial forests on traditional lands.

Chapter 4: Exploring Aboriginal Forestry: A case study in Central interior British Columbia, Canada[6]

Introduction

The most common purpose for C&I development and use is to assess, monitor and report on the state of forest sustainability. Recent work on procedures and methodologies that identify, select and prioritize local-level C&I has produced or adopted generic templates and frameworks to monitor sustainability criteria in various countries and ecosystems (e.g., McClain 1998; Prabhu et al. 1999; LUCID 2001).

A secondary use for C&I is to guide forest management planning and decision-making. This application has the potential to actualize sustainable management, particularly for landscape level forest planning. Generic criteria, however, may be inappropriate for developing landscape-level forest management strategies.

With forest management decision-making moving toward increased public involvement, it may be beneficial to develop local-level criteria through public planning processes. Individual worldviews, perceptions, identity, values and behaviour all influence and are influenced by community, culture, and environment (Tuan 1990; Sancar 1994; Kusel 2001). It follows then, that sustainability criteria may be defined and implemented differently across cultural and environmental boundaries. Therefore, to be effective, forest management criteria need to be specific and have a social and ecological context.

Criteria can also be used to highlight locally diverse perspectives on sustainable forest management. This is particularly important for countries where Aboriginal rights are prevalent. As an alternative to multi-stakeholder processes, developing local-level Aboriginal criteria would generate a better understanding of Aboriginal interests in the context of other local "communities", overcome confidentiality issues, eliminate myths about what Aboriginal groups

[6] A version of this chapter will appear in manuscript form under the authorship of Melanie K. Karjala and Stephen M. Dewhurst.

want from forest management, and direct the necessary actions to properly integrate TEK into management practice.

The purpose of this chapter is to illustrate these points using the JPRF case study. C&I results from the AFPP analysis, field excursions and scenarios identified at SAT meetings with Tl'azt'en Nation are described and discussed in the context of existing C&I templates.

Results

Forest Management Criteria

The final analysis of all the archival and interview sources resulted in four criteria themes and eighteen sub-themes (Table 7). These outline the spectrum of values, areas of concern, ideologies and priorities that Tl'azt'en community members associate with the forest. This section describes these themes using excerpts from Tl'azt'en interviews.

1) *Human factors.* Criteria that address human factors involve the non-economic, social values associated with the JPRF. Opportunities for both traditional and forestry-based education and training are included in this theme. Tl'azt'en members stress the need to provide youth with a land-based education to help them maintain a connection with their culture and history, as well as developing the skills needed to cope with the realities of the world outside of the community, which are provided by a modern education. As one community member explains,

> *The Elders said we have to teach our young generation our way of life, our language, our culture. And also they have to have the formal education. That's the only way that we can be whole again. You can't have one without the other...Like we're talking Land Claims now, we're talking self-government. We can't do that without our people being educated in management and political science and whatever is out there. In forestry, we need our own RPF's* [Registered

Professional Foresters], *we need our own biologists, we need our own archaeologists, so that we can become self-sufficient. ... Education is important.*

Table 7. The final list of Tl'azt'en criteria identified from archival sources and new interviews.

Tl'azt'en Forest Management Criteria

Criteria themes	Criteria sub-themes
1. Human Factors	1.1 Education
	1.2 Community
	1.3 Employment
2. Economics	2.1 Economic development
	2.2 Bush Economy
3. Land Management	3.1 Current Approach
	3.1 Alternative Approach
	3.3 Traditional Approach/Philosophy
	3.4 Legacy
	3.5 Knowledge/Research
	3.6 Communication
4. Resource/Environmental Concerns	4.1 Wildlife
	4.2 Fish
	4.3 Trees & Plants
	4.4 Access
	4.5 Water Quality
	4.6 Forest Health
	4.7 Climate

Forest management is also associated with the community's sense of well-being, encompassing cultural, social and health issues. This includes both retaining the skills and values that come out of a traditional land-based lifestyle, and the tangible benefits that timber revenues can provide such as enhanced community services and infrastructure, improved living standards, and economic independence.

> *How [could logging] bring things to the community so our children will have a nice safe play area, so that recreation facilities can be built, so that good culture and traditional learning centres can be built, and meaningful programs be set up. ... That's when things are going really good for our community (Tl'azt'en Elder).*

Forestry-related employment is another avenue through which individuals in the community can become financially autonomous,

> *We've got a lot of young people that's growing up and we want to see them have something to turn to in terms of jobs (Tl'azt'en community member).*

> *A lot of people got training with the equipment, different kinds of equipment on and off. But it's just a fact that there's not enough jobs for them to fully continue on training and get right into it so that they can, you know, down the road, will own the machine themselves (Tl'azt'en educator).*

2) *Economy.* Although the community views timber harvesting as a viable source of employment and financial autonomy, they are also interested in developing non-timber industries, such as ecotourism, and value-added wood products. Therefore, forest management plans must reflect the diverse economic potential of the forest.

> *We have to get into some other industry with that timber, and we have to find good markets for it (Tl'azt'en administrator).*

That's what we need is tourism instead of our logs being chopped down (Tl'azt'en youth).

Tl'azt'en members also assert that the subsistence, or "bush" economy, makes an important contribution to the local community. The availability of resources and development of skills needed to live from the land is a sort of insurance policy that will ensure the survival of the community in difficult times.

> *...if [young people] learn now that they can live off the land ...like its going to be hard days again coming soon and they all won't be going to the store to buy chips or something like that so they have to go out and see what they have to live on (Tl'azt'en Elder).*

> *... my children...if I want to teach them culture, and how to live off the land just in case something happens, well it's my duty (Tl'azt'en Elder).*

3) *Land Management.* Land management encompasses a broad range of issues relating to forest practices, ideologies, knowledge, communication and intergenerational responsibility. Many Tl'azt'en members express concern that conventional forest practices are destructive to the ecosystem and to traditional activities,

> *I've seen some negative things like too much garbage being left out there after harvesting. I've seen too many disruption or disturbance to good producing soil by machines, and also sometimes I think we are getting too close to rivers and lakes...(Tl'az'ten community member).*

> *... they are clearing out all the traplines, hunting ground, and people have nowhere to trap or go hunting because it's all clear-cutting. They can't go out to hunt or trap in the meadow-like country. In the olden days, people go anywhere to trap or hunt, but not anymore... (Tl'azt'en Elder).*

Tl'azt'enne value traditional approaches to stewardship and recognize conflicts with the status quo,

> *The Creator made the trees for everyone. They could not belong to only one person ... we are not allowed to chop down a tree for nothing (Tl'azt'en Elder).*

> *That's one of the things the First Nations taught, was how to respect a person, animals, the bush, everything out there. That was a real important part of my teaching ... (Tl'azt'en community member).*

> *Our people are so protective of the area. ...Everybody protected their Keyoh. ... They really had a lot of respect for the land, the water, everything because they knew there was a creator that made it. So the reason why they respected it so bad was because if they destroyed it, they're going to get destroyed themselves (Tl'azt'en Elder).*

Ultimately, the Tl'azt'en seek a balance between traditional and conventional forest management,

> *The white man [sic] is not going to go away and we're not going to go away so we have to have some kind of system that can be in harmony together and working together, and understand each other. White man has got to respect us, our culture, our language, our way of life, and we have to do the same too. So it's not just one way. ... We have to share the resources so that our people can grow and so that white man and their people can grow too. We have to share everything, the resources. That is something right now we're trying to hammer out. It's not an easy job (Tl'azt'en community member).*

Building harmonious management relationships requires open communication between managers, scientists, and land users such as keyoh-holders and Elders. This requires an environment that facilitates community participation, and recognition of experiential knowledge, *We don't have enough say. Local people do not have enough say in how resources are divided up (Tl'azt'en administrator).*

... I know what's in my trapline. I know how many traps I've got out there and what kinds of fur-bearing animals I have. I know where I can go fishing in my trapline. Those are the things we have to share and start thinking about (Tl'azt'en Elder).

Managing resources for future generations is a necessary focus for the Tl'azt'en community. This requires a long-term, or "legacy forest" management perspective (Wood et al. 1998),

It's up to the leaders now to do these thing[s], to pave the way for the younger generation so that they have something to work with when they grow up (Tl'azt'en community member).

I don't know why they bring in that big machine. And look at the outfit those people have and why do they want to cut it good and fast. Then here we're going to be, not for my generation but in the future, the people will be poor (Tl'azt'en Elder).

4) *Resource and Environmental Concerns.* Tl'azt'en members perceive that forest management has had considerable and wide ranging impacts on the forest ecosystem over the past several decades. Maintaining this ecosystem is the basis for securing opportunities for most other management criteria. Identifying impacted and/ or traditionally important wildlife, plant, and fish species, and issues related to climate, water quality and access, provides direction for future management,

A long time ago we used to drink ... like at that time we had no running water. We drink water from anywhere. But now, you can't do that. You're scared to do that.

And in fact, just today I think, I talked to some guy and that guy kills moose. He told me that [the moose] liver was just white and said 'I don't want to eat it'. And lots of times they've seen animals sick like that. Well, [it's] killing all the beaver that's for sure thing. And that's why the salmon too and all the fish (Tl'azt'en Elder).

...when Bob and I went up there 4 years ago we noticed the big wide area, we seen three moose and they sure didn't look very good. They didn't look good at all and it was late fall and they were pretty skinny and not much left for them to eat (Tl'azt'en Elder).

We must protect the watersheds, the river, the environment, and the fish. The survival of the fish and the survival of the Indians are one. (Tl'azt'en Elder)

The clearcutting...one of the things my Dad left me with is he said 'you know what son, one of these days you're going to see a big wind, a real big wind. You think the wind down at the ocean is bad, you're going to see it up here. When the wind starts blowing the trees holding it back slows it down (Tl'azt'en Elder).

Spatial Values

Many of the criteria listed above can be associated with place values on the JPRF landscape. For planning purposes, human places and natural features such as susbistance areas, spiritual or recreational sites, and wetlands can be delineated and assigned with appropriate management treatments to realize objectives associated with both human and ecological uses, functions and values.

Chapter 3 described how place values on the JPRF were identified and zoned from maps generated from the TUS, and other interviews and community meetings. Using these community-defined attributes, each Resource Management Zone (RMZ) was allotted into one of five designations.

1) *Cultural Reserve Zones* are places on the landscape that are associated with a community or economic (non-timber) criterion. These areas are sensitive to disturbance, and consequently are given a 'no harvest' management strategy.

2) *Cultural Zones* are also associated with the economic criterion, but can tolerate some disturbance. These zones are assigned a 'sensitive management' strategy where selection cutting is used to minimize visual and physical disturbance.

3) *Traditional Use Zones* outline areas where subsistence activities took/take place. These are also assigned a sensitive management strategy to minimize the impact of harvesting on wildlife and plants.

4) The *Integrated Resource Management (IRM) Zone* is an area where several uses overlap, and is also where most historical logging has taken place. Consequently, this zone is associated with wildlife and tree/plants criteria, where the objective is to restore these habitats to more 'natural' conditions (see MacGregor and Dewhurst, in prep.) using silvicultural treatments.

5) *Harvest Zones* represent the remaining areas in the forest where community place-values were not identified. These zones are designated for economic development, and are assigned an 'intensive management' treatment that emphasizes maximizing timber flow.

Figure 5 shows the RMZs and their designated treatments. Table 8 shows a more detailed description of each management zone. The Tl'azt'en zoning scheme results in large areas of the forest being excluded from timber harvesting. This reveals that the protection of ecologically and culturally sensitive areas is an important management criterion for the Tl'azt'en community. In addition to the RMZs, protecting riparian areas is another important spatial criterion for the

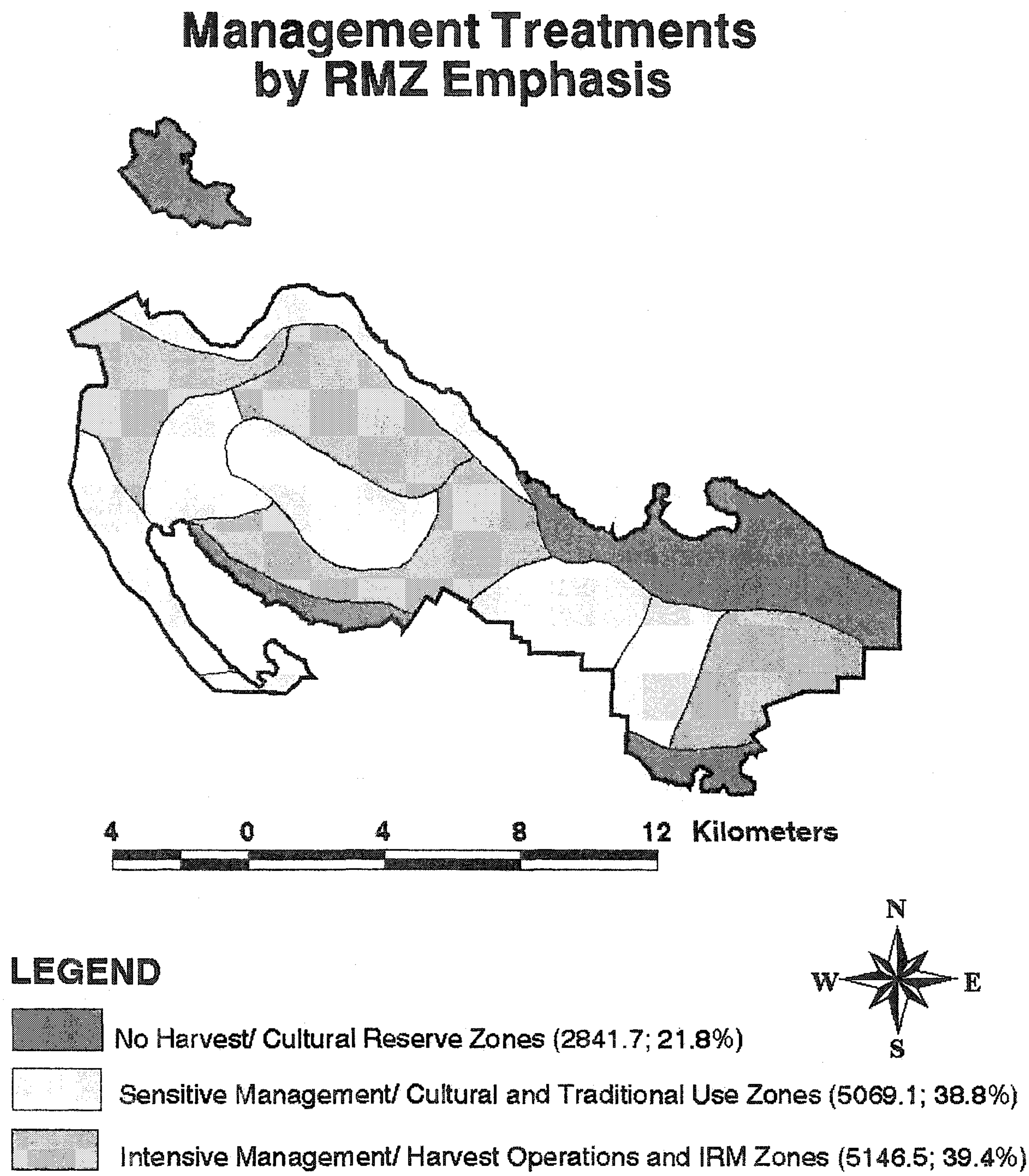

Figure 5. Resource management zone emphases and treatments based on Tl'azt'en spatial criteria applied to the John Prince Research Forest.

Table 8. Description of resource management zones and emphases.

Rmz #	RMZ Theme	Criterion Emphasis	Treatment
1	Cultural Reserve Zone	Community	No harvest
2	Harvest Zone - west	Employment/Economic development (Forest Operations)	Intensive management
3	Traditional use Zone	Wildlife	Sensitive management (selection cutting)
4	Traditional use Zone	Trees and plants	Sensitive management (selection cutting)
5	Cultural Reserve Zone	Economic development (Tourism)	No harvest
6	Harvest Zone - central	Employment/Economic development (Forest operations)	Intensive management
7	Traditional use Zone	Wildlife/Fish	Sensitive management (selection cutting)
8	Traditional use Zone	Wildlife	Sensitive management (selection cutting)
9	IRM Zone	Wildlife/Trees and plants (Restoration)	Intensive management/ Sensitive management (selection cutting)
10	Cultural Zone	Economic Development (Recreation)	Sensitive management (selection cutting)
11	Cultural Reserve Zone	Community	No harvest
12	Cultural Zone	Economic development (Tourism)	Sensitive management (selection cutting)
13	Traditional use Zone	Wildlife	Sensitive management (selection cutting)
14	Harvest Zone - east	Economic development (Forest operations)	Intensive management
15	Cultural Reserve Zone	Economic development (Recreation)	No harvest

Tl'azt'en. Although Tl'azt'en Elders acknowledge that the current provincial standards for riparian management are an improvement over past practices, many would like to increase the protective "buffer" on streams, lakes, swamps and cultural sites.

> *...they could log, but I want about 100, or 50 to 100 metres around every little pond, without logging. I mean, just leave it (JPRF Keyoh-holder).*

Riparian management suggestions from the interview analysis revealed a range of possible buffer widths. Field excursions with Elders to various sites revealed that appropriate buffer size is dependent on site-specific factors such as terrain features, and the type and distribution of plants. Given this variability, and lacking information on such specific stream characteristics on the JPRF, the SAT suggested that scenarios based on generalized riparian management options would assist the community with understanding the scenarios' effect on various criteria. The SAT also indicated that an additional scenario based on provincial standards would provide an interesting contrast to the community scenarios. In total, five scenarios were developed (Figure 6-10; Appendix 1):

1) Forest Practices Code of B.C. (FPCBC) scenario;
2) Minimum Protection community scenario;
3) Moderate Protection scenario;
4) Enhanced Moderate Protection scenario; and
5) Maximum Protection community scenario.

The "minimum protection" scenario is based on the smallest riparian buffer width identified from the interviews, and the "maximum protection" scenario is the largest buffer width identified during the field excursions. The remaining two scenarios were generated by the investigators as possible alternatives.

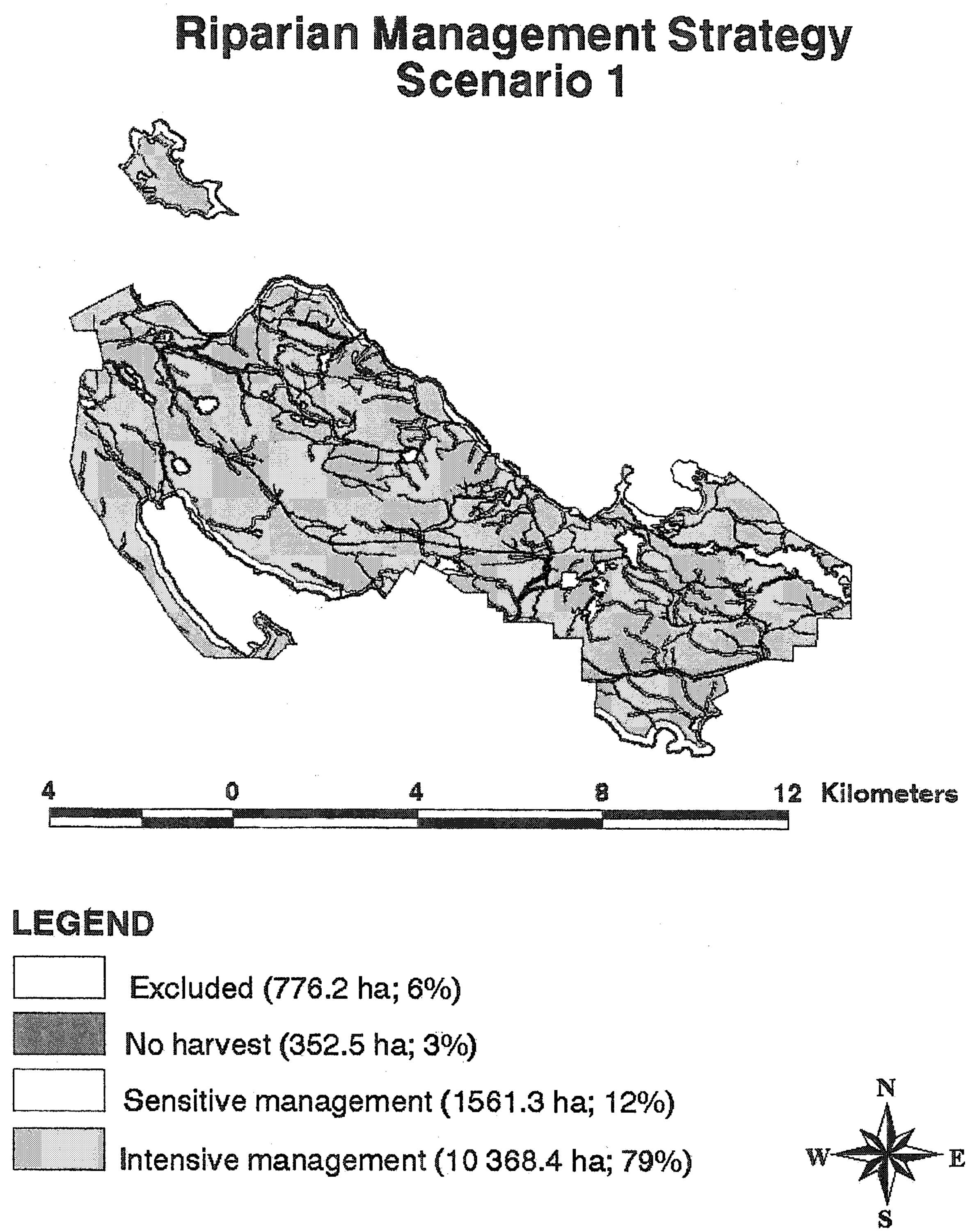

Figure 6. A riparian management strategy based on the Forest Practices Code of BC.

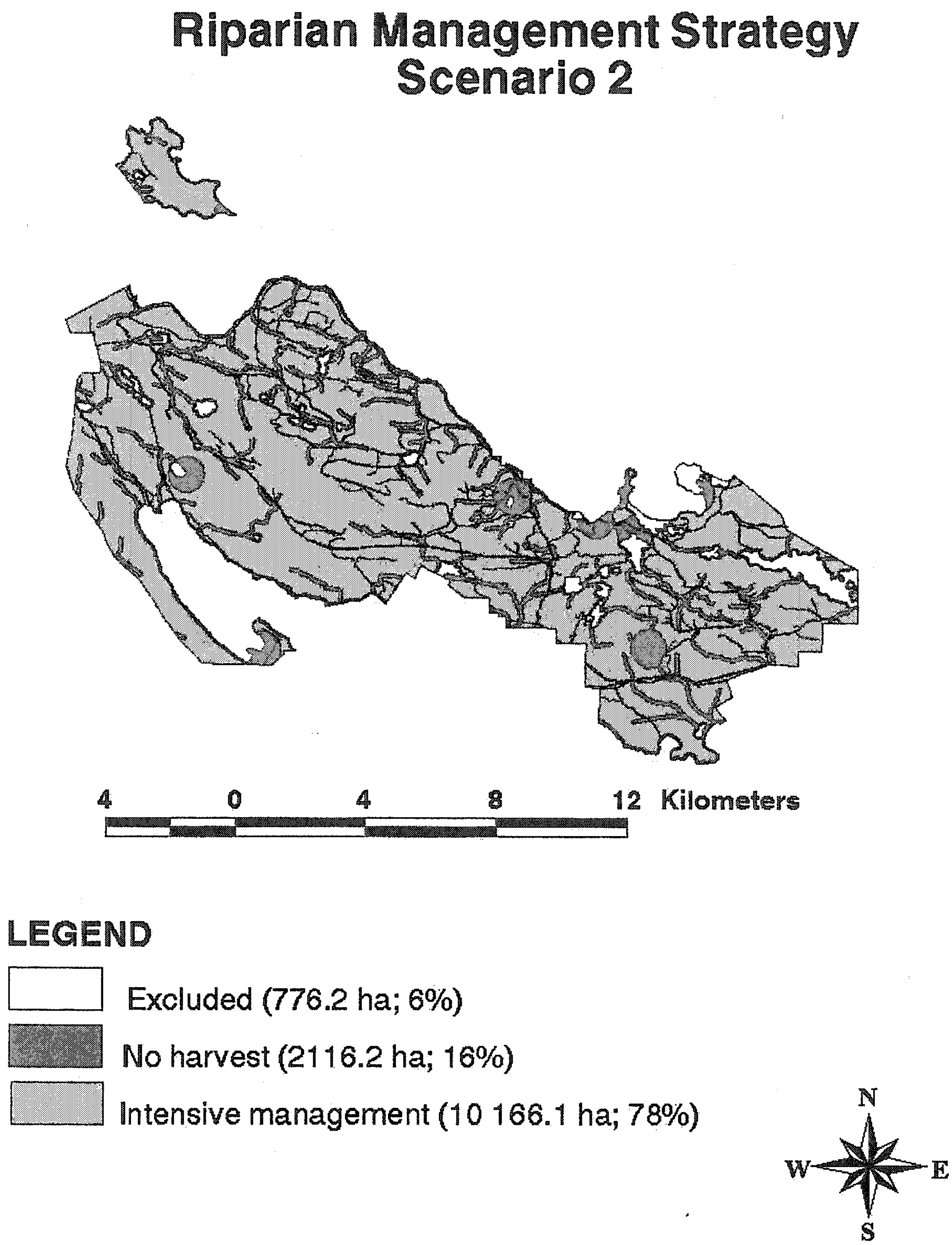

Figure 7. A riparian management strategy representing the smallest buffer widths identified from the Tl'azt'en community.

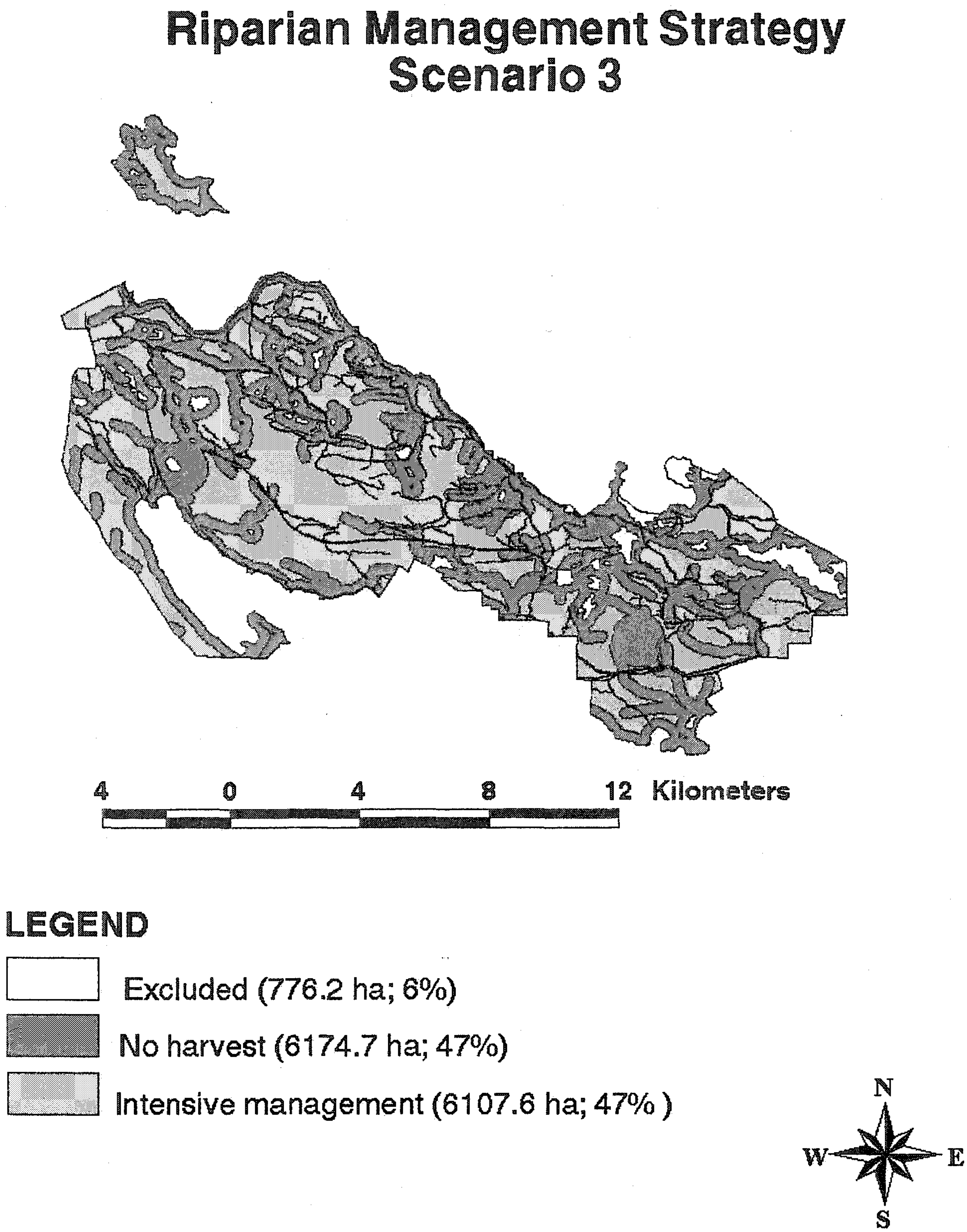

Figure 8. A moderate riparian management strategy.

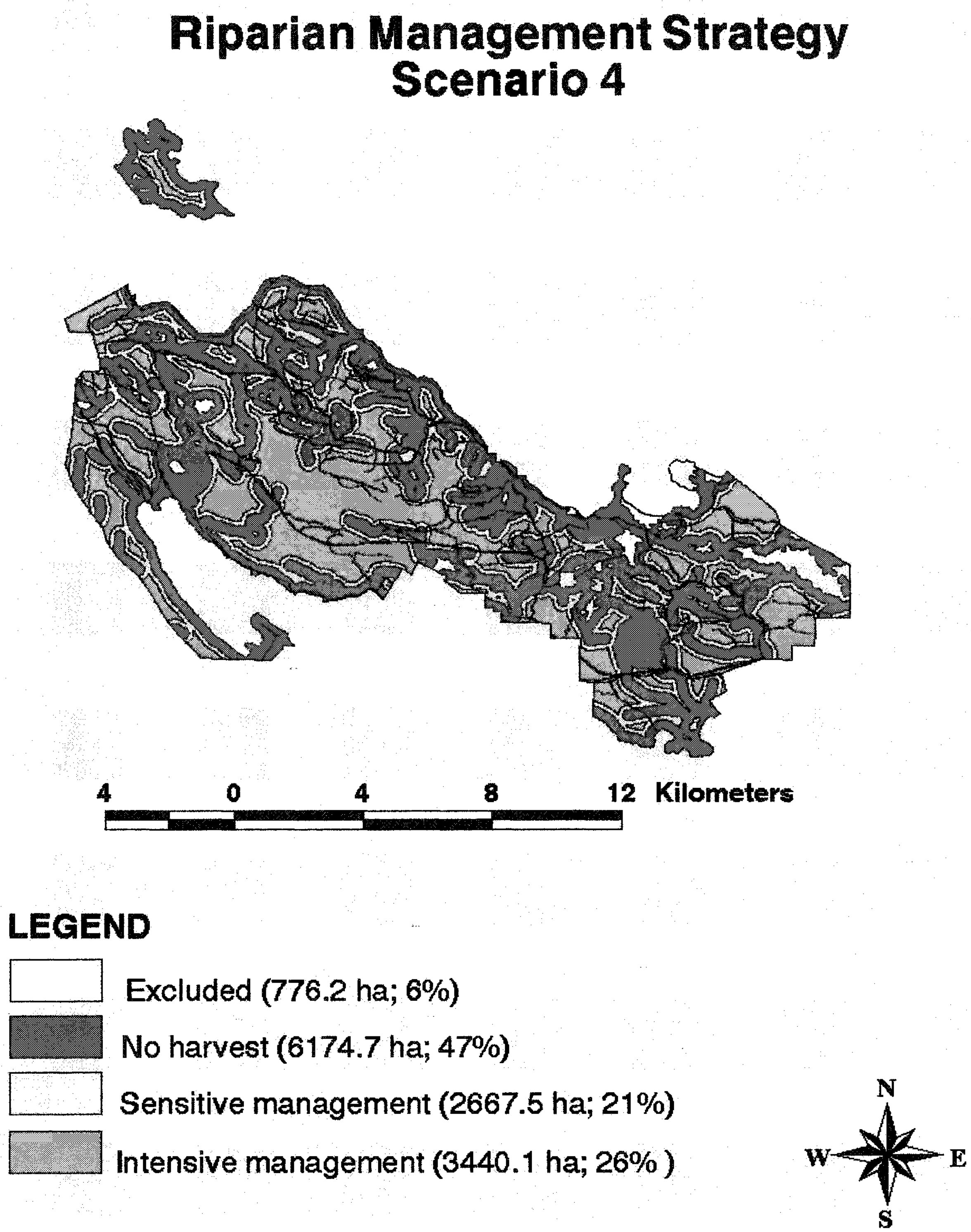

Figure 9. A moderate riparian management strategy enhanced by an addtional sensitive management zone.

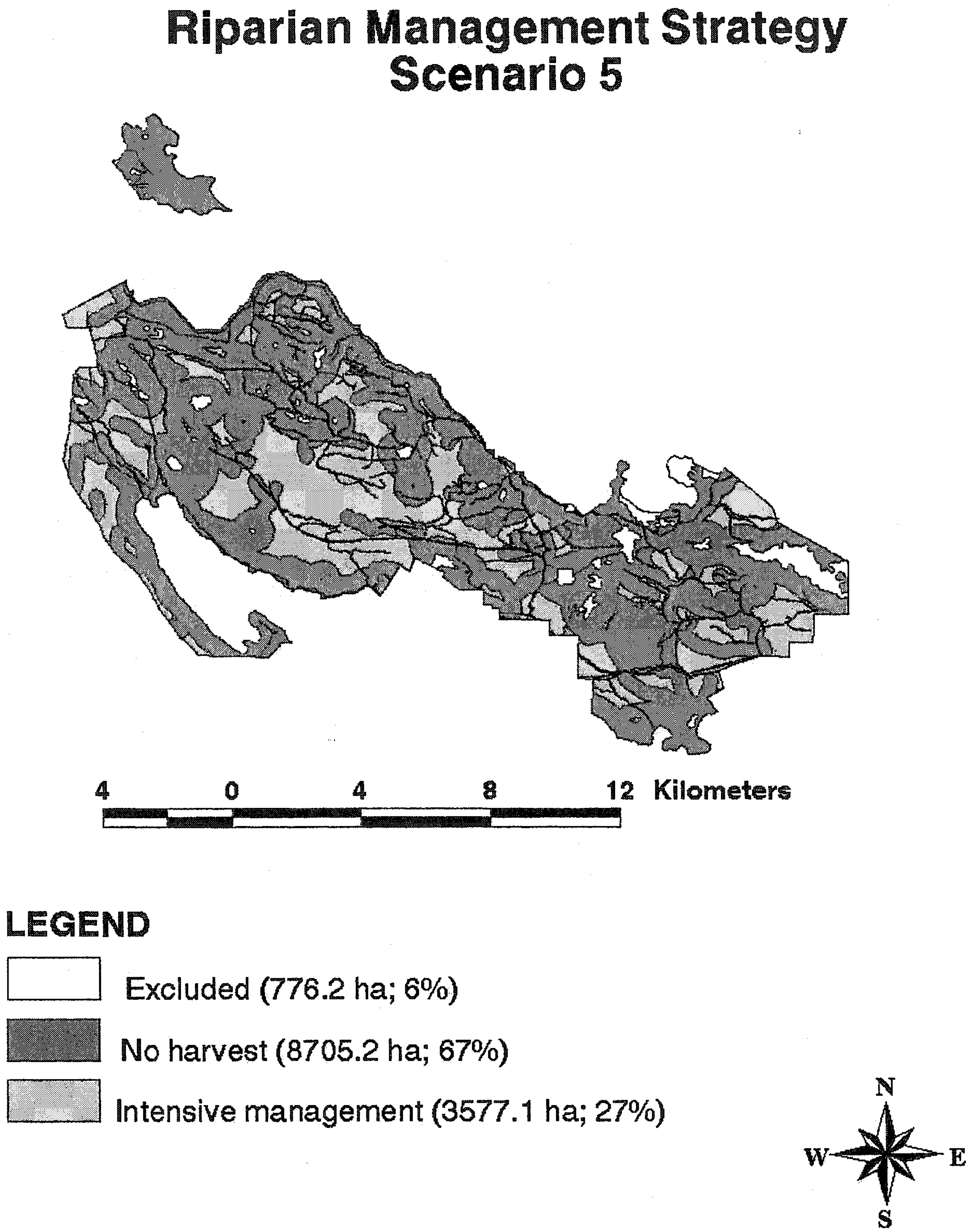

Figure 10. A riparian management strategy representing the maximum buffer width identified from the Tl'azt'en community.

Discussion

Generic Criteria vs. Community Criteria

The Tl'azt'en results show that at a local level, criteria take on a different meaning when they are used to describe community perspectives on sustainable forest management. If criteria represent a set of values that define the essential elements for good forest stewardship, then implementing those criteria on a particular land base requires a deep understanding of what those values are, why they are relevant and where (on the landscape) they are impacted.

It is important, therefore, to compare the Tl'azt'en results with generic landscape-level C&I frameworks. Some might argue against this comparison on the premise that these existing C&I templates are intended only for assessment, monitoring and reporting (e.g., Prabhu et al. 1999). However, it is important to remember the role of criteria not only for monitoring, but also for *implementing* sustainable forest management.

Currently, more emphasis and concern is focused on methods of data collection and aggregation for reporting on sustainability, than on interpreting the information (e.g., Working Group on Criteria and Indicators 1997; Hall 2000). In other words, little attention is paid to identifying "threshold" (the point at which an indicator has reached a desirable or acceptable state) levels of sustainability. This demonstrates a possible weakness in the top-down approach to developing and using these generic criteria.

Exploring and understanding thresholds is important for directing strategic-level planning. In a situation where achieving or maintaining a criterion on a managed landscape is problematic, it follows that management must adapt existing strategies, practices or objectives to ensure sustainability. Therefore, C&I play an important role in directing decisions, and keeping forest management plans “on track” with regard to sustainability.

Two sets of existing criteria will be examined. One of these is from the Canadian Council of Forest Ministers, national level C&I (CCFM 1995). The CCFM C&I are broad by design, but are still used to guide the identification of local-level indicators for Canada's Model Forests (e.g., McClain 1998). Locally unique management issues are addressed at the indicator level. The second set of criteria is from a United States Forest Service initiative called the Land Unit Criteria and Indicators Development Project (LUCID 2001). This project is conducting six test cases to refine local level C&I to link sustainability measures with national C&I, and to implement them nationwide (LUCID 2001).

Table 9 shows these two sets of generic criteria and the Tl’azt’en criteria, arranged such that the categories are matched as closely as possible. It is apparent that the levels of detail differ between them. For instance, the CCFM and LUCID frameworks use “inclusive terminology” such as “function”, “diversity”, and “values” which provide limited guidance for planning and decision-making (Wilson et al. 1996; Holling et al. 1998; Lautenschlager et al. 2000).

To be effective for planning, these criteria need further interpretation at the landscape level. This means a more specific examination of forest values (Lautenschlager et al. 2000), resulting in another level of criteria developed from the bottom-up. For example, in the LUCID framework, criteria 2.5 (population function) and 2.6 (population structure) need to be further qualified by identifying locally important wildlife, fish and plant species which then become landscape-level criteria, measured with indicators of

Table 9. Comparison of generic criteria with Tl'azt'en criteria.

National Criteria (CCFM 1995)		**LUCID Principles and Criteria (LUCID 2001)**		**Tl'azt'en Criteria**	
Criteria	Critical elements	Principles	Criteria	Themes	Sub-themes
1. Conservation of Biological Diversity	1.1 Ecosystem diversity 1.2 Species diversity 1.3 Genetic diversity	P2. Maintenance of Ecosystem Integrity	C.2.1 Landscape function C.2.2 Landscape structure C.2.3 Ecosystem function C.2.4 Ecosystem structure C.2.5 Population function C.2.6 Population structure C.2.7 Genetic function C.2.8 Genetic structure	4. Resource and Environmental concerns	4.1 Wildlife (health, abundance, habitat) 4.2 Fish (health, abundance, habitat) 4.3 Trees & Plants (abundance, habitat)
2. Maintenance and Enhancement of Forest Ecosystem Condition and Productivity.	2.1 Incidence of disturbance and stress 2.2 Ecosystem resilience 2.3 Extant biomass				4.4 Forest health (pests)
3. Conservation of Soil and Water Resources	3.1 Physical environmental factors 3.2 Policy and protection				4.5 Water Quality 4.6 Soil
4. Forest Ecosystem Contributions to Global Ecological Cycles	4.1 Contribution to global carbon budget 4.2 Forest land conversion 4.3 Forest sector CO2 conversion 4.4 Forest sector policy factors 4.5 Contribution to hydrological cycles				4.7 Climate
5. Multiple Benefits to Society	5.1 Productive capacity 5.2 Competitiveness of resource industries 5.3 Contribution to the national economy 5.4 Non-timber values	P3. Yield and production of goods and services	C3.1 Wealth and capital accumulation C3.2 Production and consumption considerations C3.3 Trade and distribution considerations	None identified	
		P1. Social values related to the forest are maintained	C1.1 Spiritual and cultural values C1.2 Aesthetic values C1.3 Recreational values C1.4 Access C1.7 Gathering (non-economic) forest values	1. Human Factors	1.1 Education 1.2 Community 1.3 Employment
				2. Economics	2.1 Economic Development 2.2 Bush Economy
6. Accepting Society's Responsibility for Sustainable Development	6.1 Aboriginal and treaty rights 6.2 Participation of Aboriginal communities in sustainable development 6.3 Sustainability of forest communities 6.4 Fair and effective decision-making 6.5 Informed decision-making	P1. Social values related to the forest are maintained	C1.5 Involvement values	3. Land Management	3.1 Current management 3.2 Traditional management 3.3 Alternative management 3.4 Communication 3.5 Legacy 3.6 Knowledge & Research

health, abundance and habitat. In contrast, the Tl'azt'en wildlife, fish and trees/plants criteria (recorded as descriptions in the AFPP framework) were based on culturally important species. Locally endangered or threatened species could also form these criteria (e.g., Lautenschlager et al. 2000).

Another characteristic of community-defined criteria is their close relationship to each other. Local criteria are not mutually exclusive, and although the CCFM and LUCID frameworks acknowledge this, these connections become extremely apparent in a local Aboriginal context. There is such a strong interdependence among Tl'azt'en criteria, that at times it presented difficulties for grouping them into themes. For example, in order to implement traditional management approaches in the future, opportunities must be available for traditional education, and for an active bush economy. This requires the maintenance of wildlife, fish and plant populations, and contributes to overall community well-being and self-sufficiency.

Another aspect of community-defined criteria is the interpretation of how forest management affects local values. For example, the Tl'azt'en criterion 4.7 (Climate) is not the same as CCFM's criteria 4.1 (contributions to global carbon budget) or 4.3 (forest sector CO_2 conversion). Local climate concerns expressed by some community members relate to either the impact of cut block size on wind intensity, or the impact of global climate change on the local ecosystem.

Other criteria relating to production, yield, capital and trade found in the CCFM and LUCID frameworks are not found in the Tl'azt'en criteria. This is because community members did not express yield and production of timber resources as a major concern. Although labour intensive silvicultural treatments are implemented and encouraged, the main objective is to generate employment rather than to improve timber yield. Improving yield and production of resources that contribute to the bush economy could fit into this category. Community members did not, however, exhibit a desire to increase the yield of traditional plants and wildlife through management. Instead, Elders emphasized imposing harvest limits through traditional land ethics.

Finally, community-defined criteria can bridge the gap between ground-level activities and processes, and higher-level planning and monitoring initiatives. As Westley (1995) suggested, adaptive management systems must be able to incorporate new knowledge and types of information in order to implement plans and to effectively respond to change. Locally-defined C&I, that are communicated in appropriate terms and level of detail, may facilitate bottom-up information exchange with Aboriginal land users (e.g., keyoh-holders). Through this interaction the land users could also contribute to generating baselines for acceptable criteria thresholds, and provide an effective response system.

Criteria Similarities

Some of the criteria in Table 9 suggest that there are elements of sustainability that are truly generic, crossing natural, cultural, and hierarchical boundaries. For instance, the importance of public involvement, particularly Aboriginal involvement, in decision-making is inherent in all three frameworks, as are the notions of intergenerational equity and information sharing. This implies that such values are currently the greatest barrier to sustainability and require attention at all management levels.

Place Management vs. Resource Management

Viewing the forest landscape as a "place" is important for management because identifying place-specific values has technical implications for planning and implementing sustainability at strategic and operational levels. Place is not only associated with physical evidence of human use or personal attachment (e.g. Eisenhauer et al. 2000), but also key components of the ecosystem (riparian areas) that contribute to its function. Spatial criteria ensure that these place values are adequately addressed in forest management plans. The scenarios presented in this chapter reveal that the Tl'azt'en perspective of good riparian management is significantly different from the approach that is currently legislated and implemented in the region.

Conclusion

This chapter has shown that:

- forest management criteria and scenarios can be used to describe an Aboriginal approach to sustainable forest management;
- spatial criteria are a significant part of Aboriginal forest management; and
- community-defined criteria provide specific information to direct forest management that meets local needs, and to facilitate communication between resource users, practitioners and decision-makers.

These results do not suggest that C&I templates are irrelevant, but rather, that local criteria are needed to bridge the gap between national and local definitions of forest sustainability, and to facilitate their implementation into the planning process.

Chapter 5: Using an Analytical Tool to Represent Aboriginal Forest Management Indicators in Strategic-Level Planning

Introduction

Westley (1995, p. 396) described planning as "...a technology for sense-making and choice generation..." Computer-based decision support tools aid planning processes by structuring management problems, producing and evaluating alternate solutions, and facilitating group processes in decision-making (W. McCrory pers. comm.). This is accomplished by integrating the decision-maker's own insights with the computer's processing capabilities to enhance knowledge, understanding, and the quality of decisions made (W. McCrory pers. comm.; Varma et al. 2000).

Traditionally, these tools have focused on maximizing yield and efficiency in timber production. However, the recent emphasis on ecosystem management approaches has increased the complexities of forest management (Dykstra 1984; Weintraub and Davis 1993). In light of this change, tools designed for the sustained-yield management approach, and relatively simple problems, may no longer be as useful to forest managers. Decision makers must now simultaneously address diverse and conflicting forest values over a variety of spatial and temporal scales (Weintraub and Davis 1993). While even timber-flow may still be desirable, maintaining the dynamic social and ecological functions that forests provide requires innovative types of analytical support.

The social sciences play an important role in addressing these challenges by identifying, interpreting, and communicating public values related to land and resources (e.g., Robinson et al. 1997). Although this information can raise awareness and understanding about the publics' perspective on forests, the linkage between values and implementation has never been clarified. There is a need to understand how these values are used to generate and evaluate alternative solutions to complicated forest management problems (Harpley and Milne 1995; Brandenburg et al. 1995; Shindler 1999).

Natural resource management adopts several techniques from the field of management science to rank, prioritize or appraise these public resource values. This information is then used to direct forest management policies and efforts. Tools, such as cost-benefit analysis and non-market valuation, are used to assess value trade-offs under various management alternatives.

Cost-benefit analysis is a decision tool where resource gains and losses are given monetary values and comparatively assessed to determine which management strategies result in the most desirable outcome (Nas 1996). The difficulty with this tool, however, is that many natural resources are "public" goods, are not sold in the market place, and therefore assigning a monetary value to these goods is problematic (Mitchell and Carson 1989; Kopp et al. 1997).

To overcome this problem, non-market valuation approaches are sometimes used. The contingent valuation technique, for instance, uses surveys to determine public preferences for the resources and services provided by nature, by eliciting individuals' willingness to pay for those goods if they were hypothetically available on the open market (Mitchell and Carson 1989). This assessment approach is often used to determine the value of wilderness recreation opportunities.

Due to the cultural differences in ideological perspectives and land stewardship approaches, the use of non-market approaches in the context of Aboriginal resource management requires caution. Adamowicz et al. (1998) note that because sacred and taboo resources (often associated with 'place') cannot be substituted or traded off for another resource, these values would be under-represented in a non-market valuation assessment. The importance of place attachment applies equally for non-Aboriginal society and goes beyond physical use of those locations (Eisenhauer et al. 2000). For the John Prince Research Forest case study, these types of values are reflected in spatial criteria.

Another problem arising from non-market approaches relates to dividing non-timber resources into categories of goods (Adamowicz et al. 1998). As shown in the previous chapter, Tl'azt'en land-based resources are valued from educational, utilitarian, spiritual, intergenerational, and cultural perspectives simultaneously. Therefore, it is difficult to assign one value to a resource or service that serves a multitude of purposes. These linkages between resources and their function in Aboriginal society also indicate that a decline of one resource value will eventually have a negative impact on other related values. Because these relationships are not always apparent, non-market valuation techniques could underestimate the actual impact of a diminishing resource. Other challenges to applying non-market valuation techniques in Aboriginal resource management include traditional institutional controls over resource use and land allocation, and differences in resource distribution according to status, gender and generational lines (Adamowicz et al. 1998).

As an alternative to using monetary values, analytical forest planning tools can address these issues by using C&I to assess relative resource values (e.g., Dewhurst in prep.). These tools, however, can present a technical barrier between formally trained professionals and planning participants. Because analytical tools are designed for professionals, it is these people who are required to interpret public values, develop alternatives, and analyze and communicate the results. This approach could allow institutional and social biases to enter into the planning process, where political agendas and personal values may influence the outcome (Rivlin 1993).

Well-designed analytical tools can help to avoid this problem by bridging the public and analytical aspects of the planning processe. In theory, if participants can conduct their own analyses, simulation/optimization models could be used to explore and communicate the forest management goals and objectives of individuals or of small groups, and to develop a better understanding of how individual and group perspectives affect the management of the landscape over space and time.

The development of such models requires consideration, not only of programming, mathematics, hardware capacity, and information management issues, but also of how social information can be incorporated into the system design so that the tool is accessible by a broader spectrum of non-technical end-users (Zhu and Dale 2000). Some necessary features include:

- sound and effective solutions to management problems;
- clear, accurate, and consistent communication of results, using high quality graphics and GIS-based information;
- transparency regarding assumptions and biases; and
- accessibility by the end-user, with real-time generation of management solutions (Weintraub and Davis 1996; Landsberg 2001).

Analytical Planning Tools

Recent developments in forest planning tool design demonstrate that modellers are attempting to address the needs outlined above. For instance, Varma et al. (2000) developed a decision support system designed to integrate spatial and non-spatial information with subjective, user-defined preferences. This linkage is accomplished using aspiration-based utility functions combined with a GIS (Geographic Information System) to integrate and analyze multiple forest values. Forest land units are assessed using criteria and indicators of sustainability, and strategies are developed for those units that do not meet the criteria (Varma et al. 2000). Another example is the Tool for Exploratory Landscape Scenario Analyses (TELSA) developed by Kurz et al. (2000). TELSA combines spatial data with user-defined vegetation succession, natural disturbance and management activities to report on a set of management indicators for strategic level planning (Kurz et al. 2000).

Similarly, the Lurch forest planning system is a spatially explicit analytical tool designed to examine the implications of management alternatives (Dewhurst in prep.). User-defined management indicators are employed to develop management goals and policies, and to assess trade-offs. This provides ideal analytical support for the scenario planning process, allowing for rapid development and evaluation of management scenarios (Dewhurst in prep.).

The forest planning tools outlined above share several design features that make them suitable for public planning processes. These features include:

- use of C&I to describe sustainability;

- incorporation of spatial criteria into the analysis;
- flexibility of integrating user's knowledge and values into the analysis; and
- manipulation of both spatial and numerical parameters, allowing the user to explore diverse solutions to management problems, and to conduct tradeoff analyses.

Consequently, the Lurch planning system is well suited for participatory forest planning with features that include:

- the flexibility of user-defined indicators;
- a user-friendly interface providing real-time summaries of both spatial and numerical implications of management scenarios;
- the capacity to adjust and monitor quantitative and spatial indicators simultaneously.

The purpose of this chapter is to demonstrate how an analytical tool with these features can incorporate locally-defined, Aboriginal quantitative and spatial C&I into the analytical planning process. The three objectives of the chapter are to:

1) explore the relationship between quantitative indicators;
2) understand the implications of Tl'azt'en riparian management scenarios; and

3) communicate between Aboriginal and conventional perspectives on sustainable forest management by incorporating both types of indicators into the analysis.

This analysis will use scenarios and selected criteria generated from the archival research and consultation with Tl'azt'en research participants described in the previous chapters. Although community information is used in the analyses, the results presented in this chapter are from hypothetical examples, and do not represent a formal planning session with Tl'azt'en community members. The results presented, and their interpretation, are dependant upon two assumptions: firstly, that the input data are accurate and correct, and secondly, that the Lurch planning system is functioning properly and is producing accurate results. The Lurch tool was calibrated by simulating targets used in the current John Prince Research Forest (JPRF) management plan and comparing the results. This calibration was completed before the case study analysis and, based on these tests, the investigator determined that the results were consistent and accurate enough to address the research questions.

Description of Model Setup and Analysis Approach

Lurch Parameters

At the time of this analysis, multiple harvest entries[7] were not yet built into the Lurch planning system. Therefore, the analysis was limited to a single entry within an 80-year planning horizon. The following user-defined parameters were also established:

[7] When a stand of trees reaches harvestable age (rotation age) once within the planning horizon, one (harvest) entry is made. If the planning horizon is long enough such that a stand can be harvested more than once, then multiple entries are made. In the Lurch system, rotation age is the point where an evenaged stand converts to age zero by being harvested, whereas an unevenaged stand remains "mature" and could potentially have an infinite number of entries throughout the planning horizon.

- the planning horizon was divided into four, 20-year planning periods;
- conversion options were based on Tl'azt'en's "put back what you take out" stand regeneration policy[8] (a qualitative indicator).
- non-forest and "not satisfactorily restocked" areas were spatially excluded from the timber harvesting land base (6% of the total land area).
- in the scenarios, areas with a "no harvest" treatment were assumed to convert to subalpine fir (*Abies lasiocarpa*) after the stands reached their biological rotation age[9] (C. Hawkins pers. comm.). Areas with a "sensitive management" designation were converted to unevenaged, mature stands at biological rotation while maintaining the same leading species.

Additional information on Lurch parameters, such as conversion options and stand yield tables are provided appendices 2-5.

Analysis Approach

Two hypothetical examples are presented to illustrate how the Lurch planning system is used to address forest management problems. The first example demonstrates how a model can be applied to understand landscape level relationships among Tl'azt'en and conventional indicators. The second example demonstrates how a model can be

[8] An exception to this is RMZ 9, which has an ecological restoration emphasis and consequently, has a broader range of conversion options. See appendix 5.
[9] The biological rotation age represents the "natural" biological life expectancy of the stand.

employed to examine the implications of Tl'azt'en's riparian management scenarios on both types of indicators.

Indicators for Tl'azt'en's wildlife and trees and plants criteria sub-themes were used in both examples. Given that few community-defined indicators were identified from the interview analyses, secondary sources were used as a surrogate (e.g., MacKinnon et al. 1990; Beaudry et al. 1999). To maintain confidentiality, these wildlife and plant species (or groups of species) are referred to as "wildlife 1", "tree/plants 1" and "trees/plants 2". Conventional management indicators were adopted from the current JPRF management plan (1999), which include seral stage distribution[10] and leading tree species distribution. Analysis units are used to classify the forest cover types, and combined with seral stage to define the indicators (Table 10; Table 11).

Harvest volume is an indicator that applies to both Aboriginal and conventional criteria, as it contributes to both Aboriginal and non-Aboriginal economies and represents opportunities for forestry training and education.

The following procedure was used for each analysis "run":

- indicator targets were set and the model was allowed to converge on a solution.

[10]In the analyses, seral stages for the Tl'azt'en indicators are defined differently than for the conventional indicators. For Tl'azt'en, Early=1-40 years, Young=41-100 years, Mature=101-140 years, Old=141+ years. For conventional seral stages, Early=1-40 years, Young=41-100 years, Mature=101+ years, Old=141+years, as per the Forest Practices Code of BC Biodiversity Guidebook (1996).

Table 10. Analysis unit names and abbreviations.

Analysis Unit Common Name	Analysis Unit Scientific Name	Analysis Unit Abbreviation
Douglas-fir	*Pseudotsuga menziesii* var. *glauca*	Df
Interior spruce	*Picea glauca* x *englemanii*	Sx
Lodgepole pine	*Pinus contorta*	Pl
Subalpine fir (balsam)	*Abies lasiocarpa*	Bl
Paper birch	*Betula papyrifera*	Ep
Trembling aspen	*Populus tremuloides*	At
Black cottonwood	*Populus balsamifera*	Ac

Table 11.Definitions of forest management indicators used in the Lurch analyses.

Indicator Name	Applicable Analysis Units							Applicable Seral Stages			
	Df	Sx	Pl	Bl	Ep	At	Ac	Early	Young	Mature	Old
Trees/plants 2	✓					✓				✓	
Wildlife 1		✓	✓			✓		✓	✓		
Trees/plants 1	✓	✓	✓			✓		✓	✓		
Seral Stage	✓	✓	✓	✓				✓	✓	✓	✓
Leading Tree Species	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

- if necessary, "penalties" were used to achieve the desired targets. A penalty is an arbitrary mathematical incentive to essentially "push" the model to the desired target (see Dewhurst 2001).
- the analysis was stopped when all the targets were attained, or when a near-optimal solution was found. A solution was considered to be

near-optimal when the model consistently stabilized at the same result after repeated randomization and convergence cycles.

- numerical and map-based results were then recorded.

The time required to run each scenario ranged between approximately 30 seconds to 30 minutes, depending on the complexity of the management constraints and targets that were set for the scenario.

In both examples, for the first four planning periods, harvests were set at the same levels as the current management plan. These volumes had been calculated based on a 300-year planning horizon, using the Echo forest planning models (Dewhurst et al. 1999; JPRF 1999). Because the analysis involved a limited planning horizon, using these targets to constrain the harvest would ensure that the long-term sustainability of the timber resource was not compromised.

Analysis, Results and Discussion

Example 1

Consider a situation in which a forest manager is in a planning session with a group of Tl'azt'en community members. Using Tl'azt'en's scenario 1 (Forest Practices Code of BC) (Chapter 4, Figure 6), the manager may begin the session by showing this group how their indicators are affected by the current 80-year harvest strategy (Table 12). These results are used as a base case for comparing subsequent analyses (Figure 11). The maps in Figures 12 and 13 show spatial outputs for the base case run. The maps allow users to assess indicator distributions across the landscape and over the planning horizon. For instance, in Figure 12, harvest activities progress from the western portion of the landscape to the east over the planning horizon. Figure 13 shows mapped indicators for period 4 of the analysis. These maps provide a visual representation of the numerical results from the model.

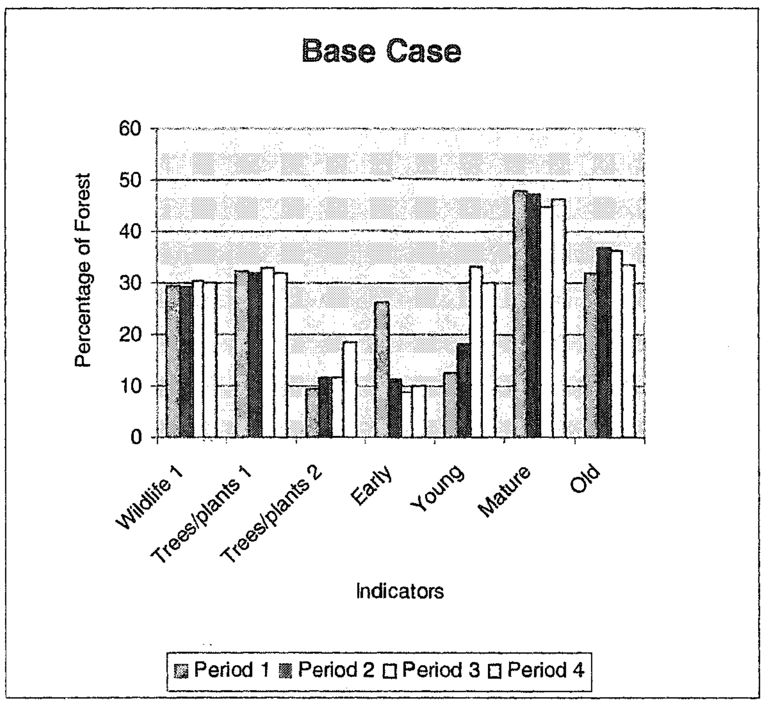

Figure 11. Base case (run 1) analysis for example 1. Lurch analysis with harvest volumes set to current management plan levels.

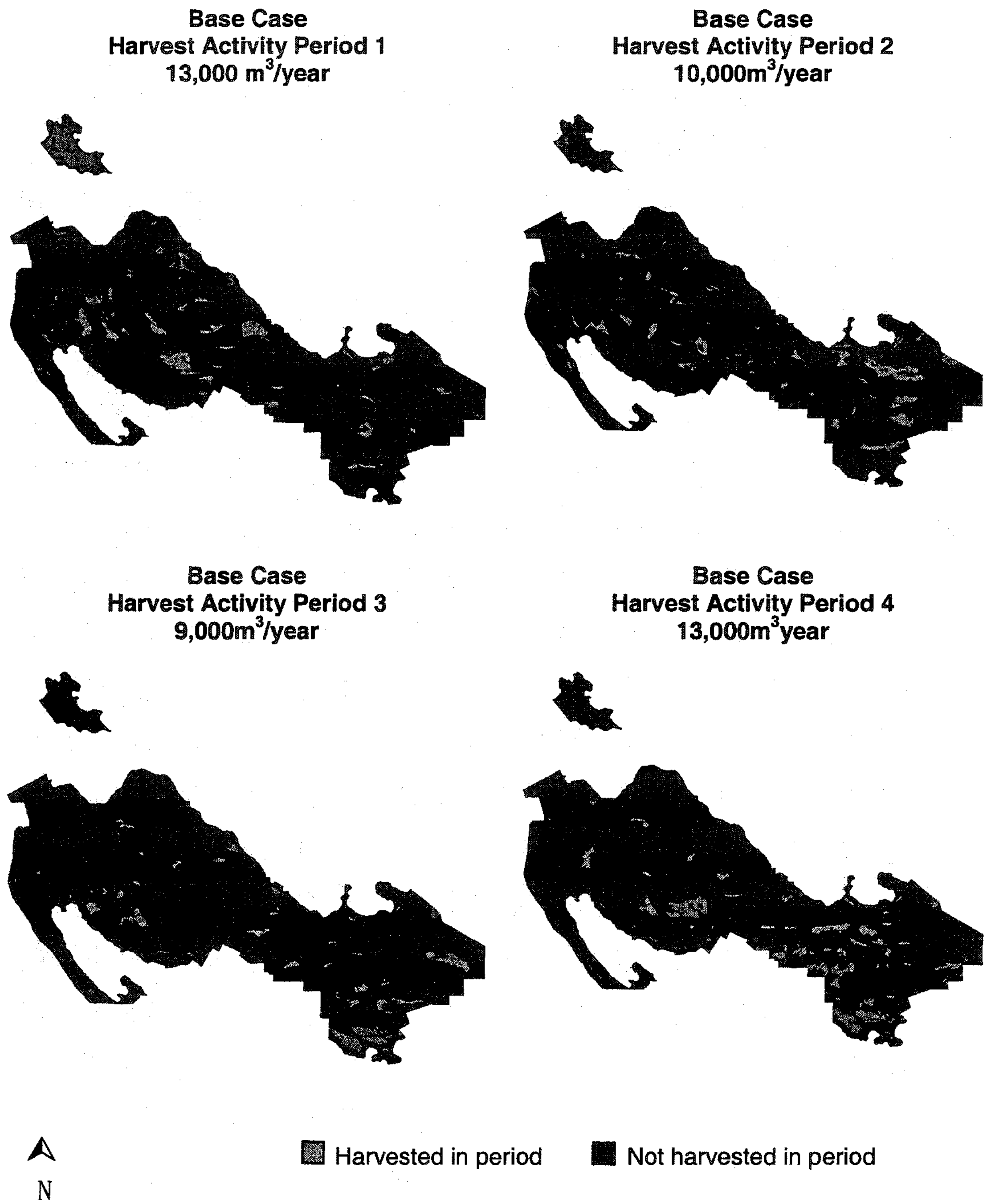

Figure 12. Lurch spatial results showing the distribution of harvest activities across the JPRF landscape for the example 1, base case run. The maps show a shift in harvest activity from west to east over the planning horizon.

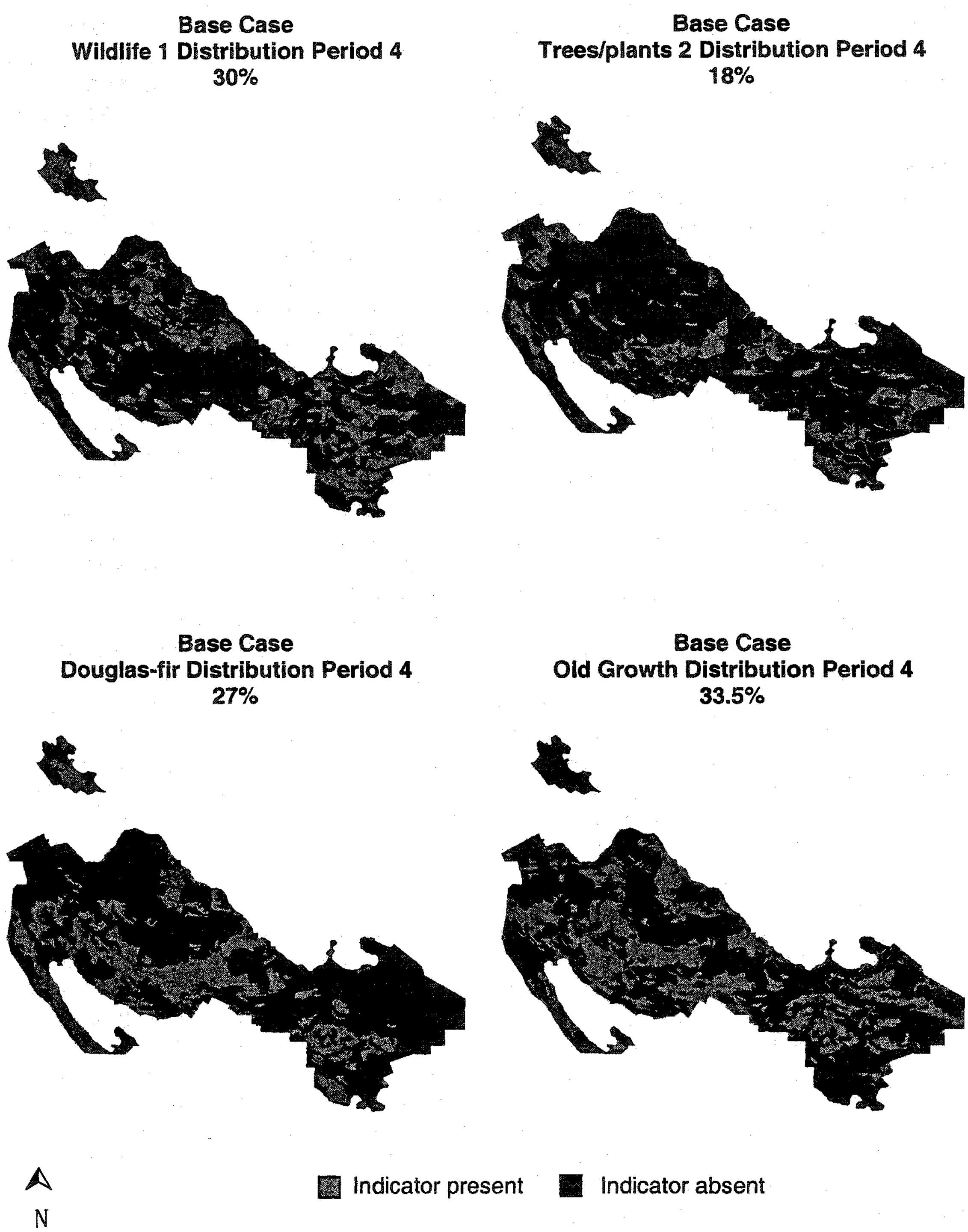

Figure 13. Lurch spatial results showing a comparison between indicators at the end of the planning horizon for the example 1, base case run. The mapped indicators provide a visual representation of quantitative indicator results.

At this point a keyoh-holder might ask if it is possible to increase the amount wildlife 1 in the forest. The wildlife 1 target is arbitrarily set to 40% in each of the four planning periods, without removing the harvest targets (Table 12). The analysis produces the following results (Figure 14):

1) *Level of target achievement:* All targets are attained except for wildlife 1 in period 1, which reaches a maximum of 38.3%.

   Explanation: With wildlife 1 defined as "early" and "young" forest (Table 11), and given that harvesting is a mechanism for generating early forest stands, it follows that the harvest and wildlife 1 indicators are compatible. The

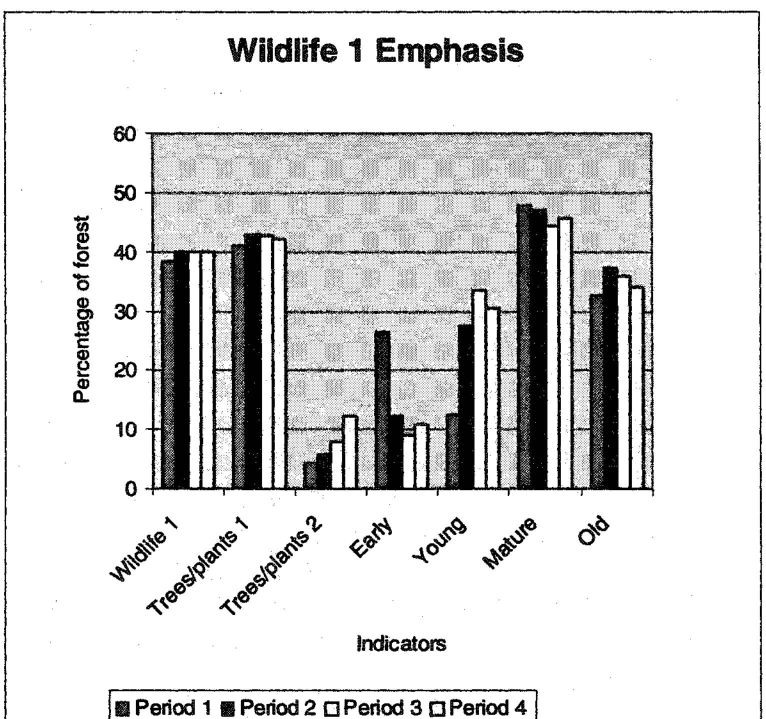

Figure 14. Example 1, run 2 analysis with wildlife 1 targets set to 40%.

shortfall of wildlife 1 in period 1 is possibly due to limited availability of appropriate analysis units (i.e., pine, spruce or aspen), or may be constrained by the harvest target.

2) *Implications for Tl'azt'en indicators:* The percentage of trees/plants 1 increases relative to the base case, while trees/plants 2 decreases by a magnitude of 1.5-2.0 (Figure 14). A visual representation of this trade-off is provided in Figure 15.

   Explanation: Trees/plants 1 increased because it shares similar habitat features with wildlife 1, and therefore by setting a target for one, the other will respond (increase or decrease) in the same way. Slightly higher percentages of trees/plants 1 are explained by the fact that its habitat is defined by one more analysis unit (Douglas-fir), and thus, more of the forest is compatible with its habitat features (Table 11).

   Because trees/plants 2 habitat is found in "mature" forest, it essentially competes with the other two indicators. Trees/plants 2 is also limited to two analysis units, making its habitat relatively rare. Logically, in a model where forest age is determined by timber harvest, emphasizing forest values that encourage early and young forest would inversely impact forest values that require mature forest.

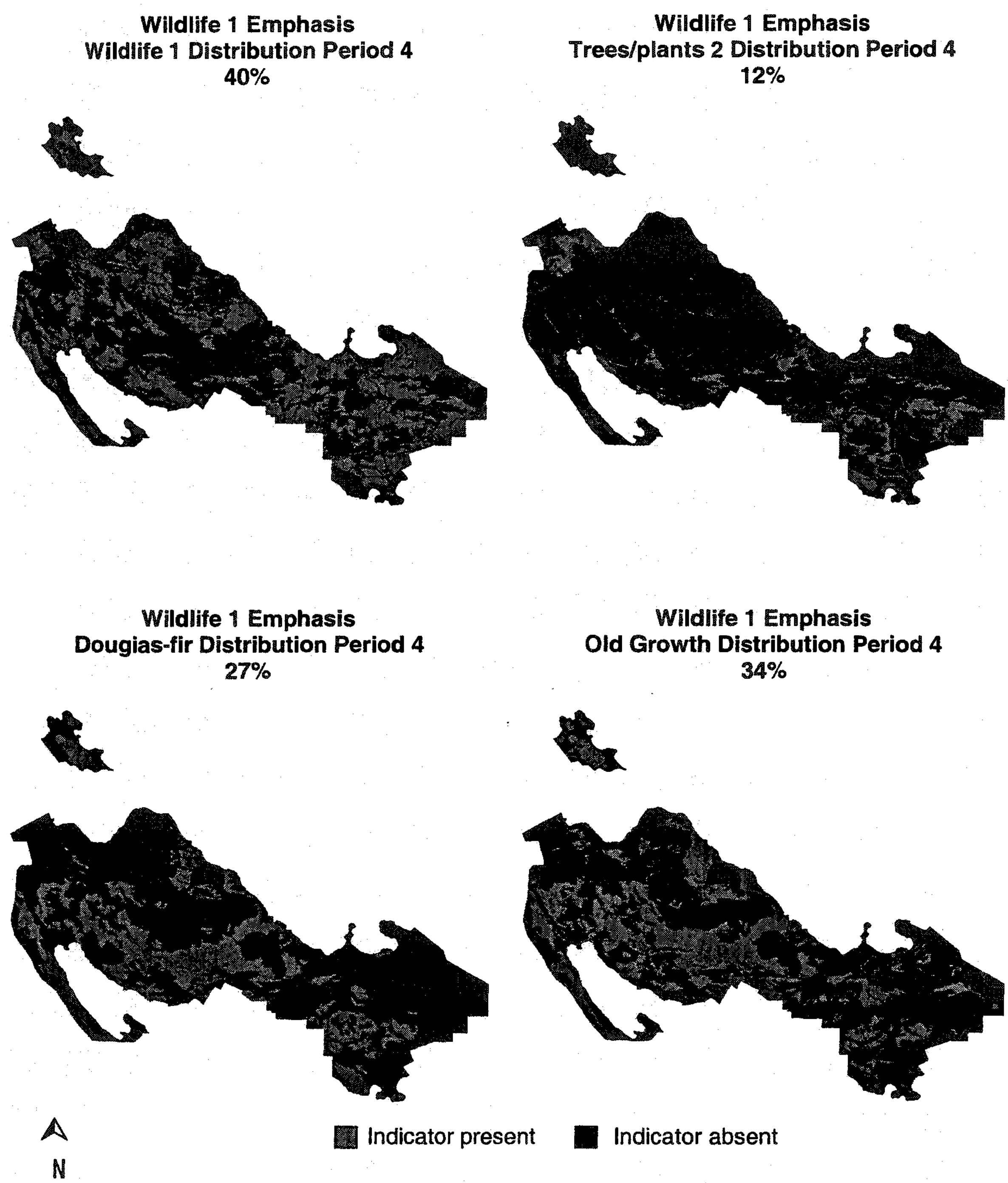

Figure 15. Lurch spatial results comparing indicators at the end of the planning horizon with wildlife 1 targets set to 40%. The emphasis on wildlife 1 produces a visible difference when compared with the base case scenario.

3) *Implications for conventional indicators:* There is no change in seral stage distribution, and due to the "put-back-what-you-take-out" forest conversion strategy, there is no change in species distribution.

Realizing that trees/plants 2 may require more attention than wildlife 1, another community member might suggest that trees/plants 2 be emphasized instead. In the planning tool, the wildlife 1 targets are removed and a target for trees/plants 2 is set to 30% for all four planning periods. Harvest volume targets are again maintained in this run (Table 12). Lurch produces the following results (Figure 16):

Table 12. Indicator targets for example 1 runs.

Scenario Targets												
	Harvest (000s m^3/yr)				**Wildlife 1 (%)**				**Trees/plants 2 (%)**			
Period	**1**	**2**	**3**	**4**	**1**	**2**	**3**	**4**	**1**	**2**	**3**	**4**
Base Case	13	10	9	13	-	-	-	-	-	-	-	-
Wildlife Emphasis	13	10	9	13	40	40	40	40	-	-	-	-
Trees/plants Emphasis	13	10	9	13	6	6	6	6	30	30	30	30

1) *Level of target achievement:* While harvest volume targets were attained, the 30% trees/plants 2 target was difficult to achieve with penalties alone, so an additional target of 6% was placed on the wildlife 1 indicator. Knowing that these two indicators have an inverse relationship, setting a low target to

"push" wildlife 1 down would consequently push the trees/plants 2 indicator up, and closer to the desired solution.

Explanation: Although this 'incentive' helped somewhat, the 30% target for trees/plants 2 was attained only in period 4. Much of the spruce forest is in an early or young seral stage, and remains in these age groups for the first three periods in the planning horizon (Figure 17). Therefore, with the current forest age structure, it is not possible to generate more trees/plants 2 habitat before the end of the 80-year planning horizon.

2) *Implications for Tl'azt'en indicators:* As expected, the wildlife 1 and trees/plants 1 indicators decreased in response to the trees/plants 2 targets (Figure 18).
3) *Implications for conventional indicators:* Very little quantitative change resulted in the seral stage, or the species distribution; however, their spatial distributions were re-allocated (Figure 18).

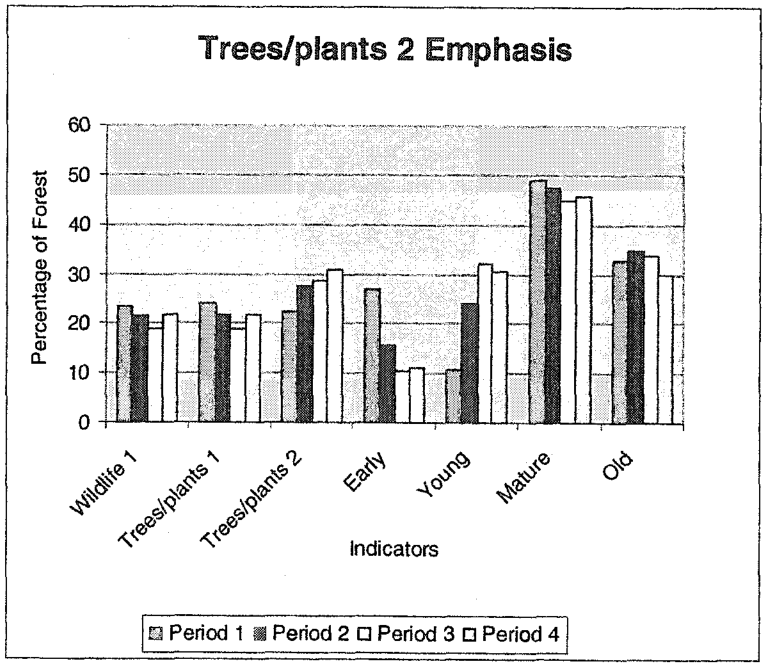

Figure 16. Example 1 (run 3) analysis with trees/plants 2 values set at 30% and wildlife 1 values set at 6%.

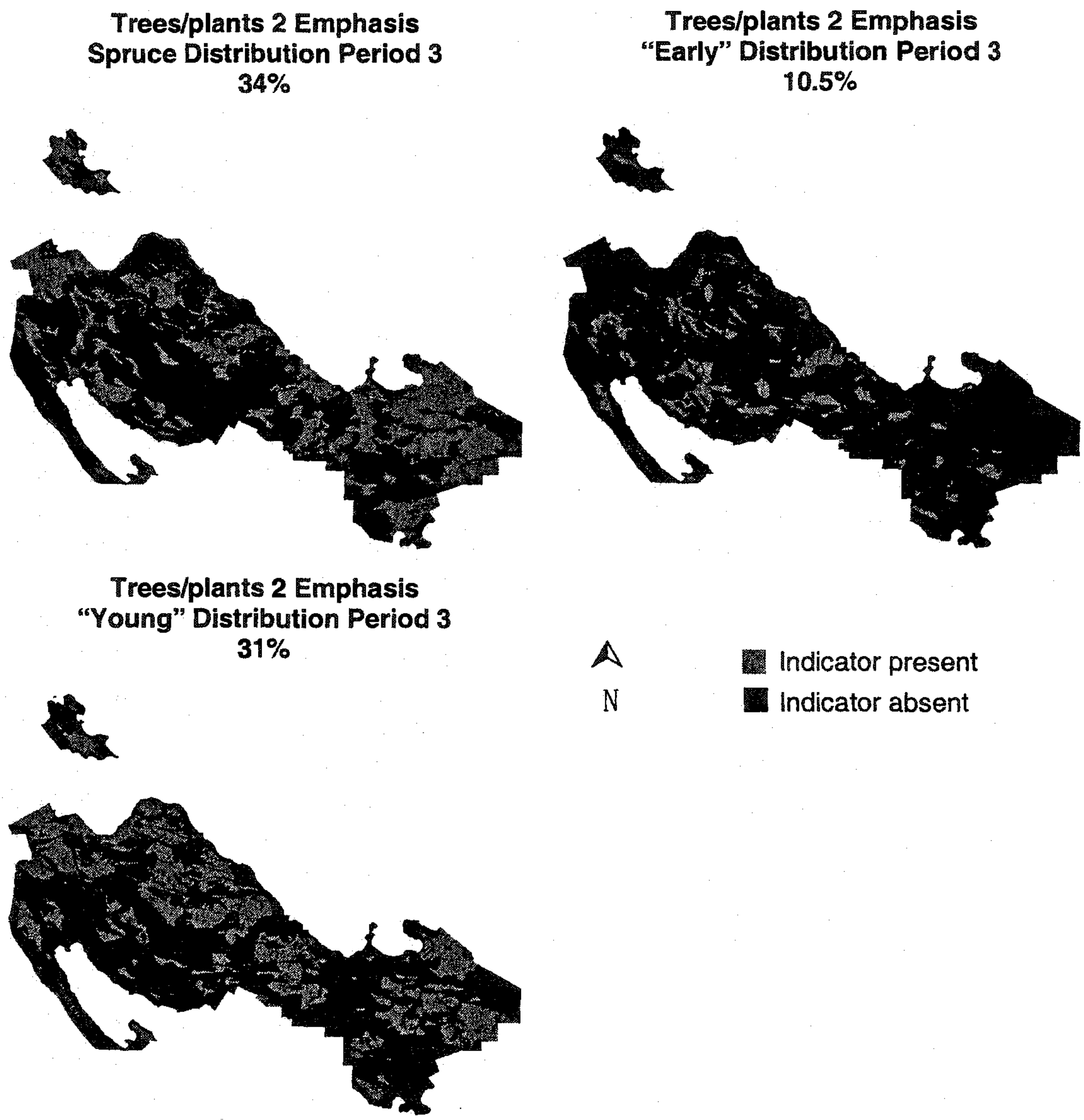

Figure 17. Lurch spatial results for example 1 (run 3) showing that much of the spruce leading stands in the forest are in early or young seral stages. The maps showing young seral stage and spruce indicators are especially similar. Spatial results such as these facilitate interpretation of the analysis.

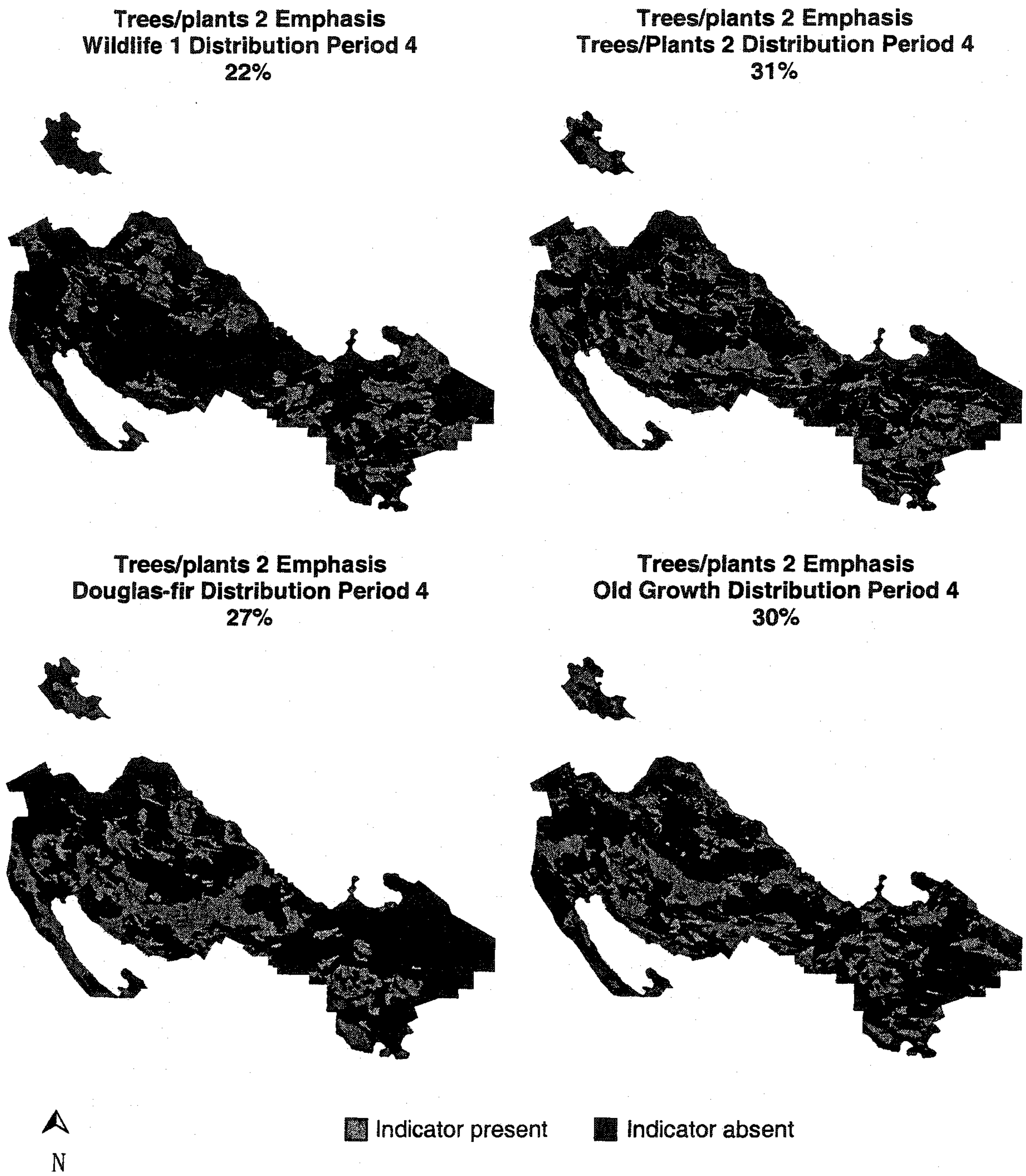

Figure 18. Lurch spatial results showing indicator distributions for example 1 with trees/plants 2 targets set to 30%.

Of the three runs (base case, wildlife 1 emphasis, and trees/plants 2 emphasis), the third run, emphasizing tree/plants 2, represents the most balanced solution without compromising revenues from timber extraction. The quantitative and map-based results of the scenario, and qualitative feedback from the planning session, provide information which can be incorporated into future analyses, management plans, development plans, or used to inform stakeholders (e.g., UNBC, government, industry) of the advantages and implications of the overall management strategy.

By tracking conventional indicators simultaneously, each scenario can be compared with provincial forest management guidelines. Table 13 shows a comparison between the 1999 JPRF seral stage distribution, the intermediate biodiversity objectives described in the JPRF management plan, and the seral stage results from the example 1

Table 13. A comparison between example 1 results and current JPRFseral stage distribution and targets. The table shows that the example 1 results are within the targeted seral stage distribution.

Seral Stage Distribution Results and Targets

		Early	**Mature**	**Old**	**Harvest (m^3/yr)**
Current JPRF levels		28	56	35	-
Intermediate biodiversity target		<54	>34	>11	-
Example 1, Base case	Period 1	26.1	47.9	32.0	13,000
	Period 2	11.1	47.2	36.8	10,000
	Period 3	8.7	44.6	36.1	9,000
	Period 4	10.1	46.3	33.5	13,000
Example 1, Wildlife 1 emphasis	Period 1	26.3	47.8	32.7	13,000
	Period 2	12.3	46.9	37.1	10,000
	Period 3	8.9	44.3	35.8	9,000
	Period 4	10.8	45.6	33.9	13,000
Example 1, Trees/plants 2 emphasis	Period 1	26.9	49.0	32.9	13,000
	Period 2	15.7	47.3	34.8	10,000
	Period 3	10.4	44.7	33.6	9,000
	Period 4	11.0	45.6	29.8	13,000

runs. This comparison reveals that each scenario was within the targeted biodiversity limits.

This example also shows that the "put-back-what-you-take-out" stand regeneration policy maintains current leading species distribution over time. Consequently, this management policy limits possibilities for increasing habitat related to certain forest values by altering species composition through management. As an alternative, the community may consider restoring the forest to a desirable, natural species distribution before implementing the policy.

Example 2

The second example will involve examining the implications of the Tl'azt'en riparian management scenarios on timber harvest, and consequently, revenues for research forest activities and programs. In this analysis, only the base case harvest volume targets from example 1 were set for each scenario. Results for selected Tl'azt'en and conventional indicators are shown in Figure 19:

1) *Level of target achievement:* This analysis revealed that harvest targets were achievable in all five scenarios. This means that even Tl'azt'en's most stringent riparian protection strategy (scenario 5) (Figure 10), where 67% of the forest is not available for timber harvest, does not restrict current levels of timber extraction (Figure 20).

2) *Implications for Tl'azt'en indicators:* The wildlife 1 and trees/plants 2 indicators experience small fluctuations between scenarios (Figure 19).

Scenario 1 results in the highest amounts of both wildlife 1 and trees/plants 2, while scenario 3 seems to represent a pivotal point in these riparian management strategies, as this is where wildlife 1 reaches its highest and trees/plants 2 its lowest value. It is also at this point where differences across the planning horizon increase for the wildlife 1 indicator.

From the spatial results, it appears that in scenario 3, much of the "early" forest is in spruce stands, which may account for the high level of wildlife 1 (Figure 21); while in scenario 2, "early" forest has a fairly even distribution across species. In scenario 4, because 26% of the forest is in sensitive management, there are higher amounts of "mature" forest which subsequently increase trees/plants 2.

3) *Implications for conventional indicators:* The most prominent impact of the scenarios on forest characteristics after 80 years is the rising proportion of balsam over the landscape with increased riparian protection (Figure 22). This results from the assumption that the 'no harvest' areas will naturally convert to balsam-leading stands. The percentages of balsam identified in this analysis in periods 3 and 4 for scenarios 3, 4, and 5 (Figure19) exceed the maximum proportion of balsam(17.5%) that is considered to be “natural” in the current JPRF management plan (1999). Consequently, there are decreases within other analysis units as they are gradually replaced by balsam in each period.

Douglas-fir decreases considerably across scenarios, with 27.0% in scenario 1, period 4, and 19.1% in scenario 5, period 4 (Figure 19). This is explained by the fact that Douglas-fir is being replaced by balsam in the

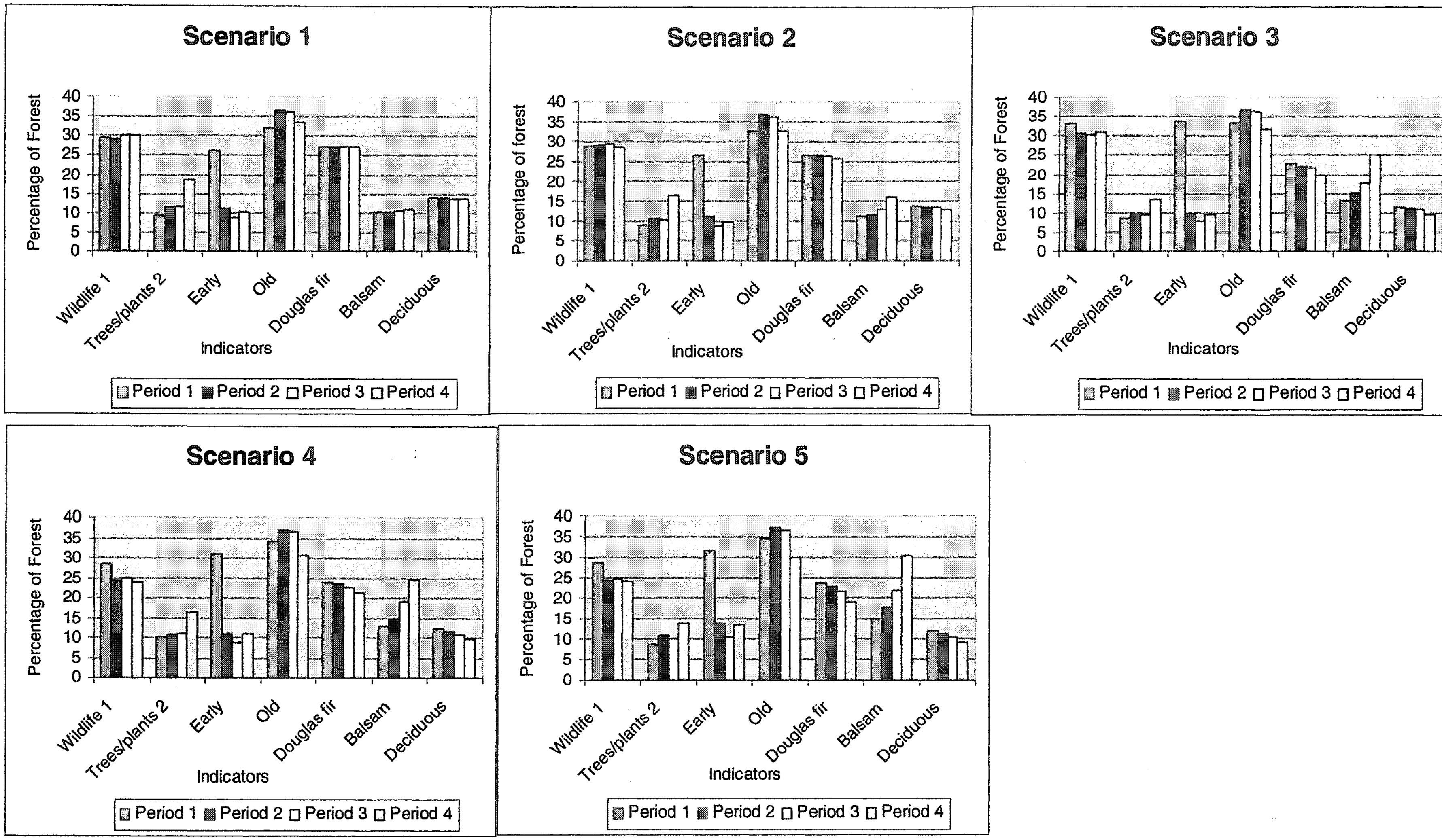

Figure 19. Lurch results from example 2, showing the five Tl'azt'en riparian management strategies, with harvest volume targets set to 13 000, 10 000, 9 000, and 13 000 cubic metres per year for planning periods 1, 2, 3, and 4 respectively.

riparian zones, and increasingly so as these zones occupy more of the forest with each scenario over time. Although it is interesting that the Tl'azt'en riparian management strategies do not restrict harvest volumes, future planning sessions with the community should include further analyses to:

- determine the long-term (200-300 years) forest conditions as a cumulative effect of implementing these policies (this will require the use of a model which supports a longer planning horizon);
- incorporate resource management zone objectives into the scenarios;
- achieve an appropriate balance between the wildlife 1 and trees/plants 2 indicators with increased riparian protection;
- test assumptions about forest conditions within the riparian protection zones; and
- develop a better understanding of the management dynamics that are driving these results.

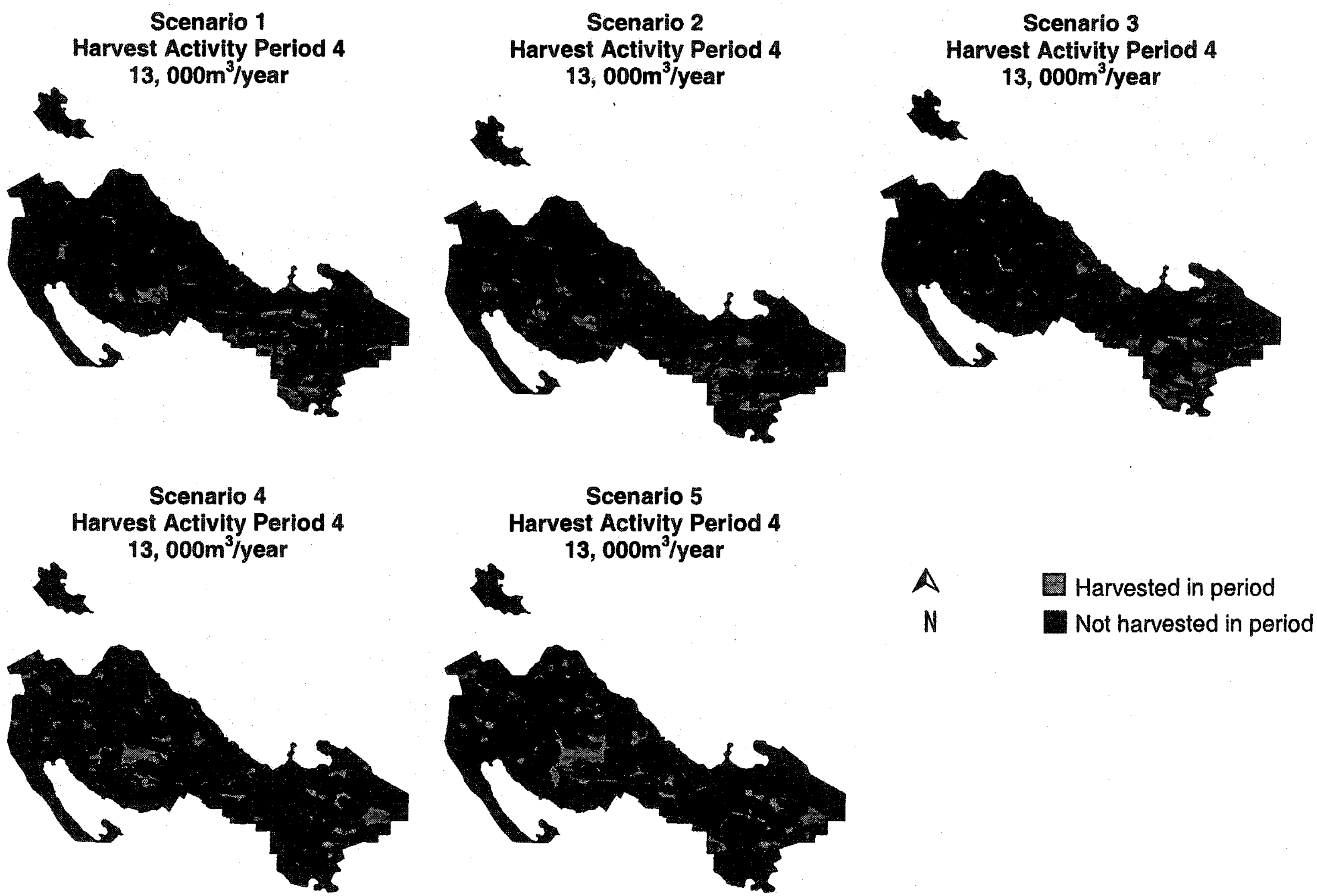

Figure 20. Harvest activities across scenarios in period 4.

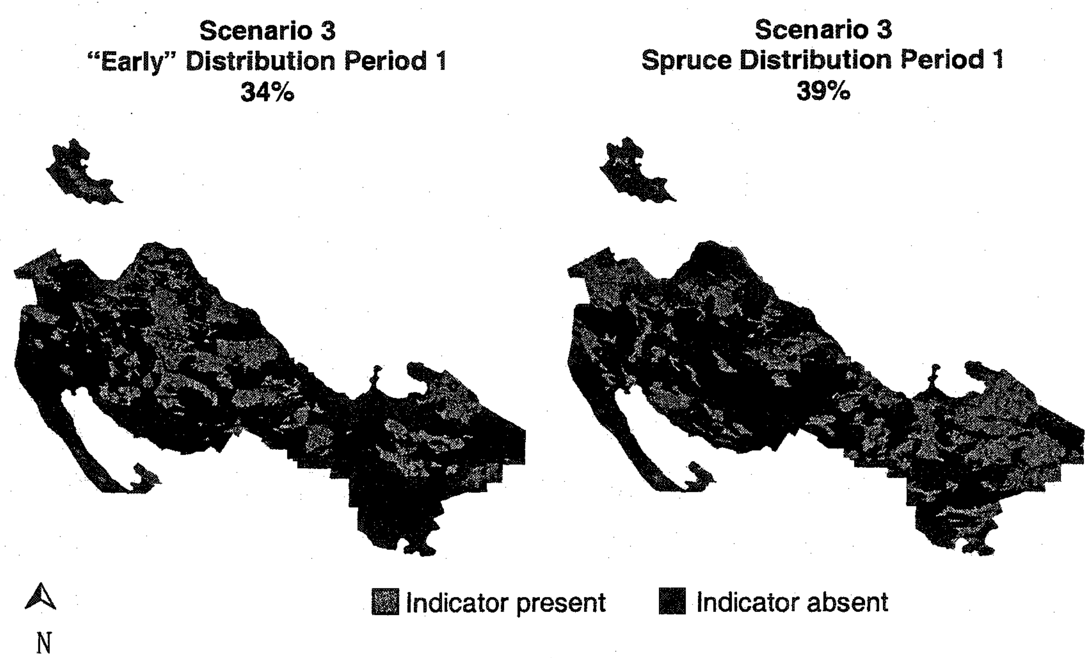

Figure 21. Lurch spatial results showing that much of the early forest is in spruce leading stands, explaining why there are high amounts of wildlife 1 in scenario 3.

This last observation presents an important point. The fact that these indicators are influenced by both species distribution and seral stage distribution makes interpreting the results fairly complicated. Without knowing the distribution of species by seral stage, or species harvested, it is difficult to determine what aspect of management, riparian strategies or harvest preferences, are driving the results. Therefore, while the model's capacity to incorporate intuitive, spatial indicators is an important feature for *making* management decisions with non-technical end-users, adequate quantitative information is required to *interpret the outcomes* of these decisions. This is particularly true as the management objectives, and indicator definitions, become more complex.

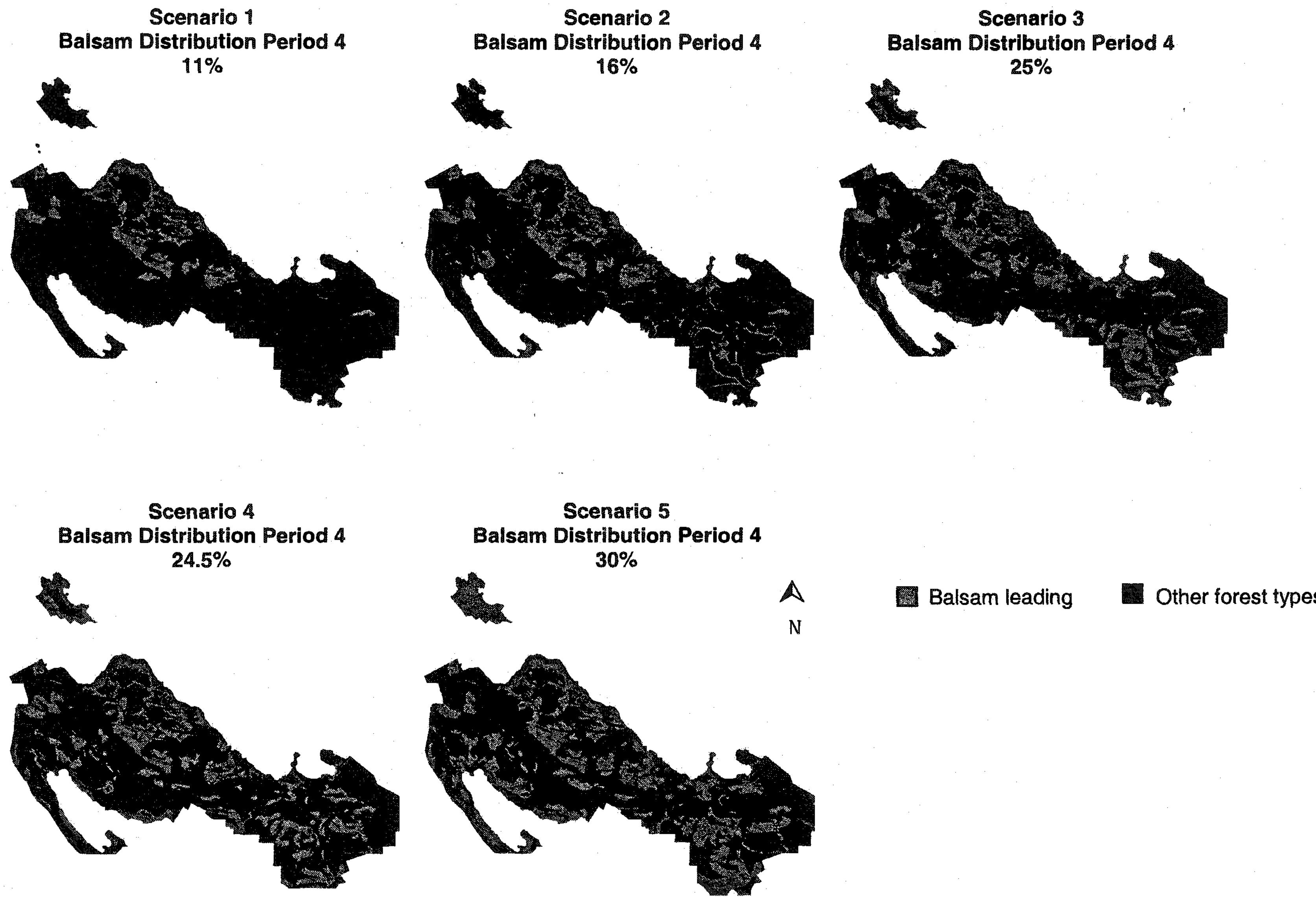

Figure 22. Balsam distributions across Tl'azt'en's riparian management scenarios in period 4. Balsam visibly occupies more of the forest as riparian zones increase in size.

Limitations of the Analytical Planning Approach

Analysts must be aware of the assumptions and limitations of the tools they use before basing decisions on scenario results. There are many possible sources of error in the input data used to conduct the analyses. For instance, forest cover and ageclass information may not be current or accurate, and yield tables based on extrapolated data from other parts of the region or the province may under- or over-estimate timber yields. Consequently, inaccurate input information will yield inaccurate results.

Another aspect of analytical tools such as the Lurch system is that they simulate the effect of management strategies and systems on landscape characteristics, but do not simulate ecological processes. The tool is designed to help people develop near-term forest management strategies that achieve a long-term, landscape level forest condition with characteristics that are considered to be sustainable. Successfully implementing these strategies, however, will require adaptability and professional skill to address ecological, economic and operational realities, which will limit achieving the ideal management strategy calculated by the analytical tool.

Conclusion

There is a need for improved communication between scientists, managers, and resources users, and also to "explore the appropriate relationship between local and scientific knowledge, and by extension, the role of resource dependent communities in management" (Weeks and Packard 1997, p. 243). All parties have a responsibility to generate a common framework for communicating resource management preferences.

Using suitable tools in the decision-making process is an important component of this process.

By incorporating locally relevant Aboriginal indicators, the analytical planning approach could be used to engage Aboriginal communities such as Tl'azt'en Nation in planning processes where community members are in control of developing and communicating their own management strategies and scenarios. Analytical tools with the appropriate features can be used to explore the relationship between quantitative and spatial indicators; develop an understanding of the implications of community-defined scenarios; provide a visual representation of quantitative targets; and reconcile Aboriginal and non-Aboriginal approaches to management by using both types of indicators. This establishes a more equitable planning framework for sustainable forest management decision-making.

Chapter 6:Thesis Conclusions

Summary

The purpose of this study was to integrate Aboriginal forest values into strategic-level planning using an analytical approach. To accomplish this task, a set of research questions and objectives was identified. These points are summarized in the context of the research results:

1) **Question:** *Can procedures be developed and used to elicit, translate, and incorporate Aboriginal information into an analytical approach to forest management planning?*

   Objective: *To translate Aboriginal community values into forest management criteria and indicators.*

   Outcome: The Aboriginal Forest Planning Process (AFPP) was developed to elicit and translate Aboriginal information into criteria and indicators so that it can be incorporated into the analytical planning approach. Some of the characteristics of this framework include:

   - the use of archival interviews and traditional use maps as an initial information source;
   - an approach to selecting information that is broad and comprehensive;
   - an information management process and structure that is transparent and verifiable; and

- the delineation between quantitative, qualitative and spatial information.

2) **Question:** *How can an Aboriginal perspective on forest management be communicated using these procedures?*

Objective: *To use these criteria and indicators and a set of forest management scenarios to characterize an Aboriginal community's forest management approach.*

Outcome: The criteria resulting from the interview and map analyses produced a comprehensive picture of the Tl'azt'en's major concerns, expectations, and management strategies related to the John Prince Research Forest (JPRF) landbase, and to forest practices in general. These included human/social factors, maintaining economic activities, developing new land management systems, and addressing resource and environmental concerns. The scenarios requested by the scenario advisory team focused on spatial criteria related to riparian and cultural areas, emphasizing the importance of place-specific values within the community.

As an exercise in identifying local-level criteria and indicators of sustainable forest management, the Tl'azt'en results demonstrate that bottom-up approaches provide the detailed information needed to develop strategic-level management goals and objectives. Furthermore, this work has shown that scenario planning can be applied to generate multiple local perspectives (both Aboriginal and non-Aboriginal) on forest management. The framework provides information that facilitates the development and articulation of forest management goals, objectives, strategies and criteria that can be used for consensus-building.

3) **Question:** *How can an analytical forest planning model be used to facilitate the integration of Aboriginal and Western perspectives on forest management?*

   Objective: *Incorporate community-defined criteria, indicators, and scenarios into the analytical planning process.*

   Outcome: Tl'azt'en's quantitative and spatial criteria, and their riparian management scenarios, were used to explore some basic questions about the capacity of the JPRF to provide for certain forest values. Two examples demonstrated how analytical tools such as the Lurch planning system could be used to:

   - understand how community defined forest values respond to certain management emphases; and
   - monitor both conventional and community-based indicators simultaneously.

The examples also revealed that comprehensive summaries are needed to fully interpret and understand the model results. These summaries would the information needed to explain the limitations of the landbase, the constraints that policies place on exploring management options, and possibly encouraging some flexibility in some of the community's stringent policies.

This additional information is particularly useful when scenarios and indicators form spatially and quantitatively complex problems.

Recommendations for Future Planning with Tl'azt'en Nation

A fourth objective of this research was to document the process of initiating Tl'azt'en participation in planning on the JPRF. This study represents a foundation for participatory planning that will change and improve as Tl'azt'en Nation and UNBC continue to co-manage the JPRF. As a contribution to this evolving relationship, the following recommendations are provided for future planning activities.

Validation and Expansion

To correct cultural biases in the interpretation and representation of Tl'azt'en values, members of the Tl'azt'en community should validate the criteria identified in this research. Once this information is reviewed, community-defined indicators should be incorporated into the process, and the suitability of the analytical planning approach for representing community values should be further assessed. This assessment exercise should be viewed as a way to engage the community in improving the approach to generate an appropriate participatory planning process. This might include documenting and incorporating traditional decision-making approaches.

Community-based Analytical Planning

If an analytical tool is to be used in future community planning sessions, its suitability should be further assessed by placing it in the control of community members and examining its effectiveness for different user-groups (e.g., age, education levels, gender, social standing), and for mixed groups. Investigators must be sensitive to the possible "generation gap" that the use of advanced computer technology might create in the decision-making process. The tool should not distract younger, more computer-literate generations from the importance of the knowledge held by older generations that is to be used as system inputs, and is essential to interpreting results and outcomes.

Future analyses should include multiple harvest entries (e.g., a 300-year planning horizon), and RMZ level targets that are consistent with the RMZ emphases identified in chapter 4. If available, new forest inventory and yield information should also be included. Until more specific information is available, management scenarios that apply different riparian management strategies according to RMZ emphases should be employed. For example, minimum riparian protection in sensitive management RMZs, and moderate protection in harvest RMZs. Assumptions related to "no harvest" areas and natural disturbances should be discussed, and strategies developed to mitigate these concerns.

Protocols and Other Perspectives

Regardless of the planning process it is essential to establish a tradition of participatory decision-making with the Tl'azt'en community. Information and planning sessions should be held regularly and consistently. Terminology must be clearly defined and used consistently at every session. The Tl'azt'en core values should be further explored and entrenched into management planning operations. Given that management improves and priorities change over time, the scope of community values must be reviewed and updated regularly.

Appropriate levels and methods of involvement for the keyoh-holders, the Tl'azt'en community, the UNBC community, and other stakeholders should be identified.

Explanation of these management perspectives and other work should be continued to develop a comprehensive, consensus-based management strategy for the JPRF.

TEK Documentation and Application

It is evident that TUS information does not fully represent the breadth and depth of traditional knowledge held by Tl'azt'en Elders. Further documentation of knowledge related to local ecology is needed, preferably developed through community directed studies. This may include traditional approaches to habitat identification, including names and ecological characteristics of important species and their habitats. Care should be taken to avoid formatting this information for a specific purpose, such as C&I and analytical planning, because excessive focus on a single application can influence the type and form of the information collected, and limits its application for other purposes.

Because riparian buffers are an important forest management criterion, community-generated guidelines for assessing and establishing site-specific riparian buffers may be useful. Site visits with keyoh-holders and Elders would help in developing these guidelines, and information from GIS, satellite data and vegetation inventories could be used to classify riparian zones across the larger landscape. This information could be used for conducting realistic strategic-level analyses, updating development plans, and directing operational-level activities. Community-generated guidelines for maintaining values such as wildlife and plant habitat at the stand-level may also be useful.

Implementation and Monitoring

Further analysis is needed to develop a feasible management strategy that incorporates operational and economic realities such as access management, and appropriate harvest and silvicultural systems. Qualitative criteria must also be incorporated into management goals and objectives.

JPRF staff should maintain a record of observations provided by keyoh-holders and other land users regarding ecological change on the landscape. This information will assist to continually adapt management to changing forest conditions, facilitate comparisons with scientific research findings, and generate a historical record of anecdotal observations of landscape dynamics over time for future reference.

Implications for Forest Management in British Columbia

There is a tradition of conflict over forest management between Aboriginal groups, and industry and government in most of British Columbia. This conflict, however, is based on legal rights and protocols for decision-making rather than actual forest management objectives. Still, this has resulted in myths that suggest Aboriginal and non-Aboriginal forest management objectives are polarized and mutually exclusive.

The planning process put forth in this thesis provides a mechanism by which Aboriginal communities and non-Aboriginal stakeholders can clarify and communicate their visions of sustainable forest management. This research has shown that these perspectives may be surprisingly compatible. As such, they can serve as a foundation for further inquiry into cross-cultural approaches to forest stewardship.

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Appendix 1: Riparian Management Strategies

Scenario1: Forest Practices Code Riparian Widths

	Assigned classification	**Reserve zone (Protection)**	**Management zone (Sensitive)**
First order streams	S3	20m	20m
Second and third order streams	S4	0m	30m
*Pinchi/Tezzeron Lakes	A-modified		
• spawning shoreline		50m	200m
• other shoreline		30m	70m
Lakes/Wetlands >5ha	L1/W1	10m	40m
Lakes/Wetlands 1-5ha	L3/W3	0m	30m
Wetland complexes	W5	10m	40m

*Classification and zone widths designated by the Fort St. James District Ministry of Forests (JPRF 1999).

Scenario 2: Minimum Protection (community-defined) Riparian Widths

	Reserve zone	**Management zone**
Streams	50m	0m
Lakes/Wetlands	50m	0m
Cultural sites	500m	0m

Scenario 3: Moderate Protection (researcher-defined) Riparian Widths

	Reserve zone	**Management zone**
Streams	150m	0m
Lakes/Wetlands	250m	0m
Cultural sites	750m	0m

Scenario 4: Enhanced Moderate Protection (researcher-defined) Riparian Widths

	Reserve zone	**Management zone**
Streams	150m	150m
Lakes/Wetlands	250m	250m
Cultural sites	750m	250m

Scenario 5: Maximum Protection (community-defined) Riparian Widths

	Reserve zone	**Management zone**
Streams	300m	0m
Lakes/Wetlands	500m	0m
Cultural sites	1000m	0m

Appendix 2: Lurch Habitat Types

Label	Treatment/Description
Habitat type 1	No harvest, riparian reserve zone/ Protection riparian zone
Habitat type 2	Sensitive management, riparian management zone/ Uneven-aged harvest riparian zone
Habitat type 3	General management/ Even-aged harvest riparian zone

Appendix 3: Analysis Units and Rotation Ages

Cover type code	Analysis Unit	Habitat type	Min/max harvest ageclass		Min/max harvest age	
1	Fd(n)	3	6	18	120	359
2	Bl(n)	3	6	16	120	319
3	Sx(n)	3	5	15	100	299
4	Pl(n)	3	4	14	80	279
5	Ep(n)	3	4	9	80	179
6	At(n)	3	4	9	80	179
7	Ac(n)	3	4	9	80	179
8	Pl6Fd3Sx1 (pg_tsa_au1r)	2&3	4	14	80	279
9	Fd6Sx3Pl1 (tfn_r)	2&3	6	18	120	359
10	Sx6Pl3Bl1 (pg_tsa_au8r)	2&3	5	15	100	299
11	Bl10(tfn_r)	all	6	16	120	319
12	Ep10(tfn_r)	2&3	4	9	80	179
13	At10(tfn_r)	2&3	4	9	80	179
14	Ac10(tfn_r)	2&3	4	9	80	179
15	Fd(rip_n)	1	18	18	359	359
16	Bl(rip_n)	1	16	16	319	319
17	Sx(rip_n)	1	15	15	299	299
18	Pl(rip_n)	1	14	14	279	279
19	Ep(rip_n)	1	9	9	179	179
20	At(rip_n)	1	9	9	179	179
21	Ac(rip_n)	1	9	9	179	179

n= natural stand
r= regenerated stand
pg_tsa_au#= Prince George Timber Supply Analysis, Analysis Unit #
tfn= Tl'azt'en First Nation (analysis units generated for Tl'azt'en scenario analysis)
rip= analysis units in habitat type 1 riparian zones

Appendix 4: Analysis Unit Yield/hectare by Ageclass

Age class	Fd (m^3 /ha)	Bl (m^3 /ha)	Sx (m^3 /ha)	Pl (m^3 /ha)	Ep (m^3 /ha)	At (m^3 /ha)	Ac (m^3 /ha)	Pl6Fd3Sx1(pg_tsa_au1r) (m^3 /ha)	Fd6Sx3Pl1(tfn_r) (m^3 /ha)	Sx6Pl3Bl1(pg_tsa_au8r) (m^3 /ha)
1	0	0	0	0	0	0	0	0	0	0
2	13	5	0.5	25.5	59.5	59.5	0	34.5	5	12.5
3	73.5	43	37	107.5	178.5	178.5	0	119.5	93	81.5
4	139.5	98.5	123.5	176.5	237.5	237.5	0	216.5	234	196.5
5	198.5	144	196.5	232.5	270	270	0	288	367	296
6	259	183.5	256	279.5	286.75	286.75	0	340	476	368
7	288	220.5	303	318	286.75	286.75	0	378	560	409.5
8	320	252.5	337	339	286.75	286.75	0	406	625	435.5
9	345	282	362	349	286.75	286.75	0	426.5	669	453.5
10	367	308	380	351	0	0	0	441	706	464.5
11	386.5	332	395.5	356.5	0	0	0	453.5	706	467.5
12	404	354.5	408	361.5	0	0	0	461.5	706	467
13	416.5	371.5	418	367	0	0	0	466	706	467
14	418	375	425.5	371	0	0	0	466	706	467
15	419	378	431.5	374	0	0	0	466	706	467
16	420	380.5	436	377	0	0	0	466	706	467
17	420.5	382.5	440	379.5	0	0	0	466	706	467
18	421	384	442	380	0	0	0	466	706	467
19	421	384	442	380	0	0	0	466	706	467
20	421	384	442	380	0	0	0	466	706	467
21	421	384	442	380	0	0	0	466	706	467
22	421	384	442	380	0	0	0	466	706	467
23	421	384	442	380	0	0	0	466	706	467
24	421	384	442	380	0	0	0	466	706	467
25	421	384	442	380	0	0	0	466	706	467

Appendix 5: Conversion Options

	Analysis Unit	Conversion/Applicable HT/Applicable RMZ								
1	Fd(n)	9/3/All	16/1&2/All	15/2/All						
2	Bl(n)	11/3/All	8/3/9	9/9/9	10/3/9	16/1&2/All	15/2/9	17/2/9	18/2/9	
3	Sx(n)	10/3/All	16/1/All	17/2/All						
4	Pl(n)	8/3/All	16/1/All	18/2/All						
5	Ep(n)	12/3/All	8/3/9	9/3/9	10/3/9	16/1/All	19/2/All	15/2/9	17/2/9	18/2/9
6	At(n)	13/3/All	8/3/9	9/3/9	10/3/9	16/1/All				
7	Ac(n)	14/3/All	16/1/All	21/2/All						
8	Pl6Fd3Sx1 (pg_tsa_au1r)	8/3/All	16/1/All							
9	Fd6Sx3Pl1 (tfn_r)	9/3/All	16/1/All							
10	Sx6Pl3Bl1 (pg_tsa_au8r)	10/3/All	16/1/All							
11	Bl10(tfn_r)	11/3/All	16/1/All							
12	Ep10(tfn_r)	12/3/All	16/1/All							
13	At10(tfn_r)	13/3/All	16/1/All							
14	Ac10(tfn_r)	14/3/All	16/1/All							
15	Fd(rip_n)	16/1/All	15/2/All							
16	Bl(rip_n)	16/1&2/All	15/2/9	17/2/9	18/2/9					
17	Sx(rip_n)	17/2/All								
18	Pl(rip_n)	18/2/All								
19	Ep(rip_n)	19/2/All	15/2/9	17/2/9	18/2/9					
20	At(rip_n)	20/2/All	15/2/9	17/2/9	18/2/9					
21	Ac(rip_n)	21/2/All								