SILVA FOREST FOUNDATION

The forest sustains us, we do not sustain the forest

AN ECOSYSTEM-BASED LANDSCAPE PLAN
FOR THE SLOCAN RIVER WATERSHED

Part I - REPORT OF FINDINGS

June 1996

Working to protect, maintain, and restore forests

P.O. Box 9, Slocan Park, British Columbia, Canada V0G 2E0 Phone 604-226-7222 Fax 604-226-7446
Canadian Charitable Registration No. 0902676-52

AN ECOSYSTEM-BASED LANDSCAPE PLAN FOR THE SLOCAN RIVER WATERSHED

PROJECT CONTRIBUTORS

The maps and report for the *Ecosystem-based Landscape Plan for the Slocan Valley* were completed by a team of professionals affiliated with the Silva Forest Foundation:

Project Design and Development: Herb Hammond, Tom Bradley, Susan Hammond

Air Photo Interpretation: Colin Mackintosh, Tom Bradley

Map Analysis, Design and Production: Jason Kubian, Herb Hammond, Tom Bradley

Data Analysis and Interpretations: Tom Bradley and Herb Hammond

Research and Report Writing: Herb and Susan Hammond, Tom Bradley

Herb Hammond is a Registered Professional Forester with a M Sc in forest ecology and silviculture. Herb has more than 25 years of experience as a forest consultant, researcher, instructor, and field forester. He has been developing ecosystem-based planning over the past 15 years. Herb is the author of the award-winning book, *Seeing the Forest Among the Trees: the Case for Wholistic Forest Use*. He is invited to speak and give workshops throughout Canada and in other parts of the world on ecosystem-based planning.

Tom Bradley is a forest technician and computer expert with more than 15 years of experience in field forestry, analysis of forest ecosystems, and air photo interpretation. He has participated in the development of ecosystem-based planning for the past 8 years and has designed computer databases and models that interface with the mapping information contained within geographic information systems (GIS).

Jason Kubian has a B Sc in geography and environmental studies. He is proficient in GIS map analysis and design and has developed clear, concise maps that portray the highly complex map information available in ecosystem-based planning.

Colin Mackintosh is a forest technician who has worked with the SFF staff on a project basis for many years.

Susan Hammond has a BA in literature and has worked as an administrator and writer/researcher on forest use issues for the past 10 years. She is the co-author, along with Herb Hammond, of *Community Guide to the Forest: Ecology, Planning and Use.*

Ecosystem-based Philosophy: The Silva Forest Foundation's work is based on an ecosystem-based philosophy, meaning that:

- Earth, from microbe to globe, is a whole system, interconnected and interdependent.
- Earth functions to sustain the whole in an equilibrium that is dynamic yet stable (in human timeframes).
- All ecosystem structures have a function. If the structure is lost, the function is lost.

- People are part of Earth. What we do to Earth, we do to each other.
- Human plans must encompass ecosystem timeframes of centuries and millennia, not short-term development timetables of one to five years.

> *Ecosystem-based planning is realistic and socially desirable. Putting it off means ruination of regions like the Slocan Valley.* J. Stan Rowe, professor emeritus of ecology, author of *Home Place,* June 12, 1996.

AN ECOSYSTEM-BASED LANDSCAPE PLAN FOR THE SLOCAN RIVER WATERSHED

TABLE OF CONTENTS

APPENDICES

(Contained in a separate volume—not on the web)

LIST OF FIGURES

LIST OF TABLES

ACKNOWLEDGMENTS

Preparation of this ecosystem-based landscape plan for the Slocan River watershed was a massive undertaking through uncharted waters. There was no blueprint to follow and the level of human activity, from government planning processes to accelerated logging in contentious areas and new mining proposals, taking place in the Slocan Valley made ecosystem-based planning extremely complex. The information provided in this report and the accompanying maps is designed to provide a basis for ongoing ecosystem-based community planning in the Slocan Valley.

All sectors participating in the Slocan Valley Pilot Project sponsored by the Commission on Resources and Environment (CORE) were invited to provide information and to participate in the development of this plan. The Silva Forest Foundation is grateful for the mapping information provided by the watershed, wilderness, tourism, outdoor recreation, and First Nations sectors of the local CORE project. We also appreciate the feedback received from many sectors following the presentation of our initial mapping in February and October 1994.

The Silva Forest Foundation received generous funding for various aspects of this project from the Bullitt Foundation, BC Wild, the Greater Ecosystem Alliance, and West Coast Environmental Law's Environmental Dispute Resolution Fund. We appreciate the confidence in ecosystem-based planning that this support represents.

The British Columbia government provided funding for an intern for six months under its Environmental Youth Team program, administered by the Ministry of Environment, Lands, and Parks. Under this program, Jason Kubian refined his skills with computerized geographic information systems (GIS) and produced the final maps for the project.

Grant Copeland provided valuable strategies, research, and background information on economics in his report, *An Economic Transition Strategy for the Slocan Valley.*

Tom Bradley shepherded the mapping through all its stages, and designed and implemented the database interpretations to provide tables and graphs for the map interpretations. Herb and Susan Hammond wrote the final report and administered the project throughout. Stephanie Judy, Dianne Novlan, and Shannon Hammond provided invaluable editing and production skills.

Most of all we wish to acknowledge the spirit and tenacity of the many people in the Slocan Valley who have worked for more than twenty years to implement community-based planning. We hope our report and mapping move those efforts one step closer to the goal of protecting the forest, the economy, and the community.

This ecosystem-based landscape plan is, to our knowledge, unique in British Columbia and Canada. A paper describing the preliminary findings and the methodology was presented at *Down to Earth*, the Third Conference of the International Society for Ecological Economics held in San Jose, Costa Rica in October 1994. The mapping was presented at the GIS World conference in Vancouver in late March 1995. Findings and methodology were presented in late May 1995 at *Sustainable Forests: Global Challenges and Local*

Solutions, an international forestry conference in Saskatoon. The maps and methodology have also been presented in workshops sponsored by the Silva Forest Foundation, in communities throughout British Columbia, and to professional planners through the University of British Columbia planning department.

The Silva Forest Foundation welcomes comments and constructive criticism about this report and the maps that accompany it. Comments or orders for reports and maps can be sent by e-mail to silvafor@netidea.com, by fax to 604-226-7446, or by mail to P.O. Box 9, Slocan Park, British Columbia V0G 2E0.

1. INTRODUCTION

This ecosystem-based landscape plan for the Slocan River watershed in British Columbia, Canada represents a fundamentally different approach to looking at and planning human activities in ecosystems. The basic premise of an ecosystem-based approach is that human societies and economies depend on a healthy ecosystem. Therefore, an ecosystem-based approach starts with the question: What do we need to protect and maintain in order to ensure short- and long-term ecosystem functioning? Once this question has been answered, then we ask: What kinds of human activities will lead to a stable, diverse, community-based economy that respects ecological limits?

An ecosystem-based approach also looks first at the landscape level, or the “big picture,” because the integrity of small forest areas depends upon protecting the pattern of and connections between the small forest areas that make up the larger landscape. The cumulative effects of human disturbances can also best be seen and evaluated at the landscape scale. As well, the habitat requirements of many large animals must be looked at across large areas. Once the ecosystem-based approach has been used over the larger landscape to define the ecological limits to human activities and areas that need to be protected in order to maintain biodiversity, then the same approach must be applied to the planning of ecologically responsible human uses for areas where these uses are appropriate. For example, in order to plan and carry out ecologically responsible timber extraction, the same sequence of steps must be followed for the forest stand: ecological limits must be further defined and connections throughout the stand must be maintained.

This report and the maps that accompany it form the landscape level plan for the Slocan River watershed. We have identified the ecological limits to human activities, a protected landscape network to protect ecosystem functioning and to maintain biodiversity, and zones where various ecologically responsible human activities are taking or might take place. The next step in the process is to apply the ecosystem-based approach to the planning of each human activity by further defining ecological limits and protected landscape networks at a scale appropriate to the size of the small area (i.e. forest stand) being planned.

In contrast to an ecosystem-based approach, conventional approaches to land use start with the question: Where are the best resources and how can we access them? In conventional approaches, protection of ecosystem functioning is secondary to resource exploitation, and managers assume that any hazards can be mitigated. Conventional approaches to timber management have resulted in soil degradation, landslides, significant reduction in the amount of mature and old growth forest, destruction of wildlife habitat, destruction of areas important to Indigenous cultures, and compromise to other forest uses such as tourism, recreation, wildcrafting. An ecosystem-based approach seeks to accommodate the needs of a variety of forest uses, including resource extraction, while protecting, maintaining, or restoring (where necessary) the integrity of the ecosystem.

An ecosystem-based landscape plan also differs from the land use planning exercises currently taking place within British Columbia. During a land use planning process, various interest groups divide up the landscape for a variety of human uses. Land use planning tends to focus on what humans want to take from the land. In contrast, an ecosystem-based landscape planning process starts by defining what needs to be protected in order to maintain short- and long-term ecosystem functioning, then establishes human uses within those ecological limits. Ecosystem-based planning focuses first on what to leave, then on what to take.

Directors and staff of the Silva Forest Foundation began developing the ideas around an ecosystem-based approach to landscape planning more than fifteen years ago. Ideas and methodologies were enriched and supported by leading-edge researchers in the fields of forest ecology, landscape ecology, conservation biology, and ecological economics. The ecosystem-based landscape plan for the Slocan River watershed represents the first attempt to apply the methodology and analysis to a landscape as large as the 340,000 hectare Slocan River watershed. It is also the first attempt to try to propose a community-based economy that builds on the diversity of the natural landscape, and the strengths and diversity of the existing economy. Because this project was charting new ground, much has been learned and developed that will streamline future ecosystem-based landscape plans.

While we have attempted to be consistent in our use of terminology, there may be instances where different terms have been used to mean the same thing or where there may be some confusion regarding the meaning of terms. Some important examples are:

- The terms Slocan River watershed, Slocan Valley, Slocan Valley drainage basin, and Slocan River landscape are used interchangeably.
- The maps accompanying this report refer to Wholistic Forest Use Zones, while the report refers to Ecologically Responsible Forest Use Zones. These two terms are interchangeable.
- Ecologically responsible forest use means that all human uses must first respect ecological limits. Ecologically responsible forest uses are part of an ecosystem-based approach that defines ecological limits and identifies where human uses can take place.

This report, *An Ecosystem-based Landscape Plan for the Slocan River Watershed, British Columbia, Canada*, consists of eight sections, with this introduction as the first:

Section 2 - An Ecosystem-Based Approach to Forest Protection and Use: Definition and Scientific Rationale - describes the philosophy and the principles that guide an ecosystem-based approach. This section also provides references from the scientific literature that support an ecosystem-based approach.

Section 3 - Slocan River Watershed: An Ecological Description - describes the terrain, climate, and other features of the ecology of the study area.

Section 4 - Methodology and Decisions on Important Issues: A Summary - defines the data, interpretations, and assumptions that form the basis for this ecosystem-based landscape plan.

Section 5 - Results: Landscape Analysis, Protected Landscape Network, and Zoning - summarizes key findings of each of these parts of the plan.

Section 6 - The Emerging and Proposed Economy - looks at how the current economy is changing from its former dependence on resource extraction industries, and how the current economy is diversifying and depends on maintaining the high quality of the natural environment. This section proposes an ecosystem-based economy that protects ecosystem functioning and meets human needs.

Section 7 - Transition Strategy: Getting from Today's Economy to an Ecosystem-based Economy - describes some paths the community can pursue to strengthen the parts of the economy that are ecosystem-based. For non-sustainable parts of the current economy, practical ways are proposed to move towards an ecosystem-based economy.

Section 8 - Conclusions and Recommendations: Where to Go from Here - provides suggestions about the next steps to be taken in order to implement ecologically responsible human uses in the Slocan Valley.

A set of appendices follows the body of the report and provides additional information about various topics within the report, sample maps at a reduced scale, and detailed tables describing the results summarized in Section 5.

The extensive mapping produced during this study forms the backbone of this report and is critical to the understanding of the information presented in the report. Computer geographic information systems (GIS) were used to compile and analyze the mapping information. The Slocan River watershed is a landscape of approximately 340,000 hectares. In order to perform the analysis at a reasonable scale, the Slocan River watershed was divided into eight landscape units with boundaries defined, as much as possible, along natural watershed boundaries. For each landscape unit, a set of six maps was prepared at a scale of 1:50,000. All landscape units were then combined to create a composite map of the entire Slocan River watershed and the same six maps were created for the entire area at a scale of 1:125,000. The six maps are:

- ***Landbase Unsuitable for Development*** (clear overlay): *Interpretation*: Shows areas that the Ministry of Forests considers unsuitable for timber management, and additional areas that SFF determined to have ecological limits to timber management and other resource extraction activities.
- ***Logged and Old-Growth Areas:*** *Interpretation:* Shows the location of ecologically sensitive and stable/moderately stable old growth forests in relationship to past logging.
- ***Protected Landscape Network:*** *Interpretation:* Shows the interconnected network of ecosystems (riparian ecosystems, old growth forests, ecologically sensitive areas, and cross valley corridors) which must be protected to maintain ecosystem functioning at the landscape level.
- ***Wholistic Forest Use Zones*** (clear overlay)***:*** *Interpretation:* Shows forest use zones (large protected areas, consumptive use watersheds, headwaters protection,

commercial tourism, restoration, wholistic timber). Zones provide for balanced use of the landscape. Wholistic (ecologically responsible) forest use zones ensure that human uses do not degrade ecosystem functioning.

- ***Siniixt Cultural Areas:*** *Interpretation:* Shows areas of identified spiritual use, high cultural use, moderate cultural use. Protection of Siniixt cultural areas requires meaningful consultation with the Siniixt Nation.
- ***Existing and Planned Logging*** (clear overlay)***:*** *Interpretation:* Shows the locations of existing and planned roads and logging.
- ***Additional map, Composite Map Set: Geographic References*** (clear overlay)***:*** *Interpretation:* Shows the eight landscape analysis units, drainage basins, provincial parks, roads (main and secondary), villages, major mountain peaks, and a map index for the Ministry of Forests forest cover maps that formed the foundation for GIS interpretations.

The interpretive maps for this project are large and expensive to reproduce. However, **Appendix 6 contains small-scale examples of the 1:50,000 interpretive map sets for two of the eight landscape analysis units.**

The ecosystem-based maps and this report for the Slocan River watershed provide critical information about the current state of the area's forests, about the ecological limits to human activities, about what areas to protect in order to maintain biodiversity and overall forest functioning, about ecologically responsible human use zones, and about how a diverse, stable economy can be developed and maintained within ecological limits.

2. AN ECOSYSTEM-BASED APPROACH TO FOREST PROTECTION AND USE: DEFINITION AND SCIENTIFIC RATIONALE

An ecosystem-based approach protects forest functioning at all scales through time as the first priority, and then seeks to sustain, within ecological limits, a diversity of human and non-human uses across the forest landscape. In other words, ecosystem-based approaches focus first on what to leave and then on what can be taken without damage to ecosystem functioning.

Where timber extraction is determined to be an appropriate activity, ecologically responsible timber management means that plans and activities are developed and carried out in ways that protect, maintain, and restore (where necessary) a fully functioning forest ecosystem at all temporal and spatial scales. Forest composition, structures, and functioning are maintained, from the largest landscape to the smallest forest community, in both short and long terms.

An ecosystem-based approach recognizes that a forest ecosystem is a continuum in time and in space. In other words, over time, a forest ecosystem is not static and unchanging. Natural disturbances constantly modify forest ecosystems as time passes. However, unlike disturbances from integrated forest management and other forms of conventional management, natural disturbances serve to maintain forest functioning and provide biological legacies (e.g. dead trees) that connect one forest successional phase to another. In a natural forest ecosystem, the most common disturbance or agent of change is the death of an individual tree or small groups of trees.

A forest ecosystem is also a spatial continuum. In other words, forests are interconnected, interdependent clusters of ecosystems, from patches of different soil types within a 4 hectare (10 acre) forest stand to a watershed of 500,000 hectares (1.2 million acres) or more. Understanding that a forest ecosystem is a continuum through time and space reinforces the wisdom that what we do to one part of the forest we do to all parts of the forest.

Two important concepts are encompassed within the understanding that forest ecosystems are spatial and temporal continuums: forest landscapes and forest stands/forest patches.

2.1 The Forest Landscape

The forest landscape is the large-scale view of a forest. When industrial timber managers use the term “forest landscapes,” they are usually concerned with scenery and visual impacts. In the context of an ecosystem-based approach, however, a forest landscape is a mosaic of interconnected, interdependent stands or patches that are repeated in a pattern across the larger landscape. This pattern has both spatial and temporal components.

An ecosystem-based approach requires that all planning and activities begin at the regional/landscape level. When planning for human use, landscape level decisions are made for watersheds of small to moderate size (less than 5,000 hectares to about 50,000 hectares, or 12,000 to 125,000 acres). In sub-regional or regional planning processes, forest landscape level considerations are expanded to large watersheds encompassing hundreds of thousands of hectares/acres.

In planning and carrying out forest uses, particularly timber management, many people tend to focus on small forest parcels. This is a result of our limited spatial view, short time frames, and cultural conditioning. In contrast, an ecosystem-based approach requires that all planning and activities start at the landscape level. The character and condition of the forest landscape dictate what is ecologically possible at the stand level.

The character of a forest ecosystem refers to how a forest works, from the landscape level to the stand or patch. For example, forests that have frequent fires have a different character than forests where wind and root decay are the primary agents of disturbance. Some forests are characterized by steep slopes, shallow soils, and well-defined drainage patterns, while other forests have gentle slopes, cold soils, and diffuse drainage patterns.

Forests of a different character will have different composition and structures, and therefore differences in how they function. Different composition, structures, and functioning lead to different kinds of ecological limits to human use. Ecological limits are natural factors or processes that are easily damaged or degraded if modified by human uses. For example, steep and/or wet slopes impose ecological limits because, if disturbed, they are likely to erode, causing problems like soil loss and siltation of streams. Cold soils are an ecological limit because nutrient cycling occurs in shallow organic layers which may be easily damaged by many types of human activities.

The condition of a forest describes how human uses have modified forest functioning from the landscape level to the stand or patch level. Conventional timber management frequently results in negative impacts, like fragmentation, loss of old growth, and soil degradation. An ecosystem-based approach protects forest composition and structure and respects the ecological limits of forests to various human uses. By respecting ecological limits ecosystem-based approaches avoid degradation of short- and long-term forest functioning.

Ecological limits to human use are determined by describing and interpreting the character and condition of, first, the forest landscape, and then the forest stand or patch.

2.2 Forest Stands/Forest Patches

Forest stands or forest patches refer to the ecosystem scale at which a relatively homogenous forest unit can be identified. The composition, structure, and ecological functions within a stand are similar enough that an ecologically responsible forest use prescription can be applied uniformly within the stand, without encountering changes in ecological parameters that may produce unexpected or undesirable results.

In conventional forestry, “stands” have largely been defined by narrow timber characteristics, which were in turn driven by short-term economic variables. However, in order to plan and carry out ecologically responsible forest uses within an ecosystem-based approach, stands must be defined in relation to whole ecosystem factors that are required to maintain fully functioning forests at the landscape and stand levels. In other words, the boundaries of a stand are not determined by rigid human management criteria such as timber size and timber quality, but by the full spectrum of ecosystem parameters that have been shaped by natural disturbance patterns and that reflect the movement of energy, nutrients, water, and animals into and out of a particular ecosystem.

Human scales are closest to forest scales at the stand or patch level. For example, the stand or patch level is the scale where visible human modification occurs. However, an ecosystem-based approach must always consider that what occurs at the stand or visible scale will also have impacts on a variety of other scales, from the large landscape to the microscopic.

2.3 Human Needs—Human Impacts

In an ecosystem-based approach, human needs (not to be confused with greed) are included as part of the needs of ecosystems. In other words, people are included as an interconnected, interdependent part of whole forest ecosystems. However, an ecosystem-based approach also recognizes that modern human beings have inordinately large powers to modify and degrade ecosystems compared to any other living organism or natural disturbance.

Activities such as clearcutting result in radical alterations of ecosystem composition and structures. In an attempt to justify these activities, government and industrial timber managers frequently compare the resulting alterations to the results of natural disturbances, such as fire or the effects of insect populations. However, this comparison fails to distinguish between exploitation of ecosystems for profitable commodities and the disturbance of ecosystems through natural processes. Clearcut timber management, for example, removes all of the merchantable trees from a cutting area, and plantation-style forestry plans the removal of all of the trees (i.e. logs) on short cycles or rotations, in perpetuity. In contrast, natural disturbances, such as root decay, insect feeding, wind, and fire, leave behind the tree trunks or tree stems, which become vital structures for maintaining forest functioning.

Some conventional timber managers have suggested that clearcuts nevertheless resemble some natural disturbances, pointing to volcanic eruptions and glaciation, which, like clearcuts, remove all of the trees from a particular area. However, this analogy is inaccurate and deceptive, for two reasons:

1. Clearcuts are predictable disturbances, planned to occur on short cycles of decades. In contrast, volcanic eruptions and glaciation are unplanned, unpredictable natural disturbances which occur on long cycles of millennia.
2. Clearcutting is a modification of an ecosystem which degrades forest functioning by removing biological legacies from a forest stand and forest landscape, including

trees and beneficial soil fungi at the stand level, and old growth or late successional forests at the landscape level. In contrast, volcanic eruptions and glaciation leave behind important biological legacies, such as nutrient-rich volcanic ash and glacial silt, which provide the foundation for the millennia of forests that follow such natural disturbances.

An ecosystem-based approach requires that people take seriously the threat of ecosystem degradation from the inappropriate use of human technology and that human uses of the forest mimic, as much as is feasible, natural processes. In other words, an ecosystem-based approach focuses on managing human activities in ecosystems, rather than on manipulating ecosystems to serve short-term human interests.

An ecosystem-based approach is consistent with the development and maintenance of stable human communities and diverse, sustainable human economies. Labor-intensive activities and value-added wood products manufacturing in close proximity to the source of wood are cornerstones of the development of ecologically responsible, community-based economies. Development of ecosystem-based, local decision making about forest use is critical to developing and maintaining ecologically responsible forest use.

2.4 Current Timber Management Approaches and Ecologically Responsible Timber Management: A Comparison

As a result of the extensive public criticism of large-scale industrial timber management, governments and timber companies around the world have developed a variety of practices that are being promoted as sustainable timber management. In many cases, these “new” approaches are simply conventional timber management in disguise or, at best, a more benign form of industrial timber cutting which still does not meet the tests of ecological responsibility.

We briefly describe and evaluate below some current approaches to timber management which do not, under most circumstances, meet the requirements of ecological responsibility. This list and discussion is not intended to be a comprehensive explanation or critique of these timber management approaches, but rather the list is included here to introduce key differences between ecologically responsible timber management and other types of timber management.

One central concept is common to all of the approaches described below: as currently practiced, all of these timber management approaches begin with the assumption that the dominant forest use will be timber extraction and the subsequent growing of timber crops. In contrast, an ecosystem-based approach focuses first on maintaining and protecting forest ecosystem functioning, and secondly, on providing for a diversity of human uses, which may or may not include timber management.

2.4.1 Sustained yield forestry

Sustained yield forestry is a concept that designs timber cutting and regrowing of timber crops to provide a perpetual yield of timber from a particular forest landscape. Initially, this concept embodied the commitment to non-declining timber yields over time. However, the determination of annual cuts under sustained yield forestry has commonly been overly optimistic when considering both tree growth rates and the portion of a forest landscape that is suitable for the cutting and growing of timber crops over time. Thus, as a result, "sustained timber yields" have tended to decline through time as a result of excessive cutting rates that cannot be matched by the rate of regrowth of timber and by extraction of timber from land that subsequently proves to be unsuitable for timber growth and/or necessary to protect for non-timber forest uses. Sustained yield forestry confuses timber or trees with forest ecosystems and fails to recognize that fully functioning forests are necessary to have trees, which are necessary to have timber. In contrast, an ecosystem-based approach protects forest functioning at all scales through time as the first priority; and then seeks to sustain, within ecological limits, a diversity of human and non-human uses across the forest landscape.

2.4.2 Multiple use

Multiple use is a system of forestry or timber management that assumes that a full spectrum of forest uses, from timber cutting and tourism to water production and non-timber forest products, can occur simultaneously throughout a forest landscape. When practiced across relatively large areas (500,000 hectares/1.2 million acres and larger), multiple use appears to work for a period of time. However, under this regime, all forest stands with merchantable and economically accessible timber are planned for eventual timber cutting. Thus, as logging progresses through the landscape, both forest functioning and non-timber forest uses are progressively degraded. Proponents of multiple use often attempt to convince other forest users that tree plantations are forests, and that society cannot afford to protect animals, plants, and microorganisms that stand in the way of economic growth. An ecosystem-based perspective maintains that human societies cannot afford not to protect forest functioning and maintain diverse forest uses that are the foundation for stable local economies.

2.4.3 Integrated forest management

Integrated forest management is a more recent version of multiple use, where timber managers attempt to "integrate" or merge forest conservation and non-timber forest uses with timber cutting and timber management across a forest landscape. However, as with multiple use, the vast majority of forest stands with economically viable merchantable timber are planned for eventual logging. Typically, integrated forest management includes extensive analysis of forest ecosystem features, such as wildlife, soil, terrain stability, and water. While this information could serve to significantly change both the amount of timber cut and the way in which timber is cut, such studies usually result in timber cutting levels and methods that best meet the short-term economic needs of the timber industry and government. In contrast, studies carried out as part of an ecosystem-based approach are applied to define ecological limits to timber management and to non-timber forest uses, and to provide for fair and protected land bases for all forest users, both human and non-human.

2.4.4 Ecosystem management

Ecosystem management is a confusing mixture of good forest ecology principles and integrated or multiple use forest management. Advocates of ecosystem management analyze and describe ecosystem functioning in ways that recognize the need to maintain natural composition and structures of forest ecosystems from the landscape level to the stand or patch level. However, while providing good information about forest functioning, practitioners of ecosystem management also continue to advocate methods and levels of timber extraction that degrade forest ecosystem composition, structures, and functioning necessary to maintain fully functioning forests through time. Conventional clearcutting and tree plantations are regular components of ecosystem management. In contrast, ecologically responsible timber management is ecosystem-based, which means that the character (i.e. composition, structure, and functioning) and condition of ecosystems determine what types of human use can be carried out and in what ways and at what level of intensity these uses can occur while ensuring the maintenance of fully functioning forests at all scales through time.

Conventional timber management approaches described above all utilize concepts oriented to exploiting natural forests for timber and to producing crops of trees in short time cycles. Most of these concepts have little or no application in ecologically responsible timber management, because conventional approaches are focused on *timber*, while ecosystem-based, ecologically responsible approaches are focused on *forests*.

2.5 Common Conventional Timber Management Concepts

Listed below are some of the more common conventional timber management concepts that have little or no application in ecologically responsible timber management.

2.5.1 Rotation ages

Also known as culmination age, the rotation age is the age at which average annual timber volume increase is the highest. This conventional timber management approach is oriented to maximizing timber *volume* as opposed to maximizing timber value and maintaining overall forest functioning. In ecologically responsible timber management, there may be reasons to cut small, young trees (e.g. when restoring natural stand structure to areas where fire suppression has occurred) and for growing trees to old ages in order to provide for late successional or old growth forests and to provide high quality, mature wood fibre. Thus, the concept of rotation ages has little or no application in ecologically responsible forestry. Trees are selected for cutting in ecologically responsible timber management by considering a variety of criteria other than age, including:

- stand condition,
- successional processes,
- the need for old growth forests and old growth trees, and
- production of high-valued, mature wood fibre.

Ecologically responsible timber cutting frequently is planned to grow trees to their ecological maturity, which both ensures that trees play their full successional roles and produce the highest quality, highest value wood.

2.5.2 Annual allowable cut (AAC)

An **annual allowable cut (AAC)** is an estimate of the timber volume that can be cut from an area on an annual basis, allegedly in perpetuity. Because AACs are based largely upon how natural forests grew in the past and on the liquidation of old growth forests, levels of timber cutting calculated according to these concepts tend to be exaggerated. The result is **falldown**—a reduction in the quantity of timber that can be cut in the future. AACs are about maximizing short-term timber cuts, as opposed to maintaining fully functioning forests. Therefore, in the long term, applying AACs to a forest landscape results in degraded forest ecosystems and non-sustainable timber cuts.

In contrast, the volume cut each year under ecologically responsible timber management is restricted by the requirement that cutting must maintain fully functioning forests at all scales through time. Thus, annual timber cuts will vary according to the needs of the forest. Once a forest landscape has been managed for an extensive period of time using ecologically responsible approaches, managers will be able to forecast a reliable range of annual cuts, depending on the needs of the forest.

2.5.3 Decadence

In conventional timber management, a forest stand is considered decadent if it includes a relatively large number of snags, fallen trees, and partially decayed, large, old trees. Conventional timber managers view decayed and dead trees to be waste. In fact, however, decadent forests are ecologically rich and absolutely vital forest phases for maintaining fully functioning forest ecosystems. Large, old, decaying trees are homes for many specialized organisms, such as carnivorous insects and lichens that fix atmospheric nitrogen. Snags are necessary for cavity nesting birds and other cavity dwelling animals such as pine marten. Fully decayed wood in rotten trees is the foundation for future forest soil and is also Nature’s water storage and filtration system. Also, large old living and decayed trees in “decadent forests” contain the highest volumes and highest valued wood of any forest phase. Conventional timber management has manipulated the concept of decadence in order to support cutting high volume, high valued old growth forests at rates that far exceed ecologically sustainable cutting rates.

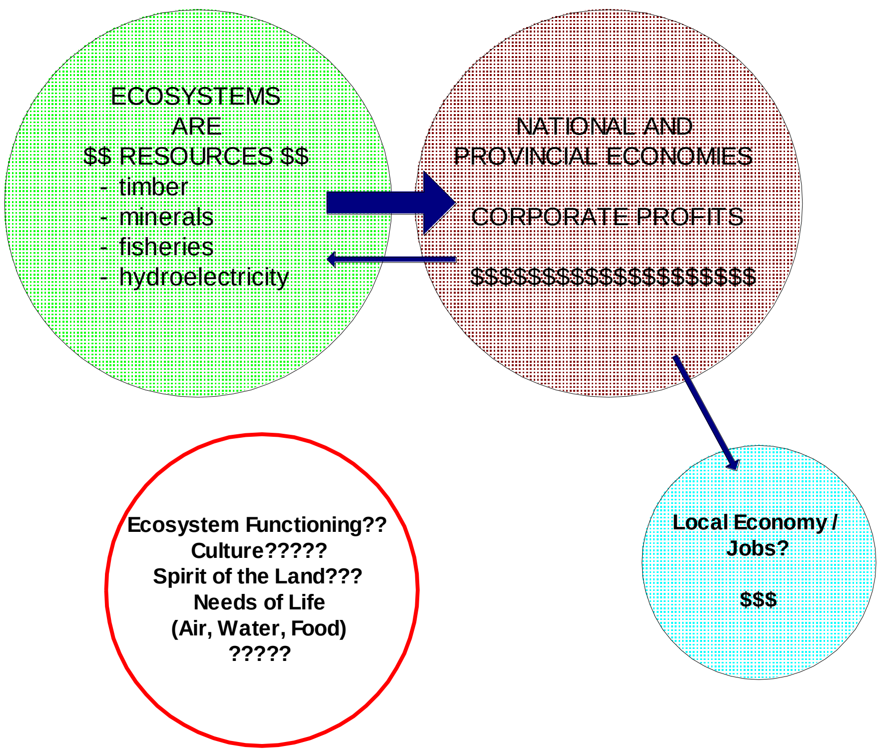
Ecologically responsible timber management understands that decadent old growth stands are critical components of any forest landscape, and old growth decadent structures (such as large, old trees, large snags, and large fallen trees) are critical to maintain at the stand level to ensure such vital forest functions as soil development, water filtration, and water storage.

2.6 Why Is an Ecosystem-based Approach Necessary?

The idea of "sustainable development" has been based on the illusion that "we can have it all." Sustainable development is an oxymoron because it suggests that we can sustain ecosystem functioning while achieving steady economic growth. In parts of the world where poverty reduces people's capacity to use forests and other ecosystems in ways that protect ecosystem functioning, *some* economic growth for a *limited period of time* may be necessary to avoid intensifying pressures on ecosystems. However, the affluent, consumer-based economy of much of North America and western Europe is not sustainable, because it increases degradation of ecosystems to support the goal of perpetual economic growth.

Figure 2-1 represents resource use based on the concepts of sustainable development. This approach assumes that the environment and the economy are of equal importance. However, this approach ignores the needs of ecosystems as well as the needs of Indigenous cultures and local communities.

THINK ONLY FOR TODAY
OR IN SHORT-TERM POLITICAL TIMEFRAMES.....



ONE-WAY RELATIONSHIP WITH ECOSYSTEMS....
TAKE AS MUCH AS POSSIBLE

EVENTUALLY, THE ECOSYSTEM DOES NOT WORK
AND THEN THE ECONOMY DOES NOT WORK AND CULTURE COLLAPSES

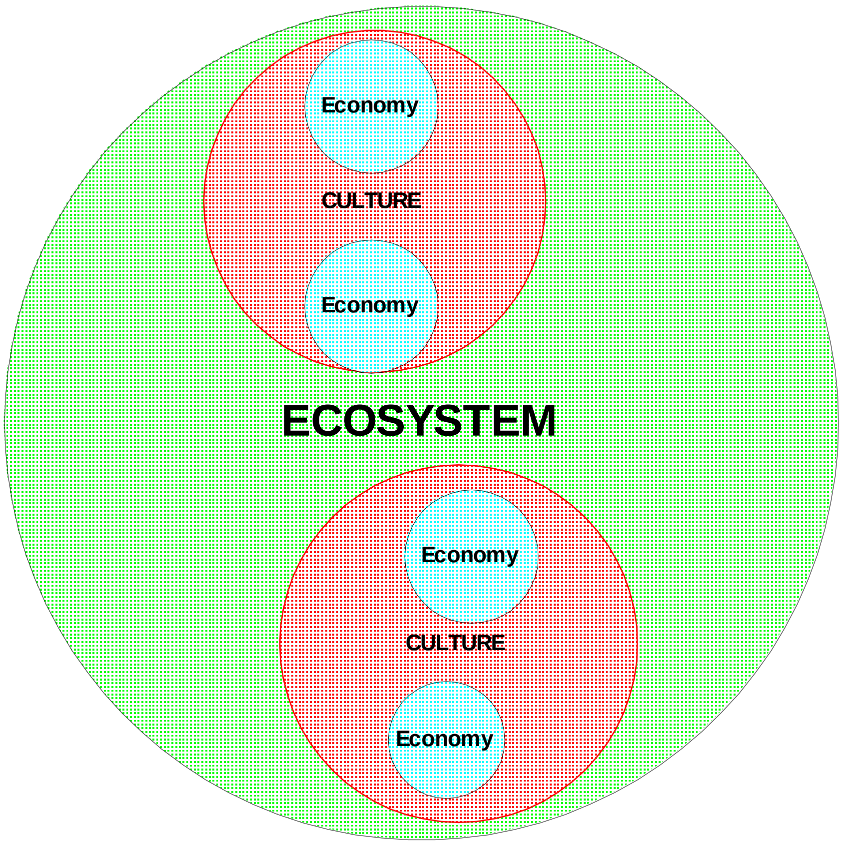
Figure 2-1: Current government and industry approach to integrated management

If we are going to sustain anything, the first priority of human use of ecosystems, including forest ecosystems, must be to protect ecosystem functioning. This priority recognizes that economies are subsets of human cultures, which are subsets of ecosystems. Thus, if human use does not sustain ecosystem functioning, it does not sustain human cultures or the economies that make up human cultures. Until recently, technologically equipped human beings have been able to temporarily avoid the consequences of ecosystem degradation by moving exploitation of ecosystems from one part of Earth to another part of Earth. As we deplete natural resources and degrade ecosystems, we also look for substitutes to previously "sustainable" resources. However, common sense tells us that this approach can only work for a short period before we have ecosystem collapse, followed by social and economic collapse.

Figure 2-2 represents an ecosystem-based approach and depicts the dependence of economies and cultures on fully functioning ecosystems.

An ecosystem-based approach protects ecosystem functioning by protecting, maintaining, and restoring (where necessary) the composition and structures that are the basis of ecosystem functioning. The composition of a forest ecosystem refers to the parts that make up a particular forest area, such as the different species of plants and animals, the type of soil, and the slope gradient of the terrain. The structures of a forest are the arrangements of the parts. Forest structures include large old trees, large snags (standing dead trees), large fallen trees, the arrangement and depth of soil organic layers, and the pattern of forest ecosystem types across large forest landscapes. Together, the composition and structures of forest ecosystems, from the largest landscape to the smallest soil microbe, are necessary to maintain fully functioning forests. This approach needs to be applied through time and to take into account natural forest disturbance types, patterns, and frequencies.

An Ecosystem-based Approach:
First, protect ecosystem functioning
Second, design ecologically responsible human uses



LAND USE AND ECONOMIC ACTIVITIES GUIDED BY
THE WISDOM OF TRADITIONAL CULTURES AND APPROPRIATE SCIENCE

Figure 2-2: An ecosystem-based approach

Conventional timber management constantly alters and removes forest composition and structures at both landscape and stand levels throughout vast areas. Because the biological legacies of thousands of years of natural forest development support tree growth after logging in most “second growth” forests, most people think that conventional forestry works. Let’s take a look at some examples that reinforce the importance of protecting forest composition and structures to maintain forest functioning.

2.6.1 Forest landscape examples

In order to maintain forest landscape functioning, human activities must maintain connectivity. This is achieved by protecting the composition and structures of riparian ecosystems, which are the wet forests adjacent to and immediately upslope from creeks, rivers, wetlands, ponds, and lakes. As well, landscape level plans need to provide for cross-valley movement corridors, which provide travel routes for animals and plants to cross the ridges that separate one riparian ecosystem from another. Cross-valley corridors are not “natural”; before human beings began extensive modifications of forest landscapes, animals moved freely throughout, and occupied all of the landscape. However, with human modification of forests, cross-valley corridors have become a necessary component of forest landscape plans in order to provide protected travel corridors between human use zones.

Successional patterns—the stages of forest growth that follow natural disturbances—are also critical composition and structures of forest landscapes. The proportions of particular successional phases in the landscape (i.e. early successional forest, young forest, mature forest, and late successional or old growth forest) need to be maintained over a variety of time scales, from years and decades to hundreds and thousands of years, in order to maintain forest ecosystem functioning. Each successional phase, with its characteristic composition and structures, provides vital functions to maintain forest ecosystems, from the smallest patch to the largest landscape, through short and long periods of time.

For example, the only two nutrient input phases in a forest lifetime occur in the shrub-herb and late successional or old growth phases. Because the late successional or old growth phase lasts for the longest time, compared to other successional phases, old growth tends to play a dominant role in maintaining forest functioning in most forest ecosystems. Old growth forests provide the highest quality water of any forest phase, because their multi-layered forest canopies and their large amounts of decaying wood intercept and hold water. The old growth phase is also the only forest phase that contains certain specialist organisms necessary for landscape and stand level forest functioning. For example, late successional forests contain the majority of carnivorous insects that eat the herbivorous insects that feed on trees. Also, certain specialist fungi that protect tree roots and pass water and nutrients from the soil into trees are found only in late successional forests.

In contrast to natural forest functioning, conventional timber management proposes to shorten the shrub-herb phase and eliminate the old growth phase over significant parts of forest landscapes. Following this approach degrades ecosystem functioning in a variety of ways, and will eventually lead to forests that are susceptible to ecological collapse. However, conventional forestry tends to evaluate its success by how many trees are growing rather than by ensuring that all parts of the forest have been maintained. Thus, there is an illusion of healthy forests when, in reality, the forests are in serious decline.

2.6.2 Stand level examples

Trees are only a small portion of the composition and structures needed for a fully functioning forest. Nevertheless, we need forests to have trees, and we need trees to have forests. This understanding leads us to one of the most important examples of the necessity of protecting stand level composition and structures if we hope to maintain long-term forest functioning. Trees, both living and dead, are critical structural members of the forest's framework. In particular, large old trees, large snags, and large fallen trees have irreplaceable roles in forest functioning.

Large old trees are literally an ecosystem unto themselves. Some insects and small mammals live out their lifetimes solely within the confines of a single large tree. Large old trees, due to their extensive foliage area, catch large amounts of precipitation, permitting it to drip slowly through the canopy to the forest floor, thereby providing the soil with adequate time to absorb and distribute water. About 30% of the precipitation, be it snow or rain, that falls on the crown of a large old tree evaporates into the atmosphere and moves somewhere else. In a watershed dominated by large old trees, this function prevents the watershed from being overloaded with water and helps to distribute water to other parts of the landscape.

Snags, or standing dead trees, function as homes for cavity-nesting birds that eat insects that eat trees. Thus, maintaining snags throughout a forest stand is a necessary part of keeping agents of change, such as bark beetles, in balance with other parts of the forest. As snags soften, what was once a home for a woodpecker becomes, with a little expansion, a home for a pine marten.

Fallen trees, particularly large fallen trees, play myriad functions. As snow drifts over a fallen tree, it leaves a void space where the curve of the fallen tree trunk touches the ground. This provides an extremely important winter habitat niche for a number of animals, including mice, voles, and pine marten. As the fallen tree decays, it becomes the foundation for future forest soil. Trees that fall across a slope serve as natural dams to hold soil in place on steep slopes. One of the most important structural roles of fallen trees is water storage and filtration. Fully decayed wood holds about 20 times as much water as an equivalent volume of most mineral soils. Thus, fallen trees are Mother Nature's water storage and filtration system. In order to function properly, even a small watershed must contain millions of tons of decaying wood distributed throughout the drainage basin.

2.6.3 Human Examples: The benefits of an Ecosystem-based Approach

These landscape and stand level examples, illustrating the functions of some important forest composition and structures, indicate why practices such as clearcutting and elimination of old growth forests are not consistent with maintaining fully functioning forests. If the degradation caused by clearcutting and removal of old growth forests were more evident, people might be more willing to adopt ecologically responsible approaches to timber management. However, because forests operate on such long timeframes, and because, for millennia, forests have been building biological legacies through many generations of trees that have lived and died, human activities that remove composition and structures do not immediately appear to be as damaging as they actually are. However, as timber managers continue to degrade composition and structures of forests, from landscape to stand levels, damage to forest functioning becomes cumulative. Eventually this approach leads to degraded ecosystems, which provide few ecological functions, compared to the fully functioning forests they replaced. Because forest degradation occurs relatively slowly, successive generations of human beings inherit degraded forests which they assume to be natural, “healthy” ecosystems. In other words, we don’t live long enough to see the results of our mistakes.

An ecosystem-based approach attempts to avoid loss of forest functioning by maintaining forest composition and structures from the smallest soil bacteria to the landscape patterns of a large forest watershed. We may not understand the functions of particular forest composition and structures; nevertheless, an ecologically responsible approach protects all composition and structures. When parts of the forest are altered during activities such as ecologically responsible timber management or tourism, provisions for the replacement of forest composition and structures are built into ecologically responsible plans and activities.

As well as providing for the protection and maintenance of forest functioning, an ecosystem-based approach fosters the development of diverse, sustainable human economies. Because an ecosystem-based approach creates the least modification to forest ecosystem composition and structures, it provides for the largest diversity of compatible forest uses. In other words, by maintaining trees on the sites where we practice timber management and by ensuring that ecologically viable old growth stands are found in each landscape, we provide an environment where the broadest spectrum of uses, from adventure tourism to timber extraction, can coexist. Such a range of activities is not possible where conventional timber management systems, such as clearcuts and tree plantations, are employed.

From a timber standpoint, because ecologically responsible timber management produces steady supplies of mature wood, the long-term economic benefits exceed those of conventional timber management practices. Mature wood—long-fibred and strong—is superior for many uses, from structural materials and pulp to furniture and fine cabinets. In comparison, short-fibred, juvenile wood is not as strong and will warp and twist easily. Mature wood is produced when the cambium layer (the single layer of cells between the wood and the bark) divides around dead branches or no branches. Obviously, increasing amounts of mature wood are produced as a tree gets larger and older.

Research indicates that old growth Douglas-fir trees contain about 80% mature wood, while 60-year-old Douglas-fir trees contain only 10-20% mature wood. Under ecologically responsible timber management, trees grow for longer periods, not only to better maintain forest functioning, but also to produce steady supplies of high-value mature wood fibre. In contrast, conventional timber management is based on cutting cycles or rotations that provide primarily low-value juvenile wood. Thus, ecologically responsible timber management maintains supplies of high-quality mature wood fibre similar to that provided by natural old growth forest ecosystems. This will ensure a healthy timber economy in perpetuity.

The elements of the Slocan Valley ecosystem-based landscape plan and the methodology used to develop the plan are further defined in Section 4-Methodology and Decisions on Important Issues: A Summary.

2.7 The Guiding Principles of an Ecosystem-Based Approach

Ten principles, which are derived from both wisdom and science, guide an ecosystem-based approach to forest protection and use.

Principle #1: Focus on what to leave, not on what to take.

An ecosystem-based approach to forest use leaves fully functioning forests at all spatial scales through time. For example, ecologically responsible timber managers identify the parts of a forest stand and forest landscape that must be protected to maintain short- and long-term forest functioning, and these decisions determine what is possible to remove for wood products and other uses.

Principle #2: Apply the precautionary principle to all plans and activities.

The precautionary principle means that plans and activities must err on the side of protecting ecosystem functioning, as opposed to erring on the side of protecting short-term monetary profits or annual timber cutting quotas. In other words, if you are not sure that an activity will protect, maintain, or restore ecosystem functioning, do not do it.

Principle #3: All plans and activities must include protection of forest functioning at all scales (time and space) and must define ecological limits of various forest ecosystem types to human disturbance.

Temporal scales refer to the need to make *forest plans* considering timeframes of 500 years and beyond, as opposed to logging development plans of 1 to 20 years. Spatial scales refer to the need to define forest landscapes as, at a minimum, small watersheds of 200 hectares (500 acres) and larger. An ecosystem-based approach requires the development of forest landscape level plans for as large a landscape as is practical, given political and ownership constraints.

“Ecological limits” are physical and biological factors which indicate that various human uses may result in unacceptable levels of modification or degradation of forest ecosystem functioning. Common ecological limits include:

- **shallow soils** (less than 30 cm/12 inches deep)
- **very dry** or **very wet sites**
- **very steep slopes** (greater than 60% slope gradient)
- **broken slopes** (abrupt slope gradient changes occur regularly across a small landscape)

- **very dry climates** (less than 25 cm/10 inches of precipitation annually)
- **cold soils** that limit biological activity, particularly soil nutrient cycling
- **snow-dominated forests** characterized by open, canopied forest stands (i.e. park land forest ecosystems)
- **riparian ecosystems**, the wet forests adjacent to and the forests immediately upslope from creeks, rivers, ponds, lakes, and wetlands.

Forest ecosystem types are relatively homogeneous forest areas delineated by their biological and physical characteristics, and by their ecological limits or lack of ecological limits. Stands or patches frequently contain several ecosystem types.

Describing a forest ecosystem type as having an ecological limit to human activities does not mean that such an ecosystem type will not grow trees following a human-induced disturbance such as logging. However, the existence of an ecological limit means that sustainable timber crops that have economically viable timber volumes and timber quality cannot be grown in reasonable periods of time. As well, both physical and biological problems, like landslides and poor regeneration of trees, result if ecological limits are not respected. If forest users attempt to ignore ecological limits, unacceptable levels of forest degradation will occur in both the short and long terms.

Principle #4: All plans and activities must protect, maintain, and, where necessary, restore biological diversity (i.e. genetic, species, and community diversity).

Maintenance and, where necessary, restoration of all types of biological diversity is necessary to sustain life as we know it in forest ecosystems. Maintaining genetic diversity means ensuring that viable natural gene pools, including the gene pools of trees logged from a site, remain on the site or, in the case of previously degraded forests, are restored (as much as possible) to the site following human use. Maintaining species diversity means that viable natural populations of plants, animals, and microorganisms must be maintained or restored, in previously degraded areas, throughout the various successional phases for each ecosystem type within a forest landscape. Maintaining community diversity means maintaining or restoring, in previously degraded areas, the variety of forest ecosystem types that result from natural disturbances at a variety of scales through short and long timeframes in a forest landscape. Protecting biological diversity must not be viewed as a frill or luxury. Instead, an ecosystem-based approach recognizes that maintaining natural biological diversity is an absolute requirement to ensure maintaining fully functioning forests through time, and thereby sustaining human cultures and economies.

Principle #5: Respect and maintain natural disturbance regimes through time and space in order to protect, maintain, and, where necessary, restore forest landscape patterns.

Natural disturbances, from the death of individual trees to large fires or windstorms, are responsible for critical composition, structures, and ecosystem functioning necessary to maintain fully functioning forests. For example, the death of an individual tree sets off a process of change: it begins with a standing snag that provides habitat for cavity-nesting birds and ends with a fully decayed fallen tree that serves as Mother Nature's water storage and filtration system. At a landscape level, natural disturbances, large and small, are responsible for diversifying habitat patterns and, therefore, maintaining a natural diversity of plants and animals. Natural disturbance regimes are also critical to the maintenance of soil nutrient cycling and adequate levels of soil nutrients. Protecting, maintaining, and, where necessary, restoring natural disturbance regimes provides for natural composition, structures, and functioning at the forest landscape level.

Principle #6: Protect, maintain, and, where necessary, restore composition, structures, and functions at the patch or stand level in all plans and activities.

Composition refers to the parts of a natural, healthy forest ecosystem, including the topography, soil, water, plants, animals, and microorganisms. **Structures** are the arrangements of the parts in a forest ecosystem, including large old trees, large snags (i.e. standing dead trees), and large fallen trees. Forest **functioning** refers to how a forest works at a full range of scales over long timeframes. Natural composition and structures must be maintained in order to maintain fully functioning forests. Many compositions, structures, and functions are beneath the surface of the ground, within the soil where human beings cannot see while planning and carrying out forest use. When implementing an ecosystem-based approach, we hope that by maintaining the forest composition, structures, and functions that we can see, we will also maintain the composition, structures, and functions that we cannot see.

Principle #7: Protect, maintain, and, where necessary, restore forest ecosystem connectivity at all scales during planning and carrying out ecologically responsible forest use.

Connectivity in forest ecosystems is maintained, in large part, by ensuring the protection of water movement patterns. This includes microscopic water movement patterns in the forest soil and in riparian ecosystems, from ephemeral streams and small wetlands to large river systems and wetland complexes. Connectivity is also maintained in forest ecosystems by protecting and, where necessary, restoring the full range of composition and structures from the large landscape level to the smallest stand or patch.

Principle #8: Recognize that the concept of landscape is relative to the forest organism or process under consideration.

Different forest organisms or forest processes operate at vastly different scales. What is a landscape to a salamander is only a small patch or small stand to a bear. Similarly, the landscape that results from a single tree falling over due to root decay and wind is much smaller than the landscape patterns created by a large fire. A forest landscape can exist at virtually any scale, depending on the organism or forest process that is used as the point of reference. Thus, applying the concept of a forest landscape, as much as possible, to all scales—from large landscape to small stand or patch level plans—is important to ensuring the maintenance and/or restoration of fully functioning forests.

Principle #9: Plan and carry out diverse, balanced activities to encourage ecological, social, and economic well-being.

In planning for a diversity of human activities in a forest landscape or forest stand, we can use as a model the natural diversity that occurs in forest composition, structures, and functioning, from the smallest forest patch to the largest forest landscape. Diversity in forest composition, structures, and functioning maintains the integrity and resilience of forests. Diversity provides for both flexibility and stability in forest ecosystem functioning. Large natural disturbances, such as fire and insect attacks, that can dramatically alter the forest are simply processes of maintaining and restoring natural diversity, and, therefore, healthy functioning in the forest.

Because natural forests depend upon diversity, a diversity of ecologically responsible human activities is most likely to maintain natural forest diversity, and, therefore, to maintain fully functioning forests. At the same time, diverse human activities best meet the needs of all interests in human society, and provide for the most stable, sustainable human economies.

Diverse forest uses also need to be *balanced* in ways that establish equitable, protected land bases for all forest users, both human and non-human. This goal is accomplished by defining ecologically responsible forest use zones within the forest landscape.

Currently, in most forests around the world, the most aggressive and consumptive forest uses are expanding, namely logging and the manufacture of a few wood products such as pulp and 2x4s. Continuing this growth of consumption is not sustainable, either biologically or economically. Ecologically responsible timber management does not intend to continue the same level of cutting as that practiced by conventional timber management. Instead, ecologically responsible timber management requires the reduction of timber cutting levels, and, therefore, a reduction in the overall use of wood. A high priority is placed upon developing and marketing recycled wood products, including paper, 2x4's, siding, paneling, windows, and doors. Reducing consumption and recycling <u>all</u> wood products is a first priority in ecologically responsible forest use.

As well as ensuring that timber cutting and the manufacture of wood products stays within ecological limits, an ecosystem-based approach will also limit the number and scale of such activities as tourism and ranching within forest landscapes in order to maintain fully functioning forests.

Principle #10: Evaluate the success of all forest use activities at meeting the requirements of ecological responsibility.

Important questions to ask during an evaluation include:

- Are natural landscape patterns maintained or restored?
- Are natural stand or patch composition and structures maintained or restored?
- Are water quality, quantity, and timing of flow, at all scales, unaltered from the standpoint of protecting forest functioning?
- Are soil structures and soil processes unaltered from the standpoint of protecting forest functioning?
- Have natural disturbance regimes, from the landscape to the stand or patch level, been protected and/or restored?
- Do all ecologically responsible forest users, both human and non-human, have a fair and protected landbase?

Evaluation—asking how we did—is an absolutely essential part of an ecosystem-based approach. By evaluating our plans and activities, we learn and are able to improve our relationship with forests and with each other. The questions posed above are inclusive of all aspects of forest functioning as it relates to a variety of human uses.

2.8 Scientific Rationale

An ecosystem-based approach relies on scientific concepts developed by leading-edge researchers and practitioners. Forest ecology, conservation biology, landscape ecology, and ecological economics have been synthesized in designing the methodology and products of the Slocan Valley ecosystem-based landscape plan. Some of the scientific concepts underlining an ecosystem-based approach are summarized below.

2.8.1 Scientific Panel for Clayoquot Sound

The Silva Forest Foundation's ecosystem-based approach is consistent with the Scientific Panel for Sustainable Forest Practices in Clayoquot Sound (1994) definition of sustainable ecosystem management:

> The Panel believes that forests should be managed as ecosystems, rather than as potential products, and that forest practices should not put at risk the long-term health of forest ecosystems. Sustainable ecosystem management is characterized by resource management practices that are scientifically based, ecologically sound, and socially responsible...
>
> The goal of sustainable ecosystem management is to maintain the integrity of ecosystems. Achieving this goal requires maintaining ecosystem components and ecological processes that enable the land, water, and air to sustain life, be productive, and adapt to change.

> The objectives of sustainable ecosystem management include: maintaining soil formation, stability, and productivity; maintaining water quality, flow, and channel integrity; and maintaining biodiversity. Failure to maintain these processes and states may lead to failure to sustain a flow of products from the forest and failure to protect cultural, scenic, recreation, and tourism values.
>
> Human needs are one of many considerations in designing management activities. The needs of current generations should not supersede the needs of future ones. The protection of ecosystem components and maintenance of ecosystem processes and productivity must take precedence over all other management objectives.
>
> In the long term, managing forests as ecosystems is the best way to secure a supply of timber and other products from the forest, and to sustain British Columbia's multitude of other forest values.

The Scientific Panel notes that at each level of planning, sustaining ecosystem productivity and biodiversity must take precedence over specific product outputs. Levels of resource extraction must be determined within the limits prescribed by ecosystems.

One of the primary goals of SFF's ecosystem-based approach is to protect biodiversity. The Scientific Panel states: "Conserving biodiversity is a prerequisite to sustaining ecosystem integrity, which depends on interactions among a broad range of the ecosystem's component species, both known and unknown." The Panel stresses the need to establish a system of protected areas as well as sustainable ecosystem management outside protected areas. Thus, one of the goals recommended by the Panel is "to maintain the functional integrity of ecosystems, recognizing the connections between terrestrial, freshwater, and marine ecosystems."

2.8.2 Landscape Ecology and Conservation Biology

An ecosystem-based approach represents the practical application of the concepts and findings in the sciences of landscape ecology and conservation biology. Landscape ecology is concerned with the connections and interactions between forest stands across the landscape, and with the effects of both natural and human disturbances on the landscape. The scientific discipline of landscape ecology originated as an attempt to integrate the spatial concerns of geography with the time and scale concerns of ecology. The following important principles of landscape ecology are incorporated in the Silva Forest Foundation's methodology for the ecosystem-based landscape plan for the Slocan River watershed:

<u>Time and Space</u>: Forest ecosystems are connected in time and space across the landscape. Risser (1987) summarized the interrelation of time and space over the landscape:

> Thus, the landscape is heterogeneous, that is, consists of dissimilar or diverse components or elements. In addition to the rather obvious spatial heterogeneity, the landscape is temporally heterogeneous. Ecological processes operate at different time scales. For example, forest trees have life spans of decades, annual crops grow for less than a year, and individual stream insects may last only a few days. It is this mixture of processes consisting of different spatial and temporal scales, all operating as a system, that leads to ideas of landscape ecology.

Heterogeneity: Landscape heterogeneity, or diversity, is essential to forest landscapes. Diversity contributes to redundancy, or the ability of ecosystems to perform important functions in more than one way. For example, after disturbance on a forest site, mycorrhizae essential to the nutrient needs of young conifers can persist in the decaying wood of fallen trees, or through association with surviving conifers, or by colonizing compatible successional plant species. This type of redundancy, maintained by landscape diversity, is a vital function which allows ecosystems to survive stress (Bormann 1987, Franklin et al 1989) and helps organisms survive through catastrophic disturbances over time (Perry et al 1989, Amaranthus et al 1989).

Extreme diversity can result in negative effects if habitat areas become too small to be effective. As with many aspects of forest functioning, a balance is required between heterogeneity and homogeneity.

Connectivity: Within a forest landscape, connectivity is provided by movement corridors, which are frequently riparian ecosystems (see Principle 3 above). Riparian ecosystems serve as movement corridors for many species of plants and animals, as well as for nutrients and energy. Riparian ecosystems are connected from valley to valley by treed forest corridors (i.e. cross valley corridors) which run up and down forest slopes. Groundwater is another landscape connector that transports nutrients and energy both within forest patches and throughout the forest landscape. Riparian ecosystems, cross valley corridors, and groundwater provide connectivity in space. The importance of these connections within forested ecosystems has been articulated by Noss (1991). Connectivity in time is represented by the various stages that a forest goes through. From the shrub/herb phase through the young and mature forest phases to old growth, each stage plays an important role in maintaining a healthy and diverse forest landscape.

Human or natural impacts that reduce or break natural landscape connectors will have direct impacts on animal, plant, energy, nutrient, and water movements (Forman 1987, Forman and Godron 1983, Noss 1987).

Conservation biology has been defined by Grumbine (1992):

> Conservation biology is the science that studies biodiversity and the dynamics of extinction. Much of this work focuses on how genes, species, ecosystems, and landscapes interact, and how human activities affect changes in ecosystem components, patterns, and processes... Conservation biologists consider the entire biodiversity hierarchy at diverse scales of space and time...

Maintaining natural forest diversity is a primary goal of ecosystem-based planning. Both landscape ecology and conservation biology study ecosystem interconnections and propose management that maintains the biodiversity within ecosystems. Numerous scientists have stressed the need to maintain the natural diversity of the forest landscape when implementing management activities (Amaranthus et al 1989, Bormann 1987, Franklin et al 1989, Harris 1984, Marcot et al 1989, Maser 1988, Perry 1988, Perry et al 1989, Schowalter 1989, Wilcove 1988).

2.8.3 Silviculture Systems

Ecologically responsible timber management differs significantly from conventional practices. In his book, *Forest Ecology*, Dave Perry defines the goals of ecologically responsible silviculture systems:

> To maintain biological diversity (and along with it the health and integrity of entire ecosystems), silviculture must do two things: (a) protect species and habitats that have no market value, and (b) mimic (to the degree possible) natural disturbance and successional patterns at the scale of both stands and landscapes. Intensive forest management does rather poorly on both scores. A more ecologically based management will focus on what it leaves behind rather than on what it takes. Biological legacies will be protected and habitat imbalances redressed by restoring forested landscapes to a higher proportion of old growth. Early and mid-successional communities will exist as islands within an old-growth matrix rather than vice versa, producing the shifting mosaic that characterized many natural forest landscapes. Silvicultural techniques for achieving this include partial harvesting, density management, and long rotations. Ultimately, a sustainable future will only be achieved by considering the Earth and all of its inhabitants as an integrated, interdependent whole.

2.8.4 Ecological Economics

The principles of an ecosystem-based economic analysis are based on the approaches of ecological economists. Ecological economics is a transdisciplinary field of study that addresses the relationships between ecosystems and economic systems in the broadest sense, attempting to integrate and synthesize many different disciplinary perspectives (Costanza et al 1991). Ecological economics points out the need to protect the integrity of ecological systems (Norton 1991). The connections between ecosystems and economics is summarized by Costanza (1991):

> Ecological systems play a fundamental role in supporting life on earth at all hierarchical scales. They form the life-support system without which economic activity would be impossible. They are essential in global material cycles like the carbon and water cycles. They provide raw materials, food, water, recreational opportunities, and microclimate control for the entire human population. In the long run, a healthy economy can only exist in symbiosis with a healthy ecology.

Ecological economics also recognizes the need to assign value to ecological goods and services (Costanza 1991) so that humans do not consider these to be “free.” Thomas Power (1988) has studied the non-commercial qualities that contribute to a healthy economy. In examining what makes a local or community economy healthy and stable, Power discovered that people valued the quality of life in an area and would accept lower wages and a certain level of reduced services if their quality of life needs were met.

2.8.5 Ecosystem-based Approach: the Foundation for Sustainability

As noted above, an ecosystem-based approach is supported by such formerly divergent disciplines as ecology and economics. Leading thinkers in ecological economics, conservation biology, landscape ecology, and forest ecology are all telling us that maintaining fully functioning ecosystems at all scales must be our priority if we are to develop and sustain human cultures and the economies that make up human cultures. The Slocan Valley ecosystem-based landscape plan puts this knowledge and principles into a practical, realistic context. The results challenge all of us, but we must determine how to implement this type of plan if we are to ensure a healthy Earth and provide options for future generations.

2.9 Literature Cited

Amaranthus, M., J. Trappe, R. Molina. 1989. *Long-term forest productivity and the living soil*. Chapter 3 *in*: Perry et al (eds.), Maintaining the long-term productivity of Pacific Northwest forest ecosystems. Timber Press, Portland.

Bormann, F. 1987. *Landscape ecology and air pollution.* Chapter 3 *in* M. Goigel Turner (ed.), Landscape heterogeneity and disturbance. Springer-Verlag, New York.

Costanza, R. 1991. *Assuring sustainability of ecological economic systems.* Chapter 21 *in* R. Costanza (ed.), Ecological economics: the science and management of sustainability. Columbia University Press, New York. pp. 331-343.

Costanza R., H. Daly, J. Bartholomew. 1991. *Goals, agenda, and policy recommendations for ecological economics.* Chapter 1 *in* R. Costanza (ed.), Ecological economics: the science and management of sustainability. Columbia University Press, New York. pp. 1-21.

Forman, R. 1987. *Corridors in a landscape: their ecological structure and function.* Ekologiya (CSSR) 2:375-387.

Forman, R. and M. Godron. 1986. *Landscape ecology*. John Wiley & Sons, New York. 619 pp.

Franklin, J.F., D. Perry, To. Schowalter, M. Harmon, A. McKee, T. Spies. 1989. *Importance of ecological diversity in maintaining long-term site productivity.* Chapter 6 *in* Perry et al (eds.), Maintaining the long-term productivity of Pacific Northwest forest ecosystems. Timber Press, Portland.

Grumbine, R. 1992. *Ghost bears: exploring the biodiversity crisis.* Island Press, Washington, D.C. 290 pp.

Harris, L. 1984. *The fragmented forest.* University of Chicago Press, Chicago.

Marcot, B., R. Holthausen, J. Tepley, W. Carrier. 1989. *Old-growth inventories in the Pacific Northwest: definitions, status, and visions for the future.* Final draft for: Old-growth Douglas-fir forests, wildlife communities and habitat relationships.

Maser, C. 1988. *The redesigned forest.* R. & E. Miles, San Pedro, CA. 234 pp.

Norton, B. 1991. *Ecological health and sustainable resource management.* Chapter 8 *in* R. Costanza (ed.), Ecological economics: the science and management of sustainability. Columbia University Press, New York. pp. 102-117.

Noss, R. 1991. *Landscape connectivity: different functions at different scales*. Chapter 2 *in* W. Hudson (ed.), Landscape linkages and biodiversity. Island Press, Washington, DC, pp. 27-39.

Noss, R. 1987. *Corridors in real landscapes: a reply to Simberloff and Cox.* Conserv. Biol. 1:159-164.

Perry, D. 1994. *Forest Ecosystems.* Johns Hopkins University Press, Baltimore. 649 pp.

Perry, D. 1988. *Landscape pattern and forest pests.* Northwest Environmental Journal 4:213-228.

Perry, D., M. Amaranthus, J. Borchers, S. Borchers, R. Brainerd. 1989. *Bootstrapping in ecosystems*. BioScience (39)4.

Power, T. 1988. *The economic pursuit of quality*. M.E. Sharpe, New York. 218 pp.

Risser, P.G. 1987. *Landscape ecology: state of the art.* Chapter 1 *in* M. Goigel Turner (ed.), Landscape heterogeneity and disturbance. Springer-Verlag, New York. 239 pp.

Schowalter, T. 1989. *Insects and old growth*. Presentation at Old Growth Conference, August 1988, Oregon State University, Corvallis, OR.

Scientific Panel for Sustainable Forest Practices in Clayoquot Sound. 1994. *Progress Report 2: Review of Current Forest Practice Standards in Clayoquot Sound.* Cortex Consultants Inc., Victoria.

Wilcove, D. 1988. *National forests: policies for the future. Vol. 2: Protecting biological diversity.* The Wilderness Society, Washington, D.C.

3. SLOCAN RIVER WATERSHED—AN ECOLOGICAL DESCRIPTION

3.1 General Biology and Physical Characteristics

The Slocan River watershed or landscape consists of approximately 340,000 hectares (840,000 acres) of land and water located in the West Kootenay Region of southeastern British Columbia. The Slocan River watershed is found within the Selkirk Mountains within what is known as the “wet interior” forest. The map in Figure 3-1 shows the general location of the Slocan River landscape in relation to other areas in southeastern British Columbia.

The dominant feature of the Slocan Valley landscape is steep terrain. The main valley and its tributaries are characterized by narrow flat valley bottoms which change abruptly to extremely steep, broken side walls. Slopes often exceed 30 degrees, or 60%. These steep slope gradients can be found either in short pitches that repeat themselves across the local topography (i.e. broken or strongly complex terrain), or in long continuous slopes that cover much of a valley wall. As indicated in *Biophysical Resources of the Slocan Valley* (B.C. Ministry of Environment, Terrestrial Studies Branch, 1982): “The large vertical changes in topography, with short horizontal distances, has a profound effect on the way the climate is expressed, the kinds of soil, and the kinds of vegetation and aquatic systems.” The steep broken topography characteristic of the Slocan River landscape is shown in the photograph in Figure 3-2 which depicts the Elliot-Anderson-Christian Creeks slope in the central portion of the Slocan Valley landscape.

The climate of the Slocan River landscape can generally be described as continental, with warm summers and cold winters. Annual precipitation is approximately 800 mm (30 inches), with annual snowfall ranging from about 250 mm (10 inches) in the exposed portions of the valley bottoms to 1500+ mm (60+ inches) in upper elevation forests. Frost free days vary from about 150 in the valley bottoms to approximately 70 or less in the upper elevation forest areas. Cold air drains down slopes and down creek bottoms, effectively extending the colder, shorter growing seasons of the upper elevation parts of the landscape into lower elevation positions along the rivers and streams in the landscape.

Soils in the area are highly variable due to the broken, steep topography, and narrow, rapidly eroding valley bottoms. In general, soils are derived from coarse textured, nutrient poor bedrock. Thus, soils are frequently well-drained and below average in nutrient content. However, notable exceptions can be found in valley bottom locations, or receiving sites, where soil, water, and nutrients collect to develop relatively rich forest ecosystems.

Map unavailable

Figure 3-1: Slocan Valley watershed—location map

Figure 3-2: Steep, broken slopes of Elliot-Anderson-Christian watershed.
These steep, broken slopes in this Slocan Valley watershed are typical of the ecological limits posed by rugged topography throughout the Slocan Valley landscape. The Elliot-Anderson-Christian area is a consumptive use watershed with multiple users and multiple water systems. This area is zoned as a consumptive use watershed zone and as a headwater protection zone

The steep broken terrain and narrow valleys of the Slocan River landscape result in a wide diversity of habitat for plants and animals. The area can be characterized as an ecological transition zone, being neither as wet as adjacent areas to the north, nor as dry as areas to the east, west, and south. Due to this characteristic of the Slocan River landscape, mixed tree species forests are found on most combinations of elevation and aspect. Upper elevation forests are dominated by Engelmann spruce and subalpine fir, with occasional components of western red cedar, western hemlock, whitebark pine, and alpine larch. In the middle and lower elevations on drier aspects, ponderosa pine and Douglas-fir are the dominant tree species. Wherever sufficient moisture and nutrients collect, western red cedar, western hemlock, western larch, and western white pine stands develop. Extensive mixtures of these species together with Douglas-fir are found on the moist aspects in middle and lower elevations. Large western red cedar and western hemlock stands once dominated the main Slocan River riparian ecosystem. However, virtually all of this ecosystem type has been cleared for settlement. Where this type occurred in large tributaries to the Slocan River, logging has extirpated these lower elevation cedar-hemlock forests.

Early successional tree cover frequently contains lodgepole pine, paper birch, and trembling aspen. On the moister and upper elevation sites, Sitka alder is a common tree species that follows a variety of disturbances. A vibrant shrub community featuring willow, ceanothus, ninebark, Saskatoon berry, and oceanspray is found from early to late successional phases on the drier aspects within the lower elevations of the Slocan River landscape.

3.2 Ministry of Forests Ecological Classification

The Ministry of Forests Ecological Classification System recognizes four subzones within the Slocan River landscape:

- dry warm interior cedar-hemlock variant (ICHdw)
- moist warm interior cedar-hemlock variant (ICHmw2)
- wet cold Engelmann spruce-subalpine fir variant (ESSFwc4)
- alpine tundra/Engelmann spruce-subalpine fir wet cold parklands (AT/ESSFwcp)

Detailed information about these biogeoclimatic subzones, including plant species, soil moisture characteristics, soil nutrient characteristics, climate, geology, and landforms, can be found in *A Field Guide for Site Identification and Interpretation for the Nelson Forest Region*, *Land Management Handbook No. 20* (B.C. Ministry of Forests 1992). This handbook also contains recommended timber management treatments and the impacts that various timber management activities may have on such factors as soils, terrain stability, and wildlife habitat.

The Nelson Region *Field Guide for Site Identification and Interpretation* provides excellent ecological descriptions for the range of forest ecosystem types found throughout the Slocan River landscape. This basic ecosystem information is vital for the design of ecosystem-based or ecologically responsible forest plans, and for the development of standards that protect and maintain forest functioning at all scales. However, interpretations provided in the Nelson Region *Field Guide for Site Identification and Interpretation* tend to be biased towards short-term timber management, and, therefore, are unlikely to protect long-term ecosystem functioning.

3.3 Resource Exploitation as a Determinant of Ecosystem Types

Mining and associated settlement activities were prevalent throughout the Slocan River landscape approximately 100 years ago. During this period, settlers burned much of the Slocan Valley landscape, sometimes out of carelessness, and sometimes to expose the rock underlying the vegetative cover, thereby making prospecting easier. At lower elevations, only small remnants of late successional or old growth forests escaped these fires. Some significant areas of upper elevation old growth were spared from these large landscape level fires. When planning the protection and use of the Slocan River landscape today, it is important to remember that we are starting with a landscape that has been significantly altered by human activity. The settlement related fires affected most of the landscape about 100 years ago, and much of the forest area that the settlement fires missed has been modified by clearcut logging that has accelerated since the early 1970s.

3.4 The Ecological Limits

Key factors in defining the ecological limits to human use of forest ecosystems include the shape of the terrain, the slope gradient, the soil depth, the soil texture, the amount of moisture available, and the local climatic conditions. However, technologically equipped, industrial resource exploitation virtually knows no limits. For example, industrial timber extraction plans in the Slocan River landscape seek to mitigate ecological limits by application of different technology on more sensitive sites and/or slower removal of timber on more sensitive ecosystems. This approach, which is rooted in short-term economics, often results in site degradation such as soil erosion and landslides that not only impact the sites where they occur, but also result in downstream damage to water supplies and negative impacts to wildlife, which depended upon the resources of the disturbed area to meet a portion of their needs. The photograph in Figure 3-3 shows examples of site degradation that result when ecological limits are not respected.

Figure 3-3: Examples of site degradation in the Slocan Valley landscape

The area in the foreground of this picture is the slope below Frog Peak, while Airy Creek flows from the upper left corner of the photograph to the lower right corner. A large landslide, resulting from road construction and clearcut logging on steep slopes and shallow soils, is evident in the clearcut immediately below Frog Peak. The road continuing to the right around Frog Peak was constructed to provide access for another clearcut which has occurred subsequent to the date of this photograph. This clearcut has resulted in another landslide in the steep terrain beneath Frog Peak. Careful inspection of the clearcut in the upper right hand corner of this photograph reveals another landslide as a result of clearcutting and road construction beyond the ecological limits imposed by steep terrain and shallow soils. Due to the long distance between the camera and the landslides shown in this photograph, it may appear that these landslides are not large.

However, when inspected on the ground, these landslides will be frequently more than 50 meters wide and hundreds of meters long. Not only do landslides of this nature degrade the sites which they directly impact, but such landslides also contribute to introduction of sediment into watercourses, thereby degrading downstream water supplies and fish habitat.

Ecosystem-based planning and activities require that ecological limits be respected, and that human uses be designed to prevent (as opposed to mitigate) damage to ecosystem functioning. Thus, identifying ecological limits is the starting point for the development of ecosystem-based plans. This topic is discussed in more detail in *Section 4: Methodology and Decisions on Important Issues—A Summary*. The list below discusses briefly the major ecological limits defined by the ecological characteristics of the Slocan River landscape.

1. **Steep, broken slopes**: With the exception of the main Slocan Valley floor, which has been virtually entirely modified by settlement, the valley sidewalls and the tributaries are characterized by steep, broken slopes. The landform processes that shaped this terrain often left shallow, erodable soils perched on this sensitive topography. Because large trees hold soil on this sensitive terrain, and pump water out of the soil as part of their life processes, forest cover of large trees tends to stabilize these slopes and to give a false sense of security about the actual stability of these ecosystems. Once tree cover is removed from steep, broken slopes, there are no root systems available to stabilize soil, trees to pump water from the soil, and tree crowns to intercept a portion of snow and rain, which is evaporated back into the atmosphere. The result can be mass movement of soil in landslides, which cause extensive damage to the sites where they occur as well as creating negative impacts downstream.

   Where slopes exceed 60% (approximately 30 degrees) and/or are strongly broken, timber extraction and road construction are not ecologically responsible and should be prohibited in order to protect ecosystem functioning.

   For purposes of this ecosystem-based plan, steep slopes have been defined as slope gradient in excess of 60% (approximately 30 degrees). Strongly broken or strongly complex terrain consists of highly variable slope gradients from 0% to 60+% that bisect the main slope, either up and down or across the primary slope of the valley wall. Broken or strongly complex terrain may contain some stable inclusions, but cannot be reasonably accessed by roads or skid trails without excessive degradation of the steeper portions of this complex topography.
2. **Naturally unstable hydrological systems**: The tributaries that feed the main Slocan River frequently originate in very small drainage basins (less than 10 square km). These small tributaries are younger geologically than the main Slocan River valley; the mountain and valley glaciers that shaped the terrain of the tributaries left these areas only 3,000 to 4,000 years ago, as opposed to about 10,000 years ago in the main valley. Therefore, these small watersheds are characterized by a young geology that is still rapidly eroding and downcutting, and that is inherently unstable.

These small tributaries are characterized by deeply incised channels, particularly in the middle portion of the length of the stream. In this area, active erosion is occurring with coarse and fine sediments being deposited where these streams join the main Slocan River. The upper portion of these stream lengths is often found in a relatively gentle basin where the mountain glacier once sat. At first glance, these basins may seem to be stable due to their gentle terrain. However, they are inherently unstable because they consist of many small feeder streams that have downcut through the surficial or glacial deposits and join together to form a single stream in the deeply incised middle portion of these watersheds. As well, these "gentle" upper basin often have broken terrain, which varies from dry, rocky sites to very wet, spongy sites.

Logging and road construction in these headwater areas releases and concentrates a large amount of water, which in turn feeds sediment and higher peak flows into the unstable middle channels of these sensitive watersheds. The deeply incised middle length, or reach, of these streams is, as mentioned above, highly erodable. All it takes is one large rock dislodged in the upper portion of the stream reach to dislodge two, four, eight, sixteen, and so on as the impact is magnified downstream.

This type of stream channel erosion is a common natural disturbance in these sensitive watersheds due to their youthful geology. Any kind of disturbance at the headwaters or in the middle reach of these streams will result in accelerated erosion downstream. Therefore, particularly where these tributaries are consumptive use watersheds, the ecological limit of unstable hydrological systems precludes timber management and road construction throughout much of the area, particularly the headwaters, comprised by these watersheds.

3. **Upper elevation forests**: Forests found above 1200 m (4000 ft) have severe limits to growth due to cold climates, deep snowpacks, cold soils, and slow nutrient cycling. Much of the soil activity and nutrient cycling occurs in the upper 2-4 cm of soil and, thus, can be easily disturbed by any kind of logging activity. Any degradation from logging in upper elevation forests is much more long lasting than in lower elevation forests. Thus, these upper elevation forests have limited value as potential sites for <u>sustainable</u> timber extraction, or other activities that rely on tree regeneration and growth. These upper elevation forests are also found at the headwaters portions of all watersheds. What occurs in headwaters areas impacts all downstream parts of the watershed.

   Thus, for both reasons of ecological sensitivity (i.e. ecological limits to tree growth), and the economic limits of regrowing trees in climate-limited forests, high elevation forests are not recommended for timber management. As well, these forest areas have critically important values for water management, because they are frequently located in the headwaters portions of drainage basins.

The precise elevation where high elevation forest types begin will vary with aspect, local soil conditions, and topography. Forest planners must be able to recognize the characteristics of high elevation forests and be prepared to remove these areas from consideration for timber management zones.

3.5 Scale—A Medium Sized Landscape

While the Slocan Valley landscape, consisting of about 340,000 hectares (840,000 acres), may seem to be a large forest area compared to human scale, from the perspective of landscape ecology, the Slocan River landscape is only a medium-sized landscape. This landscape is greatly affected by what happens in the landscapes which surround it, both in terms of ecology and economics. For example, the Slocan Forest Products (SFP) mill located in the village of Slocan in the Slocan Valley depends upon sources outside of the Slocan Valley for a significant portion of its wood supply. (Probably more than 50% of the wood requirements for SFP's mill in Slocan comes from outside the Slocan Valley landscape. SFP declined to provide information that would define this number clearly.)

In ecological terms, the logging-induced forest fragmentation that has occurred extensively to the north and west of the Slocan Valley has degraded overall biological diversity and negatively impacted wildlife populations. As a result, because of the loss of intact landscapes adjacent to the Slocan Valley, it is now important to protect the unfragmented portions of the Slocan River landscape as reserves for genetic, species, and ecological community diversity.

In order to ensure both the long-term functioning of the Slocan River landscape and the larger surrounding landscapes, the Silva Forest Foundation recommends that an ecosystem-based plan be prepared for the West Kootenay region. This type of regional plan will serve as both the foundation to maintain fully functioning ecosystems at all scales and as the basis to develop sustainable human economies. The Commission on Resources and the Environment (CORE) developed a land use plan for the West Kootenay area. Information assembled during the CORE process will be useful in the process of developing an ecosystem-based plan for the West Kootenay area. However, the CORE plan focused on developing compromises between competing human interests (i.e. land uses), and was not an ecosystem-based plan.

3.6 Scale—Highly Variable Ecosystem Types

Due to the steep broken topography and young geology described earlier (*Section 3.4*, item 2), many <u>specific</u>, sensitive sites exist in the Slocan Valley. These extremely sensitive sites are characterized by high water tables, springs and seepage sites, shallow soils, very dry sites, and small areas of unstable soil and terrain combinations. When tree cover is present, these specific sensitive sites or stands may appear to be relatively stable. However, when this ecosystem-based landscape plan is developed into operations plans, field inspection must look for indicators of ecological sensitivity such as swept boles or stems of trees as a result of soil creep or snow press, perched roots of trees over shallow soils or high water tables, small areas of steep, broken slopes, and very wet or very dry conditions. These and other stand level ecological limits may restrict access to parts of the Slocan Valley landscape that are otherwise considered as stable or moderately stable timber management areas within this ecosystem-based landscape plan.

As can be seen from this discussion of ecological limits and scale, viewing an ecosystem from the standpoint of the ecosystem's needs to maintain functioning results in a much different picture of what makes sense for human use than viewing an ecosystem primarily as a stockpile of resources. Respecting ecological limits, by taking a cautious, precautionary approach to decision-making, is a critical underpinning for ecosystem-based planning.

3.7 Literature Cited

B.C. Ministry of Environment. 1982. Biophysical resources of the Slocan Valley. APD Bulletin 28, May 1982. Victoria, B.C.

B.C. Ministry of Forests. 1992. A field guide for site identification and interpretation for the Nelson Forest Region. Land Management Handbook No. 20. Nelson, B.C.

4. METHODOLOGY AND DECISIONS ON IMPORTANT ISSUES—A SUMMARY

4.1 Overall Process—Ecosystem-Based Planning

Ecosystem-based planning is based upon the principle that economies are subsets of human cultures or societies, which are subsets of ecosystems. In other words, human societies and their economies are dependent upon the natural diversity and integrity of the ecosystems they are part of. The primary objective of an ecosystem-based plan is to maintain fully functioning ecosystems at all scales through time in the landscape being planned. Protection of ecosystem functioning is put ahead of human uses of ecosystems. The methodology used in preparing the Slocan Valley Ecosystem-Based Landscape Plan reflects these priorities, which are the foundation for ecologically sustainable human activities.

4.1.1 Landscape Analysis and Zoning

A landscape analysis was performed to understand the **characteristics** and **condition** of the Slocan River watershed.

Characteristics describe and analyze the ecosystem patterns that sustain landscape level ecosystem functioning through time and space. The characteristics of the landscape explain how the ecosystem functions and give us the basis to determine essential composition and structures that are necessary in order to protect and maintain ecosystem functioning while meeting human needs. An important interpretive tool used to determine the spatial characteristics of the landscape is Silva's Ecosystem Sensitivity to Disturbance (ESD) rating system. Through air photo interpretation, this system identifies riparian ecosystems and ecologically sensitive sites that define ecological limits to resource extraction activities and other human uses. The ESD Rating System is described in more detail in Appendix 1.

The **condition** of the landscape describes how past and present human uses have impacted landscape functioning. The condition of the landscape is determined through air photo analysis and map analysis correlated with ESD ratings. In other words, we first use air photo interpretation and map analysis to locate human modifications to the landscape, and to form the basis for predicting ecosystem sensitivity. Then, we are able to describe the severity of impacts, such as fragmentation and soil erosion, that have been caused by human activities, such as road construction and logging. In the Slocan Valley, the condition of the landscape has been largely affected by two human uses: timber extraction and settlement.

Using this analysis of the characteristics and conditions of the landscape, combined with ESD information, a **protected landscape network** is designed, consisting of:

- riparian ecosystems
- old growth nodes
- ecologically sensitive areas
- cross-valley corridors
- some stable and moderately stable terrain
- stable terrain
- representative ecosystem types

In an ecosystem-based landscape plan, the protected landscape network is maintained as a permanent, undisturbed network of ecosystems, and provides the basic framework for landscape level functioning through time. (*Section 2, An Ecosystem-Based Approach to Forest Protection and Use*, Appendix 4, and Appendix 5 explain the concept of protected landscape networks.) In the Slocan Valley landscape, the protected landscape network must be connected to large protected areas, such as Valhalla Park, Kokanee Glacier Park, and the White Grizzly Park, in order to ensure ecological integrity of this landscape through time.

It is possible to move components of the protected landscape network over long time periods (i.e. 200+ years). For example, part of a cross-valley corridor and a timber zone could trade places, *provided* that the timber zone had developed old growth composition and structures, or forest ecosystem types, similar to those in the cross-valley corridor. This type of change in the timber zone will require timeframes of 200+ years. Thus, for all intents and purposes, a protected landscape network is a permanent feature in terms of human time frames.

After defining the protected landscape network, human use zones are designated across the landscape. A human use zone is assigned a priority use, and that priority use, in turn, defines the appropriateness and terms of any other human uses within that particular zone. In this way, more than one use is frequently accommodated or encouraged within human use zones.

Consumptive human uses, such as timber and mining, are generally limited to the stable and moderately stable portions of the landscape. In designing consumptive human uses for the future, *the effects of past human uses must be taken into account.* Information about effects of past human use is collected during analysis of the condition of the landscape; this information is then used to define human use zones for the future so as to ensure the protection, maintenance, and restoration of forest ecosystem functioning.

For example, in the Slocan Valley, both timber extraction and human settlement have negatively impacted functioning of the forest landscape. Therefore, past timber extraction is considered in this methodology both in the design of a protected landscape network and in the designation of human use zones. Human settlement (private land), however, is only considered from the standpoint of the protected landscape network. Zoning is not undertaken for settlement areas or private land.

Some human uses may be zoned to occur in selected portions of the protected landscape network. For example, hiking trails, built and used to ecologically responsible standards, may be designated in various portions of the protected landscape network. Similarly, ecologically responsible timber cutting may occur on stable inclusions within ecologically sensitive areas and within stable parts of riparian ecosystems. However, in general, human activities are discouraged from components of the protected landscape network.

4.1.2 Economic Analysis

Once the protected landscape network and human use zones have been defined, employment and economic outputs within the ecological limits of the landscape can be proposed. Our economic analysis looked at economic trends in the Slocan Valley and considered ways to could encourage the development of ecologically sustainable economic activities.

4.1.2.1 Ecologically responsible timber cutting

Sustainable timber cutting rates or allowable annual cuts (AACs) are determined for stable and moderately stable parts of the landscape that are socially suitable for ecologically responsible timber management. These **ecologically sustainable AACs** must be determined and applied on a small watershed basis within the overall Slocan River watershed.

This method of planning and distributing ecologically sustainable timber cutting rates is completely different from the conventional approach now being applied in the Slocan Valley. Under conventional timber management, an allowable annual cut (AAC) is determined for very large units (a Tree Farm License and a Forest License). The timber extraction needed to meet this AAC is then *concentrated* in a few small to medium size watersheds within the Slocan Valley landscape. Concentrating a large AAC in a few small areas has resulted in seriously degraded ecosystems all over the Slocan Valley.

Section 5, Results—Landscape Analysis, Protected Landscape Network, and Zoning provides an estimate of the overall ecologically sustainable AAC for the Slocan River watershed, and an initial list of the small watersheds among which this AAC must be proportioned, depending upon the ecological characteristics and condition of each watershed. This estimated AAC for the entire Slocan Valley landscape represents a synthesis of data gathered from air photo interpretation and map analysis during this phase of preparing the Slocan Valley Ecosystem-Based Landscape Plan. This data provides sufficient and reliable information for determining initial ecologically sustainable AACs for small watersheds within the Slocan Valley landscape. Defining functional boundaries for those small watersheds (both in terms of ecological responsibility and logging efficiency) and finalizing ecologically sustainable AACs will require additional air photo interpretation and field assessment. Silva Forest Foundation recommends that definition of these small watershed boundaries and finalizing watershed-specific AACs have a high priority as one of the next steps in this planning process.

At this point, we have estimated an AAC for the entire Slocan Valley landscape in order to compare an ecologically sustainable AAC estimate with the current non-sustainable AAC as determined by government and industry. Once this plan is further refined and operational plans are developed, ecologically sustainable AACs will be determined and applied for small watershed units, and no overall AAC will be determined for the entire Slocan River landscape per se.

4.1.2.2 Tourism

Tourism employment and economic opportunities are determined from a spectrum of activities possible within large protected areas, within specific portions of the protected landscape network, and throughout areas designated as commercial tourism zones. Diverse home-based businesses depend upon maintaining a high quality environment, which is realized through the protected landscape network and a balance of human uses, all based upon standards for ecologically responsible activities (see Appendix 5).

4.1.2.3 Small business

Small wholesale and retail businesses provide products and services needed by the various communities within the landscape being planned. These small businesses are also designed to supply sustainable quantities of value-added products to locations outside of the Slocan Valley landscape.

4.1.2.4 Mining

Mining was not considered as a part of the ecosystem-based economy in this plan. Mining proposals are unpredictable at this scale of planning, and each mining proposal must be evaluated on the potential ecological impacts that would result from mining activity in the short and long terms. Provided it could meet the test of ecological responsibility, mining could occur on a variety of sites, with preference given to stable and moderately stable portions of the landscape.

4.1.3 Community Consultation

Community consultation was carried out on three separate occasions in the preparation of this ecosystem-based landscape plan for the Slocan Valley. Public participation was based upon representation from the sectors, or interest groups, that comprised the government-sponsored local CORE table (Commission on Resources and the Environment). In the first public session, the overall flow of the Slocan Valley Ecosystem-Based Landscape Plan was explained, and concerns and interests were compiled from various sectors about both methodology of planning and use of specific areas in the Slocan Valley landscape. The second public session presented the initial protected landscape network. During this session, sector representatives were able to ask questions and to provide specific input for modifications of the protected landscape network. The third public session focused on current human uses and projected or desired human uses for various parts of the Slocan Valley landscape. In this third consultation, representatives of various sectors provided the Silva Forest Foundation with maps and other information describing the location and characteristics of their interests. This information was collated and used in the designation of human use zones.

All sectors from the Slocan Valley CORE table were invited to participate in each public session. Most sectors attended each session. Sectors were also invited to provide information throughout the project. However, the information provided and the description of interests varied widely by sector.

4.1.4 Mapping and Analysis

Throughout the methodology of preparing this ecosystem-based landscape plan, PAMAP geographic information system (GIS) software was employed to organize and analyze data, to quantify ecosystem-based activities such as timber cutting rates and employment from tourism, and to produce interpretive maps. Without the assistance of GIS, we would have been unable to carry out the kinds of sophisticated analyses, from the distribution and fragmentation of old growth to geographically specific timber cutting rates, that were determined in this plan. It is possible to do these kinds of interpretations “by hand,” without the assistance of GIS; however, working with GIS is not only more efficient in terms of time, but also allows planners to change variables easily at various points in the analyses. GIS furnishes a flexibility and breadth of interpretation that is not possible without this computer application.

To facilitate the handling of information, both electronically and by hand, the Slocan River watershed was stratified into eight **Landscape Analysis Units**. These stratifications are largely watershed-based, consisting of the major tributaries to the Slocan River. The map shown in Figure 4-1 depicts the locations of the eight Landscape Analysis Units used in this ecosystem-based landscape plan. All analyses and interpretations in this planning process were first carried out by landscape analysis unit, and later amalgamated to provide a picture of the overall Slocan River watershed.

The overall methodology for the Slocan Valley Ecosystem-Based Landscape Plan is described in the flow chart in Figure 4-2. As can be seen from this flow chart, preparing an ecosystem-based plan is not a linear process. Rather, wholistic thinking is necessary to define ecological limits, to understand how these ecological limits operate from the landscape level to the stand level, and to use these ecological understandings to encourage development of a sustainable, ecosystem-based economy.

It must always be recognized that both ecological interpretations and design of the ecosystem-based economy are filtered through human culture and human values. Any methodology and any outcome of planning inevitably reflect the values of the planners. Accordingly, this plan reflects a major value of the Silva Forest Foundation: *Protecting* *and maintaining ecosystems at all scales through time is the necessary foundation for diverse, sustainable human cultures and the economies found within human cultures.*

Ecosystem-Based Landscape Plan for the Slocan River Watershed *Page 4-6*

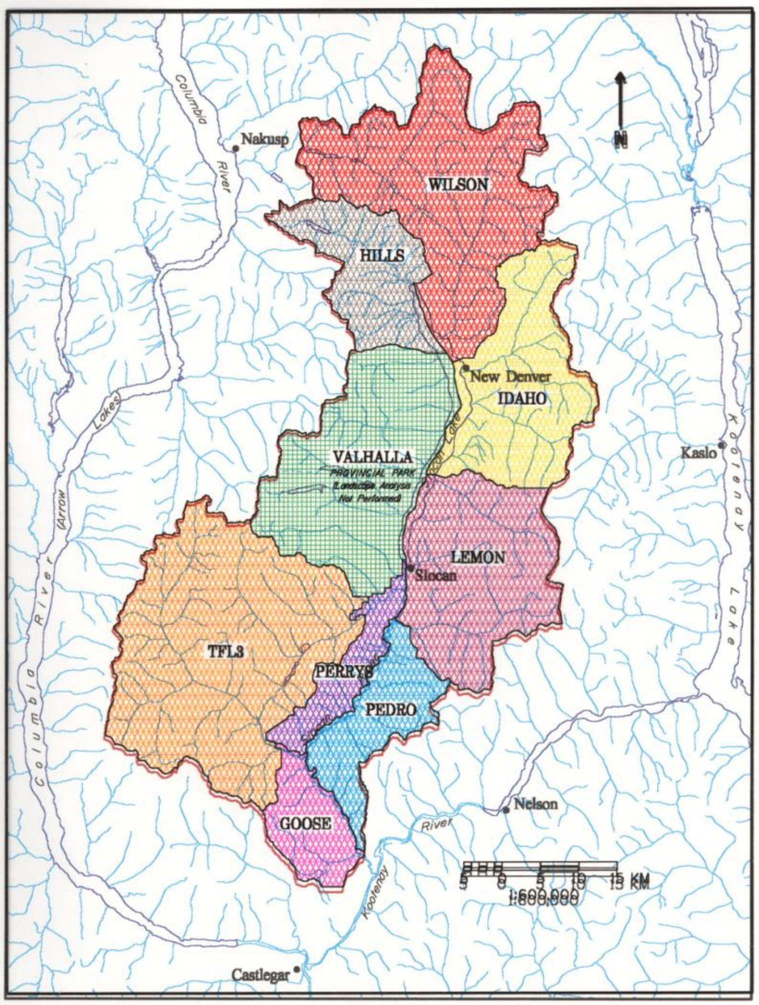


Figure 4-1: Slocan Valley Watershed -- Landscape Analysis Units

Silva Forest Foundation *June 1996*

Figure 4-1: Slocan Valley Watershed—Landscape Analysis Units

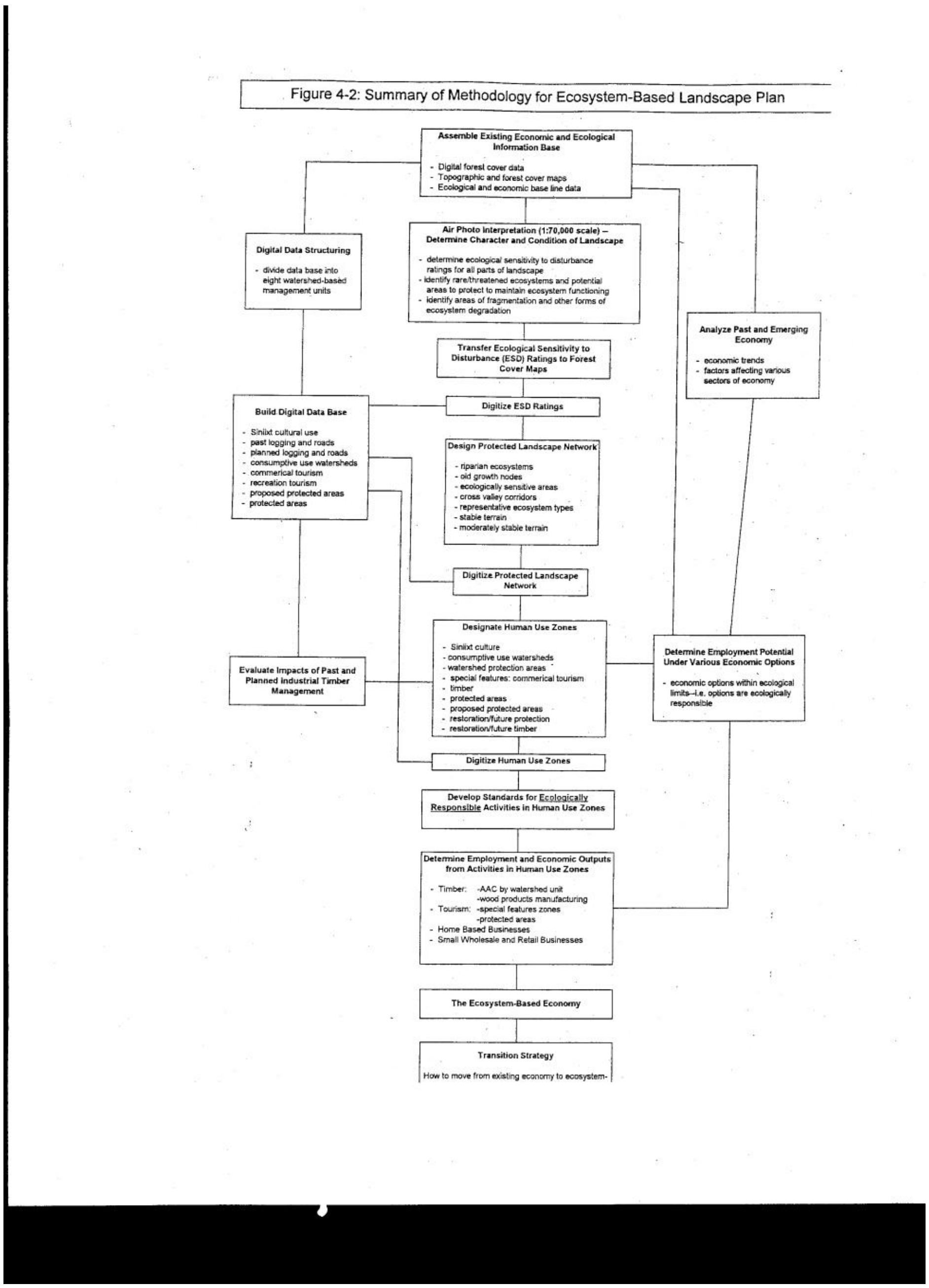


Figure 4-2: Summary of methodology for ecosystem-based landscape plan

4.2 The Database

- Black and white aerial photos from 1987 at a scale of 1:70,000 were used to analyze the characteristics and condition of the landscape and to design the protected landscape network and human use zones. The 1:70,000 scale was used because it provides a landscape perspective. Larger scale aerial photography does not permit the interpreter to see landscape level patterns over large enough areas to make decisions about landscape level ecosystem functioning easily and reliably. Designing operational plans will require more detailed aerial photo interpretation using large scale aerial photographs as well as field sampling to refine the protected landscape network and human use zoning.
- Digital forest cover maps at a scale of 1:20,000 were employed to assess and describe forest ecosystem characteristics across the landscape. These maps were obtained from the Ministry of Forests for the Arrow Timber Supply Area portion of the Slocan River watershed, and from Slocan Forest Products for the Tree Farm License #3 portion of the Slocan River watershed. Forest cover maps provide timber inventory information, as opposed to forest ecosystem inventory information. However, if forest cover maps are interpreted from a conservational point of view, they provide many valuable interpretations about ecosystem composition, structures, and functioning.

  Digital mapping of the boundaries of consumptive use watersheds was also used. However, this mapping contained numerous errors that were beyond the scope of this project to correct. Identified errors are detailed in Appendix 2.
- Paper copies of National Topographic Series (NTS) topographic maps at a scale of 1:50,000, and TRIM topographic maps at a scale of 1:20,000 were used to verify slope gradients and slope shapes interpreted initially from air photos. NTS and TRIM maps were also used to assist in the location of consumptive use watersheds.
- Economic analyses carried out by Grant Copeland, Gary Holman, and Susan Hammond were incorporated with ecological interpretations to propose an ecosystem-based economy. Susan Hammond researched the economic analysis, explained in *Section 6, The Emerging and Proposed Economy.*
- Community consultation sessions provided specific locations for current and proposed activities for various sectors as defined by the local CORE table. Input was received from the watershed, tourism, wilderness, and outdoor recreation sectors. Special information about cultural use was obtained from the Siniixt Nation. A further explanation of Siniixt cultural needs can be found in Appendix 3. Economic information was received from the wildcrafting and agricultural sectors. Input was not received from the sectors representing timber, mining, labour, local government, and independent logging contractors.

As indicated by this description of the overall methodology and the data base, preparation of this ecosystem-based landscape plan relied upon indirect data sources, as opposed to field sampling of ecosystems. However, the people carrying out the photo interpretation, landscape analysis, and design of the protected landscape network and human use zones are very familiar with the ecosystems of the Slocan Valley. The Silva Forest Foundation staff has worked in various capacities, including field assessments, for ten years or more, describing and interpreting the forest ecosystems of the Slocan Valley.

4.3 Decisions on Important Issues

Many issues, both technical and social, arose during the development of various parts of this ecosystem-based plan. Decisions about some of the important issues encountered in formulating this plan are described briefly below. Since the Slocan Valley Ecosystem-Based Landscape Plan is intended to be a community information document, decisions on the issues discussed below can be considered to be recommendations of the Silva Forest Foundation to the Slocan Valley community. Ongoing planning in the Slocan River watershed will necessitate further discussions on these and other issues. From the standpoint of the Silva Forest Foundation, future decisions regarding all issues will not be sustainable unless the decisions place the protection and maintenance of fully functioning ecosystems at all scales through time as the first priority.

4.3.1 Siniixt

The entire area of the Slocan River watershed is found within the Traditional Territory of the Siniixt Nation. Therefore, the entire area of the ecosystem-based plan is divided into three Siniixt Cultural Zones:

- Identified Areas of Spiritual Importance
- High Cultural Use Areas
- Moderate Cultural Use Areas

Any other human uses must be designed in a way that protects Siniixt Cultural Zones, and this protection must be defined through direction from the Siniixt Nation. More specific information about Siniixt Cultural Zones is found in Appendix 3.

4.3.2 Old growth

Old growth is a critical forest phase which must be maintained throughout the landscape of the Slocan Valley and, as well, old growth composition and structures must be well-distributed at the stand level. Late successional or old growth forests provide a variety of specialized functions not available in other successional phases. These functions include:

- production of the highest quality water
- regulation of herbivorous insects (i.e. insects which feed on the foliage of trees) by carnivorous insects found in large numbers only in old growth forests
- storage of the greatest amount of carbon by comparison to other forest successional phases

- production of the highest quality, highest value, and highest volumes of wood for potential timber supplies
- production and storage of large amounts of soil nutrients necessary for use in other successional phases, particularly the young and early mature forest phases
- provision of unique habitat likely necessary for the persistence of the majority of the animals within this landscape (extrapolated from Bunnell, 1990)
- provision of a source of specialized species, including soil flora, fauna, and microorganisms necessary for the healthy development of other forest successional phases

Clearly, late successional or old growth forests are required in significant quantities throughout the landscape to maintain both short- and long-term forest functioning. Unfortunately, in many parts of the world, this ecological reality has not been recognized until most of the old growth forests have been liquidated or so seriously fragmented that most of their important functions have been lost.

In the Slocan Valley, old growth forests once dominated the landscape. However, fires around 80 to 100 years ago that were a result of mining exploration, railroad development, and other industrialization; and clearing in the valley bottoms for settlement have greatly reduced the area of old growth in the Slocan Valley. In the past thirty years, timber cutting in the Slocan River landscape has focused on the liquidation of remnant old growth stands, with the highest timber quality, that remained following fires associated with industrial activities and clearing for settlement. Thus, current areas of old growth in this landscape are well below the historical range of variation of old growth that resulted from natural disturbance regimes such as fire and insect activity.

At this point, little research has been carried out to describe the historical range of variation of old growth as a result of natural disturbance regimes in the Slocan Valley. Discussing this topic with a conservation biologist who has studied similar ecosystems in the Pacific Northwest United States indicates that old growth would have covered a minimum of 30-40% of the Slocan Valley landscape, even immediately following a major disturbance such as a holocaustic fire in the landscape. Such disturbance regimes have been unlikely to repeat themselves more frequently than 250-500 years (Perry 1995 and Frost 1994). In the periods between holocaustic or stand replacing fires, old growth forests probably developed to cover 80+% of the Slocan Valley landscape.

Using this hypothesis, we analyzed the amount of old growth forests by biogeoclimatic subzone in each of the 8 landscape analysis units which comprise the Slocan River watershed. This analysis showed that late successional or old growth forests **on stable and moderately stable terrain** occupied less than 30% of the area in all biogeoclimatic subzones in each landscape analysis unit. For a more detailed discussion of these results, see *Section 5, Results—Landscape Analysis, Protected Landscape Network, and Zoning.*

In other words, the current area of old growth on stable and moderately stable terrain is at or below the low end of the historical range of variation from natural disturbances. Therefore, for purposes of this plan, we have decided that all remaining old growth forests in the Slocan River watershed need to be protected from timber extraction and other activities that significantly alter their composition, structure, and functioning. This decision affects only old growth on stable and moderately stable terrain, because old growth on unstable or ecologically sensitive terrain is always protected (i.e. is not a potential timber zone). As discussed later in Section 4.3.5, the Slocan Valley Ecosystem-Based Plan recommends restoration zones for recruitment of future old growth forests.

4.3.3 Ecological Sensitivity to Disturbance (ESD) Ratings

This rating system has been developed and refined by Silva Ecosystem Consultants over the past 15 years and is used by the Silva Forest Foundation. This ecological sensitivity rating or classification system is based upon ecological limits as described by a group of physical factors which are:

- slope gradient
- slope shape or complexity
- soil depth to a water impermeable layer
- site moisture conditions

Various combinations of these factors result in high or extreme ecological sensitivity to disturbance ratings. Timber management, road construction, mining, and other activities that require extensive modification of ecosystems are excluded from all but the stable and moderately stable areas, and inclusions of stable and moderately stable areas within larger areas of high and extreme ecosystem sensitivity to disturbance ratings.

In Silva's opinion, the ecological limits inherent in high and extreme ecosystem sensitivity to disturbance ratings are such that, even with extensive mitigation measures and high-quality operations, in most cases unacceptable losses of ecosystem functioning will result if timber management, road construction, mining activities, and other consumptive resource extraction occurs in these ecosystem types. This decision is firmly rooted in the principle that prevention of ecosystem degradation must be placed ahead of mitigation of ecological limits. Indeed, "mitigation" of ecological limits is seldom, if ever, successful in maintaining ecosystem functioning, particularly in the long term.

Ecologically responsible timber management, road construction, mining, and other consumptive resource extraction activities are permitted within moderate and low ecosystem sensitivity to disturbance ratings. Such activities can also be carried out in low and moderate ESD inclusions located within larger high and extreme ESD rating areas. If mining impacts can be limited to small areas within extreme and high ecologically sensitive areas, it may be an acceptable use in a very limited number of ecologically sensitive areas. Each instance must be evaluated on a case by case basis, considering the type and extent of potential impacts, and whether or not the mineral to be mined is required for human needs.

The Ecological Sensitivity to Disturbance Rating System is described in more detail in Appendix 1.

4.3.4 Existing fragmentation

With the exception of the Valhalla Park and some consumptive use watersheds, the Slocan River landscape has been extensively fragmented, both in time and in space. Even the Valhalla Park, the White Grizzly Park, and undisturbed consumptive use watersheds are islands in a sea of clearing for settlement and clearcutting to meet short-term timber objectives. The riparian ecosystem of the main Slocan River has been cleared for settlement purposes along its entire length. This fragmentation has been in place for over 50 years, resulting in extensive degradation of the most important riparian habitat in the Slocan River landscape.

Figure 4-3: Fragmentation of the Slocan River riparian ecosystem

As can be seen in this photo of the Slocan Valley floor, the main riparian connector—the Slocan River riparian ecosystem—has been extensively fragmented as a result of clearing for settlement, logging, and roads on both sides of the river. Virtually all of the Slocan River riparian ecosystem was logged at one time or another. Thus, the forest fragments visible in this photo have little structural value compared to the multi-canopied old growth forests that once occupied the Slocan River riparian ecosystem. Restoration of the Slocan River riparian ecosystem needs to be a high priority.

During the settlement period, fragmentation has also resulted from extensive clearcut logging throughout much of the Slocan River watershed. Fragmentation from clearcutting has been most pronounced in the Little Slocan River drainage, or within the boundaries of Tree Farm License #3. Accelerated clearcut logging since about 1970 has exacerbated fragmentation in the Little Slocan River drainage to the point that ecological integrity is seriously threatened in this portion of the Slocan River landscape.

Figure 4-4: Clearcuts in Berry Creek drainage basin

Extensive large clearcuts are shown in the Berry Creek drainage basin of TFL #3. Note how logging is concentrated on gentle terrain. This logging pattern is called highgrading, and is typical of industrial logging throughout the Slocan River landscape. Remaining old growth patches within this fragmented clearcut landscape have lost much of their ability to function as old growth forests.

Figure 4-5: Fragmentation from large patch clearcuts in TFL #3

Fragmentation from large patch clearcuts in TFL #3 is shown on the Tedesco slope (left center), Little Slocan River (lower right to center), and Airy Creek (upper right). Airy Creek is a consumptive use watershed, and water quality has been significantly diminished by clearcut logging activity. The Little Slocan River was once a main animal movement route in this landscape. Today, logging, roads, and a powerline have severely degraded the use of this part of the landscape for animals from cavity nesting birds to grizzly bears and pine marten.

Fragmentation is both a spatial and a temporal problem.

Clearcutting, roads, and clearings for various human activities break necessary connections in the landscape ecology. The movement of plants and animals, water, nutrients, and energy is interrupted or blocked by this spatial fragmentation. Healthy landscape ecology also requires a natural and *connected* distribution of forest ecosystem types and forest successional patterns (i.e. forest ages) across the landscape, which is interrupted by clearcuts and roads (particularly the wide roads which characterize industrial logging).

Clearcut logging and short cycle (i.e. rotation) timber cropping as practiced by the Ministry of Forests and the timber industry interrupt or fragment the natural pattern of forest disturbances and forest succession across the landscape. Clearcut and short cycle timber management fragments the forest landscape in time by shortening or eliminating the early successional shrub/herb phase and eliminating the late successional mature and old growth phases. Each of these phases has unique contributions to forest functioning at both the stand and landscape levels. For example, the shrub/herb phase and the old growth phase are the only nutrient input phases in the forest successional process. Thus, shortening or eliminating these phases will result in long-term nutrient impoverishment of forest landscapes and stands. Eliminating mature and late successional phases also eliminates vital habitat for a variety of animals, from a spectrum of unidentified soil microorganisms to large animals such as wolverines and eagles.

Removing late successional or old growth forests from the landscape also degrades water quality and timing of flow, resulting in both degradation of natural ecosystem functioning and diminished water values necessary for human settlement.

From the beginning of the development of the ecosystem-based plan for the Slocan Valley, the options for protecting and maintaining ecosystem functioning, and designing a diverse community-based economy have been constrained by the temporal and spatial fragmentation of the Slocan River landscape. Options for locating elements of the protected landscape network, particularly old growth nodes and cross-valley corridors, have often been limited by existing fragmentation. In other words, the extensive human modification of much of the Slocan River landscape has, in essence, defined the location for the components of much of the protected landscape network.

In some situations, due to existing fragmentation, we have included degraded sites within our protected landscape network. These sites are high priority areas for restoration as this plan is implemented. Indeed, active restoration of forest stands and forest landscapes needs to be a high priority activity throughout the Slocan River landscape. Restoration now is the key to developing and maintaining future ecological and economic options in the Slocan Valley.

4.3.5 Protected landscape network

Forest landscapes (or, for that matter, all landscapes that are essentially unmodified by technologically equipped human cultures) contain a full array of ecosystem types and have a successional pattern through time that is tied to unpredictable natural disturbance regimes. Such natural landscapes are fully occupied by their plants, animals, water, nutrients, and energy. Extensive modification of these landscapes results in degradation, loss of ecological integrity, and, if human perturbations are persistent, in ecological collapse. Scientists and planners now recognize the need to maintain, protect, and/or, where necessary, restore a framework of ecosystems throughout a landscape to ensure connectivity and ecosystem functioning at all scales, from the small patch or stand to the large landscape. This “framework” must be an interconnected web where natural ecosystem functioning remains essentially intact and undisturbed by all but the softest of human interventions. It is hoped that such “protected landscape networks” will ensure the short- and long-term health and ecological functioning of forest landscapes at all scales. Protected landscape networks are necessary not only for ecological health, but also for the long-term survival of healthy human societies and economies.

The protected landscape network developed as the foundation for this ecosystem-based plan includes the following components:

- ***Riparian ecosystems/Riparian areas***—these include both the wet forest immediately adjacent to streams, rivers, lakes, and wetlands (i.e. the riparian zone) and the upland forest immediately adjacent to the riparian zone (i.e. the riparian zone of influence).
- ***Ecologically sensitive terrain/sites***—ecosystem types that have clear limits to human use and that cannot be reasonably protected by careful or ecologically responsible human activities. Such sites include steep slopes, broken slopes, upper elevation forests, shallow soils, and very wet or very dry areas.
- ***Cross-valley corridors***—undisturbed or minimally disturbed movement corridors for animals and plants that connect riparian ecosystems across ridges or mountain ranges. Cross-valley corridors need to contain a range of habitat types and must not contain blockages
- ***Old growth nodes***—areas of late successional or old growth forests joined to riparian ecosystems, ecologically sensitive sites, and cross-valley movement corridors. Together with old growth forests found in riparian ecosystems, ecologically sensitive sites, and cross-valley corridors, old growth nodes constitute the *minimum* late successional or old growth forest necessary to ensure long-term ecosystem functioning throughout the forest landscape. Old growth nodes are separated into two groupings in the protected landscape network:

  —Old Growth on Sensitive Terrain

  —Old Growth on Stable or Moderately Stable Terrain
- ***Old Growth Recruitment Reserves***—low elevation, natural, and near mature forests on stable and moderately stable terrain that will soon become old growth forests. Low elevation old growth, particularly on stable and moderately stable terrain, is rare in the Slocan Valley landscape, and areas of natural forest (as old as possible) that will eventually become old growth need to be protected to maintain overall ecosystem functioning. Old growth recruitment reserves were selected using the need for a minimum of 15% of each biogeoclimatic subzone to be in an old growth stage. Some old growth recruitment areas are old growth remnants fragmented by clearcutting. In these situations, the clearcuts will be restored and protected along with the old growth fragments.

Adequate diversity of young forests are assumed to be protected in cross valley corridors, ecologically sensitive areas, riparian areas, and in no-cut areas within potential timber zones.

Elements of a protected landscape network should not be confused with large protected areas, parks, or wilderness reserves. Large protected areas are required throughout the landscape to provide reservoirs of fully functioning ecosystems and to furnish the biological blueprints required to reestablish functioning in landscapes degraded by human activities. The protected landscape network is the minimum ecological fabric that connects large reserves and ensures long-term ecological functioning within the landscapes and stands that are modified by technologically-equipped human cultures.

Silva has incorporated protected landscape networks in our ecosystem-based planning methodology for nearly ten years. In the past several years, the British Columbia Ministry of Forests has recommended that forest ecosystem networks or “FENs” be established in industrial timber management plans. The concept of FENs is very similar to Silva’s protected landscape network. When we compare FENs with a protected landscape network, two important differences arise:

- Protected landscape networks err on the side of being inclusive of the full range of ecosystems and on the side of protection, not on the side of exploitation. We believe this is necessary, both to maintain ecosystem functioning and to provide future social and economic options. In contrast, FENs usually constitute minimal area, often exclude commercially valuable timber stands, and do not provide full connectivity across the landscape.
- FENs are viewed by the Ministry of Forests and the timber industry as temporary or moveable parts in a timber management plan. Silva has reviewed plans containing FENs that call for the movement of FENs once areas outside the FENs have been logged. In this approach, degraded ecosystems will be incorporated in FENs in order to gain access to commercial timber supplies contained within initially established FENs.

  In contrast, Silva’s protected landscape networks constitute permanent networks of representative, protected, and interconnected ecosystems across the landscape. While it may be possible to shift portions of the protected landscape network into the commercial timber landscape and to move portions of the timber landscape into the protected landscape network, such “movement” would occur on very long timeframes (e.g. 200+ years). These long timeframes are necessary to ensure the development of fully functioning ecosystems within logged or otherwise modified portions of the landscape.

If long-term studies (i.e. 100+ years of observations) demonstrate that the protected landscape networks are fulfilling their ecological roles, limited timber extraction and other human activities may be able to occur to ecologically responsible standards within <u>some</u> portions of the protected landscape network. However, for all intents and purposes, protected landscape networks are permanent fixtures, in human time scales, within the forest landscape. Hopefully, together with large protected reserves and the maintenance of ecological integrity in areas modified by human activities such as timber management, protected landscape networks will ensure the maintenance through time of forest landscapes that are able to withstand the spectrum of natural disturbances.

Appendix 4 contains a more detailed description of protected landscape networks as they relate to ecosystem-based planning and conceptual maps that are the foundation for development of actual protected landscape networks like the one incorporated in the Slocan Valley ecosystem-based plan.

4.3.6 Human Use Zones

In the areas between the components of the protected landscape network and in some parts of the protected landscape network, we established human use zones. All human use zones, whether used for timber, tourism, domestic/agricultural water, and/or wildcrafting, require that human activities be carried out in ecologically responsible ways. Ecological responsibility is defined by principles and standards detailed in Appendix 5. Ecological responsibility simply means that any human use within the Slocan River landscape must ensure the protection and maintenance of fully functioning ecosystems at all scales through time. Human use zones identify the priority use or the human use that dictates the terms (within the limits of ecological responsibility) under which other uses may be carried out within a particular zone. Thus, commercial tourism zones may include ecologically responsible timber extraction. However, any timber extraction that occurs within these zones must, as a first priority, protect any and all aspects of the zone that are necessary for current and future tourism activities.

Human use zones are also located in some portions of the protected landscape network. However, these uses must not occur in ways that alter the composition and structure of the forest, thereby resulting in loss of forest functioning.

Appendix 5 provides general principles and standards for a diversity of ecologically responsible forest uses and specific standards for ecologically responsible timber management.

Human use zones have been identified through consultation with several sectors represented in the Slocan Valley CORE Pilot Project. As explained earlier, all sectors were invited to participate in three consultation sessions carried out by the Silva Forest Foundation as an integral part of preparing this ecosystem-based landscape plan. As the SFF ecosystem-based landscape plan is used further in planning the future of the Slocan Valley, all sectors will have ongoing opportunities to refine the zoning recommendations made in this plan.

Human use zones proposed for establishment by the ecosystem-based plan include:

- ***Siniixt Cultural Zones***—As explained earlier in this section, Siniixt Cultural Zones cover the entire Slocan River watershed. All forest uses, including large protected areas, are subject to a just and lasting settlement of the land question. In the interim, Siniixt culture and land will be protected throughout the Slocan Valley by taking direction from the Siniixt Nation. The three Siniixt Cultural Zones are:

  —Identified Areas of Spiritual Importance

  —High Cultural Use Areas

  —Moderate Cultural Use Areas

- ***Consumptive Use Watersheds***—These are small watersheds within the larger Slocan Valley landscape which are used to supply water for domestic and agricultural purposes to settlement largely in the main Valley floor. Consumptive use watersheds restrict a variety of activities, including timber management, mining, commercial tourism, outdoor recreation, and wildcrafting. Maintenance and protection of natural levels of water quality, quantity, and timing of flow are required in consumptive use watersheds. Thus, aspects of other human uses that impose unacceptable risk to water quality, quantity, and timing of flow are not acceptable in consumptive use watersheds. Specific concerns include introduction of sediment into water supplies, destabilization of stream channels, deeper snowpacks and more rapid snowmelt in logged areas, and introduction of human waste into watershed areas. As with all human use zones, future planning must identify specific standards for ecologically responsible activities that are appropriate for consumptive use watershed zones.

The boundaries for consumptive use watershed zones used in this ecosystem-based plan were obtained from a digitized Ministry of Environment database used in the Kootenay Regional CORE process. This database contains a variety of errors which were beyond the scope of this planning project to remedy. A listing of these errors is found in Appendix 2. As planning continues for the Slocan River landscape, these errors need to be corrected through a process which includes public consultation and careful checking of government databases.

Figure 4-6: Headwaters and mid- and lower stream channel, McFayden Creek

The complex, wet headwaters, and the steep, narrow (i.e. deeply incised) mid- and lower stream channel of McFayden Creek are shown in this photograph. The headwaters, while containing gentle terrain, is a wet, seepage complex that is unsuitable for logging, because of its extreme ecological sensitivity to disturbance. Stream channels, like that of McFayden Creek, are naturally unstable, because they are actively eroding. Even small disturbances from logging and/or road construction can cause permanent (in human timeframes) degradation to water and ecosystem functioning in such channel types.

- ***Headwaters Protection Zones:*** The headwaters areas of consumptive use watersheds regulate water quality, quantity, and timing of flow throughout the watershed. As well, these areas are the storage basins where water is concentrated in a watershed, and are thus very wet and ecologically sensitive. For these reasons, human activities are excluded from headwaters protection zones.

Figure 4-7: Headwaters, McFayden Creek

Headwaters areas often contain patches of old growth forests (the darker stands in the photograph) which are particularly important for water storage and filtration. The large amounts of decaying wood in old growth forests earn them their title of "Nature's sponge". Protecting this headwaters area of McFayden Creek on Perry Ridge and other headwaters is necessary for maintenance of old growth values, regulation of water flow, maintenance of high water quality, and protection of the very wet erodable soils.

- ***Large Protected Areas:*** Two proposed protected area extensions are included as zones within this ecosystem-based plan: Kokanee Glacier extension, and Valhalla extension. Protected areas are large reserves that provide critical reservoirs for ecological communities, species, and genetic diversity. All landscapes that comprise Earth need large protected areas. With the addition of the two proposed protected area extensions to existing protected areas (Kokanee Glacier Park, Valhalla Park, and White Grizzly Park) and establishment of the protected landscape network, we hope that the Slocan Valley landscape will be able to withstand future changes, such as global climate change, that have been created by industrial society, as well as changes from natural disturbances. Protected areas also provide essential blueprints of fully functioning ecosystems at all scales which are necessary to provide the template to restore degraded ecosystems. Other than small-scale, minimal impact recreational and tourism activities, no human uses are permitted within protected areas.

In North America, we are often inclined to think that we are leaders in large protected areas, and often we suggest that only the North American socio-economic situation permits the "luxury" of large protected areas. However, these thoughts are misconceptions. There is a clear consensus of scientists around the world that large protected areas, joined by protected landscape networks, are necessary to maintain both the short- and long-term ecological integrity of Earth. The reader may be interested in know that in Russia there is a system of *zaporvedniks* or nature reserves which are large protected areas distributed across the Russian landscape . A significant portion of each zaporvednik excludes all human activities except scientific research. Clearly, there is a long-standing and growing international understanding of the need to protect an interconnected and significant area of ecosystems from extensive modification by industrially-based societies, if we are to sustain the long-term functioning of Earth.

- ***Commercial Tourism Zones:*** SFF employed information obtained from the Tourism sector to establish commercial tourism zones in various areas throughout the Slocan River landscape. The priority use for these zones will be a variety of commercial tourism activities. Current principal users of various commercial tourism zones are identified according to information provided by the Tourism sector. Ecologically responsible timber management is permitted within Stable, Moderately Stable, and Heli terrain within commercial tourism zones *subject to the needs of commercial tourism operators.* Because ecologically responsible timber management maintains the composition and structure of natural forests, for purposes of this ecosystem-based plan, we have assumed that ecologically responsible timber management can occur within commercial tourism zones. However, the exact nature and extent of this timber management will require ground truthing and the approval of commercial tourism interests that would be affected by ecologically responsible or wholistic timber management.
- ***Potential Wholistic Timber Zones***—These are areas of stable, or moderately stable terrain, located throughout the landscape of the Slocan Valley. Where this stable and moderately stable terrain can be accessed by road in an ecologically responsible manner, timber zones are planned for use through logging systems that employ roads. However, where this is not the case, wholistic timber zones are designated as "heli" indicating that any timber extraction in these area must be carried out with aerial logging systems (such as helicopters) that exclude the construction of roads.

The annual allowable cut (AAC) for timber zones has been calculated on a Landscape Analysis Unit basis. To protect forest functioning at landscape and stand levels, AACs must be determined and implemented for each small watershed that makes up a Landscape Analysis Unit. An initial list of the small watersheds in which an AAC must be determined and applied is found in *Section 5, Results—Landscape Analysis, Protected Landscape Network, and Zoning.* This initial list will be revised through field assessments and further GIS analysis. In order to minimize negative impacts of timber extraction, timber cutting must be planned and carried out on a "watershed specific" basis according to the annual allowable cut developed for the particular watershed in question. Without this approach, timber cutting activities will systematically over cut each watershed within the Slocan River landscape, resulting in short- and long-term degradation of ecosystem functioning.

Wholistic timber management is carried out by ecologically responsible partial cutting or very small patch cutting. These systems of wholistic or ecologically responsible timber cutting are described in more detail in Appendix 5. All ecologically responsible timber cutting requires permanent reservation of large trees, large snags, and large fallen trees, well distributed spatially and by species throughout a logging unit.

For purposes of this plan, a minimum of 25% of the timber yield is permanently reserved in large trees, well distributed spatially and by species, that are left on each site to grow old and die. (Note: This is slightly below the minimum structural retention of 30% recommended by the Silva Forest Foundation in our standards for ecologically responsible timber management. See Appendix 5.) Eventually, as permanent leave trees die, replacement trees will be designated, ensuring that the minimum cover of large old trees will always be maintained.

Individual cuts seldom remove more than 10-15% of the trees and are separated by at least 15 years. Roads are small (less than one-half the width of conventional timber cutting roads) and fit into the terrain. For these reasons, wholistic timber management can be carried out in portions of other zones and in small portions of the protected landscape network. This is explained further in Appendix 5.

In order to determine an ecologically sustainable allowable annual cut (AAC) for timber zones within the Slocan River landscape, we developed assumptions as to what portion of timber zones will be available for ecologically responsible timber cutting. Development of these assumptions is necessary to protect ecosystem functioning, to protect non-timber zones where timber extraction may occur, and to recognize the lack of field assessment in this planning process. The following assumptions were made regarding the availability of land for timber cutting within Wholistic Forest Use Zones:

Table 4-1: Percent (%) of land in Wholistic Forest Use Zones available for wholistic/ecologically responsible timber management

Wholistic Forest Use Zones	Stable Terrain	Moderately Stable Terrain	Heli
Wholistic Timber Zones—not found in combination with any other human use zone	100%	50%	75%
Wholistic Timber Zones—found in combination with other human use zones:			
Commercial Tourism Zones	100%	50%	75%
Consumptive Use Watersheds	50%	25%	50%
Proposed Protected Areas	0%	0%	0%
Headwaters Protection Zone	0%	0%	0%
Protected Landscape Network Components			
• Riparian Ecosystems	5 - 10%	2.5 - 5%	5 - 7.5%
• Cross-valley Corridors	0%	0%	0%
• Old Growth Forests	0%	0%	0%
• Old Growth Recruitment Areas	0%	0%	0%
• Ecologically Sensitive Areas	0%	0%	0%

As can be seen from Table 4-1 above, some timber management will be permitted throughout the landscape of the Slocan River. However, this timber management is constrained by ecological limits, standards for ecologically responsible or wholistic timber management (see Appendix 5), and by the requirements of the protected landscape network or the human use zone within which timber management may occur.

- ***Restoration Zones***—By removing or falling all or nearly all large old trees and snags, and removing or damaging large fallen trees, clearcuts degrade and may destroy forest functioning at the patch or stand level. In addition to this loss of structure, roads (which are linear clearcuts), landings, and skid roads degrade soil, cause soil erosion, including landslides, and damage water quality. Removal of all large trees in an area results in higher spring runoff, which scours stream channels, causes siltation of streams, and contributes to erosion, landslides, and debris flows. Clearcuts, particularly extensive clearcutting in a landscape, result in loss of plant and animal habitat, and the death of plants and animals.

Therefore, all existing clearcuts in the Slocan River watershed are classified as Restoration Zones. Depending upon their location in relationship to old growth fragments and cross valley corridors; and the need for old growth recruitment, Restoration Zones are subdivided into:

Restoration/Protect—Following forest restoration, these areas will be added to the protected landscape network.

Restoration/Potential Wholistic Timber Zones—These are clearcuts which have occurred on stable and moderately stable terrain, *and* are in areas that are not needed for the protected landscape network. Therefore, once composition, structure, and functioning are restored to these sites, they may be used for *ecologically responsible/wholistic* timber management.

Forest restoration is the price of timber exploitation. However, employment from forest restoration activities is an important part of the economic transition strategy for moving from an externally controlled, non-sustainable economy to a locally controlled, sustainable economy. This is discussed further in *Section 7, Transition Strategy—Getting from Today's Economy to an Ecosystem-based Economy*.

4.3.7 Settlement Patterns

The extensive clearing of the riparian ecosystem of the Slocan River and of portions of the riparian ecosystem of the Little Slocan River for settlement purposes has greatly modified and degraded the overall functioning of the Slocan River landscape. There really are no other ecosystem types within the Slocan River landscape which can substitute for the riparian ecosystem of the Slocan River. The Silva Forest Foundation recommends that planning and carrying out the restoration of the Slocan River riparian ecosystem be a high priority for communities and rural areas in the Slocan Valley.

We understand that this issue is complicated by the reality that nearly all of the riparian ecosystem of the Slocan River is privately owned. However, there needs to be means developed to work with private landowners in the restoration of riparian ecosystem functioning for the Slocan River. Such restoration meshes with the needs of many interest groups. For example, such restoration will improve water quality, wildlife habitat, fish habitat, forest landscape and stand level functioning, and agricultural pest control. Restoration of the Slocan River riparian ecosystem would be eligible for funding under Forest Renewal B.C., and could provide a model of cooperation between private landowners, public interest groups, and provincial agencies. Restoration of the Slocan River riparian ecosystem needs to be a high priority issue for future community planning in the Slocan Valley.

Other than identification of this issue and strong support for the importance of restoring the riparian ecosystem of the Slocan River, it was beyond the scope of this ecosystem-based plan to make any further recommendations for Slocan River riparian ecosystems.

With the notable exceptions of the north end of Slocan Lake, Roseberry (including Slocan Forest Products log dump), New Denver, Silverton, and Slocan, there are significant areas of undisturbed riparian ecosystems adjacent to Slocan Lake. However, even within Valhalla Park, the mouth of Nemo Creek has been fragmented by cottages, and logging has reached the lakeshore or near the lakeshore in some places. All of the communities mentioned above are situated on the alluvial fans of major streams flowing into Slocan Lake or, in the case of Slocan, the Slocan River flowing out of Slocan Lake. At one time, these were unique habitats in the riparian ecosystem of Slocan Lake. Because much of the lakeshore riparian ecosystem consists of steep slopes and rock bluffs, restoration of as much of these village areas as is practically possible would improve the functioning of the overall Slocan River watershed.

4.3.8 Timber Management and Wood Products Manufacturing Employment

Direct employment from timber management and wood products manufacturing is commonly expressed as the number of people that are required to log and mill 1,000 m^3 of timber (about 30 logging truck loads). In 1993, Slocan Forest Products (SFP), which is the major timber company in the Slocan River landscape, employed 0.75 people to log and mill 1,000 m^3 of timber. Over time, SFP's employment has declined while its timber cut has increased (See *Section 6, The Emerging and Proposed Economy*). This is due to mechanization in both logging and milling operations.

Mechanization to the degree practiced by many timber companies in British Columbia is not required to compete in local, regional, national, or international markets, because the high quality of wood available from most forests in British Columbia cannot be found in most other parts of the world. Mechanization is more about maximizing corporate profits than it is about staying competitive in the market place. Therefore, employing more people for each tree cut and milled, or each 1,000 m^3 of timber cut and milled is economically viable. All other major timber and wood products producing countries achieve this goal better than Canada and British Columbia. For example, in 1984 Switzerland produced 11 times as many jobs, New Zealand 5 times as many jobs, and the United States 3.5 times as many jobs as generated in British Columbia per 1,000 m^3 of timber (Hammond 1991).

For purposes of determining direct employment from ecologically responsible timber management, we have used the following assumptions:

- **Logging**
  planning, logging, transportation of timber: approx 1.5 people/1,000 m^3 of timber
- **Wood products manufacturing**
  primary and value added (secondary and tertiary products): 3-6 people/1,000 m^3 of timber

  TOTAL: 4.5-7.5 people/1,000 m^3 of timber

This compares with SFP's employment of 0.75 people/1,000 m^3 in 1993.

Direct employment per 1,000 m^3 of timber was derived as follows for ecologically responsible timber management and value added wood manufacturing:

1. Literature shows that in recent years about 50% of employment comes from logging and about 50% from milling (Price Waterhouse 1991 and Fortrends 1991).
2. Recent past and current employment in the timber industry (logging and milling) hovers around 1 person/1,000 m^3 of timber, or 0.5 person for logging and 0.5 person for milling (Price Waterhouse 1991 and Fortrends 1991).
3. Ecologically responsible timber management, including planning, layout, road construction, logging, and log hauling, can require 3 to 10 times the number of people per 1,000 m^3 (Hammond 1991).
4. Value-added wood processing jobs can increase wood products employment by an average of 2.25 jobs per 1,000 m^3 of timber cut. Increased value added employment ranges from 1.7 additional jobs per 1,000 m^3 of timber cut for remanufacturing to 5.25 additional jobs per 1,000 m^3 of timber cut for cabinets. These employment figures are for existing value-added operations in B.C. (Select Standing Committee 1993).
5. Derivation of logging employment: Ecologically responsible timber cutting will require 4 times the number of people than conventional clearcutting.
   - SFP employs approximately .38 person/1,000 m^3
   - 4 x .38 person/1,000 m^3 = 1.52 people/1,000 m^3
     (conservative calculation from point 3)
     *** use 1.5 people/1,000 m^3**
6. Derivation of wood products manufacturing employment:
   - SFP employs approximately .38 person/1,000 m^3
   - 2.25-5.25 additional jobs for value-added wood products manufacturing (conservative employment increase from point 4)
   - .38 person + 2.25 people = 2.63 people/1,000 m^3
   - .38 person + 5.25 people = 5.63 people/1,000 m^3
     *** use 3-6 people/1,000 m^3**

These employment factors for timber management and wood products manufacturing are applied in *Section 6, The Emerging and Proposed Economy.*

4.4 Groundbreaking Methodology

To the best of our knowledge, the Slocan Valley ecosystem-based plan is unique. In our review of the current literature and through discussion with scientists and practitioners throughout North America, we do not believe that a practical ecosystem-based plan of this kind, using GIS and an interactive database for ecological and economic interpretations, has been previously attempted. While there may be efforts that we are not aware of, the Silva Forest Foundation found it necessary to develop methodology, computer programs, and interpretations from scratch. Thus, this first effort at ecosystem-based planning has required an extensive level of brainstorming and development of interpretive tools that will not be necessary in future ecosystem-based planning exercises.

For example, design of interpretive maps that were plotted from the GIS database required in the order of ten times longer than predicted. In future ecosystem-based plans, it will not be necessary to duplicate this time-consuming design work. While some of the computer programming for ecological and economic interpretations may be refined, future ecosystem-based plans will also not require extensive computer programming.

However, one aspect of ecosystem-based planning with GIS will always remain time consuming: organizing and preparing or “cleaning” the database. An extensive amount of time is necessary to organize digitized data into logical analysis units that can be processed by GIS software. In addition, a large amount of time is necessary to correct inaccuracies in digitized databases so that errors are not introduced into interpretations, and so that GIS software will even be able to use the digitized data.

What is gained for this large amount of time in building an accurate, practical GIS database? The answer is flexibility and depth of the ecological and economic interpretations that are possible with a GIS approach. We are now able to link ecological and economic factors in ways that, before the availability of GIS, were simply not possible within any reasonable timeframe. Ecosystem-based planning assisted by GIS and interactive databases is a particularly important tool for landscape level planning where divergent interests and values need to be considered. In such situations, ecosystem-based planning provides a clear definition of ecosystem composition, structures, and functions that are necessary to protect in order to maintain short- and long-term ecosystem functioning at all scales. Within this context of protected ecosystem functioning, a variety of human use options can be relatively easily compared using GIS.

The Silva Forest Foundation and a growing number of ecologists and economists around the world believe that if we want to maintain sustainable human cultures and their economies, then human activities must be based upon protecting ecosystem functioning at all scales. An ecosystem-based plan, like that described in this document, maps out the way to reach this objective. However, in the event that landscape level planning is carried out among interests who share an overall ecosystem-based value, planning would not necessitate the in-depth analysis that requires the GIS support used in this plan. In such instances, an effective ecosystem-based plan could be developed with maps, air photos, and colored pencils. Unfortunately, until the broader society accepts the need for ecosystem-based principles to be applied in all landscapes, a more complicated type of ecosystem-based planning will be required to educate people to the necessity and practicality of ecosystem-based approaches. GIS and interactive data bases are particularly valuable in this complicated planning environment.

4.5 Literature Cited

Bunnell, F. 1990. Forestry wildlife: w(h)ither the future? In: A. Pearson and D. Challenger, eds. Forests—wild and managed: differences and consequences. Students for Forestry Awareness, University of British Columbia, Vancouver, B.C.

Evans, C., E. Conroy (chairpersons); Select Standing Committee on Forests, Energy, Mines and Petroleum Resources. 1993. Lumber remanufacturing in British Columbia. First Report. 48 pp.

Fortrends Consulting Inc., Clayton Resources Ltd., and Robinson Consulting and Associates Ltd. 1991. Forest Resource Management Alternatives Study. Consultants' report prepared for the B.C. Forest Resources Commission.

Frost, Evan. Greater Ecosystem Alliance. 1994. Personal communication.

Hammond, H. 1991. Seeing the forest among the trees: the case for wholistic forest use. Polestar Press Ltd.: Vancouver. 309 pp.

Perry, D.A. et al. 1995. Interim protection for late-successional forests, fisheries, and watersheds: a summary of the Report of the Eastside Forests Scientific Society Panel. In: Proceedings of Ecosystem Management in Western Interior Forests. Symposium held May 3-5, 1994, in Spokane, WA. pp. 103-114.

Price Waterhouse. 1991. The Forest Industry in British Columbia. Vancouver, B.C. 34 pp.

5. RESULTS OF LANDSCAPE ANALYSIS, PROTECTED LANDSCAPE NETWORK, AND ZONING

The results of the ecosystem-based landscape plan for the Slocan River watershed represent a synthesis of the information derived from the methodology described in *Section 4, Methodology and Decisions on Important Issues: A Summary*. Specifically, the results presented below combine data and interpretations from map and air photo analysis, various databases, GIS interpretive maps, and data files linked to the GIS maps. In particular, the GIS interpretive map sets (1:50,000 for each landscape analysis unit and 1:125,000 for the entire Slocan River watershed) were vital to developing the results presented in this section. The foundation for the proposed economy (Section 6), the transition strategy (Section 7), and conclusions and recommendations (Section 8) are largely derived from the data presented in Section 5.

The reader is reminded that this is both an initial plan and a landscape level plan. Therefore, the specific results in this section are likely to change over time as data inputs are refined and operations planning proceeds. However, the results described below are sufficiently accurate to make ecosystem-based, landscape-level decisions. Applying the results described in this section at the landscape level before developing operations plans will ensure that connectivity, diversity, and other aspects of fully functioning forest ecosystems are maintained at both the landscape and stand levels.

5.1 Existing Land Tenure

The existing land tenures within the Slocan River drainage basin are listed in Table 5-1 and are graphically depicted in Figure 5-1.

Considering TSA or PSYU timber land, timber agreement lands, Tree Farm Licence #3, and woodlot licences, approximately 70 percent of the land in the Slocan River drainage basin is controlled by one form or another of timber tenure. The vast majority of this timber tenure land is controlled by one company, Slocan Forest Products (SFP), which is owned and controlled outside of the local area. If the emerging, diverse economy is to be sustained, the imbalance represented by timber interests controlling 70 percent of the landbase within the Slocan River drainage basin must be corrected. Not only do timber interests control 70 percent of the land in the Slocan River drainage basin, but this land is situated within the landscape so that what occurs on the timber tenure land affects all other parts of the Slocan River drainage basin.

Nearly 24 percent of the Slocan River drainage basin is contained in Class A provincial parks, which have the highest degree of protection of any land tenure within British Columbia. Together with the protected landscape network (described in Section 5.4), these parks form a critical and minimum framework to maintain short- and long-term forest functioning throughout the Slocan River drainage basin.

Table 5-1: Tenure of Land Within Slocan River Drainage Basin per Ministry of Forests

Description	Area (ha)	% of Total Area
Private land	16,673	5.0%
U.R.E.P. Reserves	284	0.1%
TSA or PSYU Timber Land	149,291	45.1%
Timber Agreement Lands (1)	64	0.0%
Class A Provincial Parks (2)	77,572	23.4%
Class C Provincial Parks (3)	7	0.0%
Recreation Areas	1,020	0.3%
Miscellaneous Crown Reserves (large)(4)	6,732	2.0%
Miscellaneous Crown Reserves (small)(4)	165	0.0%
Tree Farm License	78,928	23.8%
Woodlot License (5)	292	0.1%
Total Area:	331,028	100.0%

Notes:
(1) The "Timber Agreement Lands" listed above is surveyed Crown Lot 8859 on the north end of Perry's Ridge. This area is now a part of Woodlot License # 498. See Note 4.
(2) Large Class A Provincial Parks in the study area include Portions of Kokanee Glacier Provincial Park, all of Valhalla Provincial Park and portions of White Grizzly Provincial Park.
(3) The Class C Provincial Park is the Summit Lake Park in the Hills area.
(4) Miscellaneous Crown Reserves (large and small) include Watershed Reserves, Recreation Reserves, and other reserve types. In our opinion, these areas receive little or no special consideration during conventional resource planning, and were left within the Ministry of Forests timber management landbase in our analysis.
(5) The area of Woodlot Licenses is incomplete. The Crown Land portion of Woodlot License #496 is delineated in the MoF data used for this analysis. The private land portion of Woodlot License # 496 and all of Woodlot License #498 are not delineated.

Table 5- 1: Tenure of Land within Slocan River Drainage Basin per Ministry of Forests

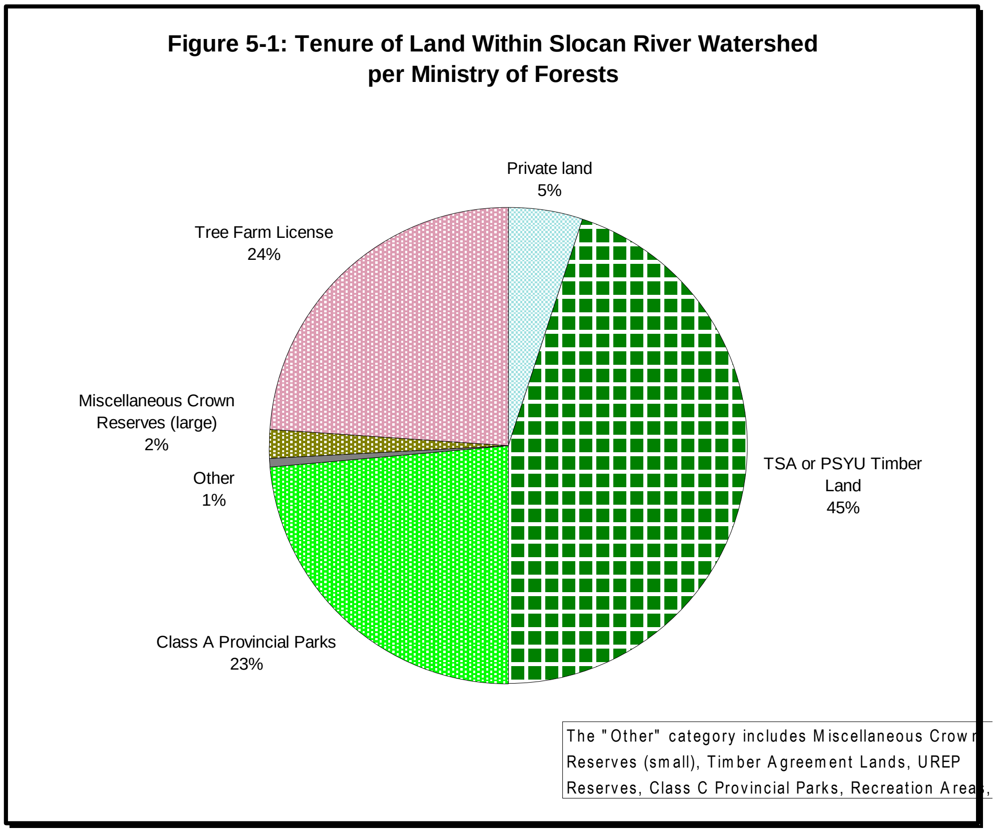


Figure 5- 1: Tenure of Land Within Slocan River Drainage Basin per Ministry of Forests

5.2 Land Categories per Ministry of Forests

Using the Ministry of Forests' forest inventory database, SFF stratified the Slocan Valley drainage basin into land categories as defined in the Arrow TSA Timber Supply Analysis prepared by the Ministry of Forests, September 1994. Table 5-2 and Figure 5-2 depict the Slocan River landscape from the timber planning standpoint of the Ministry of Forests and Slocan Forest Products.

Table 5-2 and Figure 5-2 indicate that about 1 percent of the Slocan River drainage basin has been "disturbed by logging". This figure is only an estimate of the area of the watershed which has been permanently removed form production by roads and skid trails, not an estimate of the total area logged.

Nearly 30 percent of the Slocan River drainage basin is found within the Gross MoF timber management landbase after netdowns for MoF environmental sensitive areas and other MoF constraints. In contrast, the Silva Forest Foundation potential wholistic timber management landbase is less than half of the MoF timber management landbase (see Sections 5.3 and 5.6). Results presented later in this section define and quantify the netdowns for environmental/ecological sensitivity and for other constraints which were used to derive the MoF and SFF timber management landbases.

Table 5-2: Slocan Valley Drainage Basin
Land Categories per Ministry of Forests

	Area (ha)	% of Total Area
Total Area of Slocan River Watershed	331,028	100%
Private Land, UREP, Recreation Reserves	17,984	5%
Class A Provincial Parks	77,572	23%
Non Forested Areas	54,173	16%
Non Commercial Forest	20,661	6%
Inoperable Areas (1)	37,230	11%
ESA Class 1 Areas	15,088	5%
Non Merchantable Forest (2)	10,186	3%
Disturbed Areas from Logging (3)	1,848	1%
MoF Timber Management Landbase	96,287	29%

Notes:

(1) Defined per the Arrow Timber Supply Analysis as areas above the MoF Operability Line on Forest Cover maps.
(2) Areas described in the Arrow Timber Supply Analysis as "problem forest types": areas with low site quality, specific types of old growth forest with high proportions of rotten trees, and deciduous stands.
(3) Per the Arrow Timber Supply Analysis, a 10.1% reduction was made to al forest stands not in the above categories which are less than 40 years old. These stands are assumed by the MoF to be part of the managed forest landbase, and to have roads and skid trails in place.

Table 5- 2: Slocan Valley Drainage Basin Land Categories per Ministry of Forests

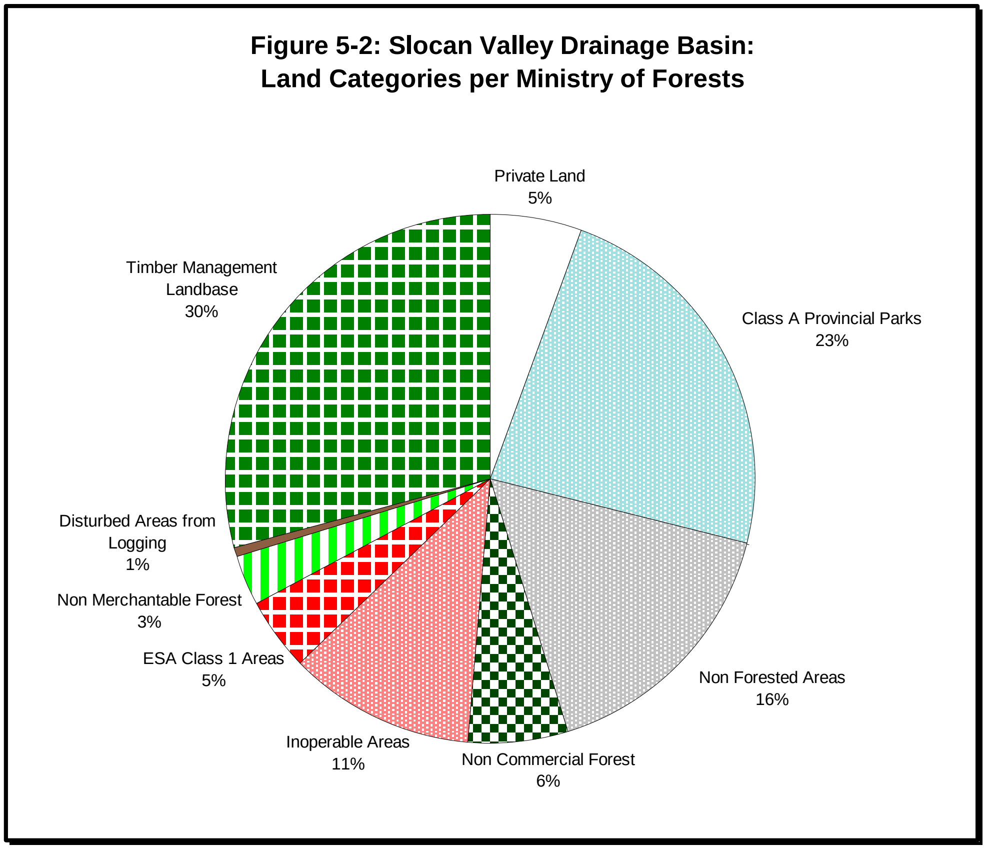


Figure 5- 2: Slocan Valley Drainage Basin: Land Categories per Ministry of Forests

5.3 Land Categories per Silva Forest Foundation

The first step in an ecosystem-based landscape plan is to assess the ecological limits of the entire landscape in order to determine what land needs to be protected to ensure fully functioning forests at all scales through time. The data presented in Table 5-3 and depicted in Figure 5-3 are the results of SFF's map and air photo interpretation of all of the Slocan River drainage basin (except the Class A provincial parks).

MoF Forest cover data files were used to identify non-forested land, which was defined as all areas classed by the MoF as non-forested, alpine forest, non-productive sites, non-commercial cover or disturbed by logging roads and trails.

Air photo and map interpretation were used in conjunction with SFF's ecosystem sensitivity to disturbance rating system (see Appendix 1) to identify ecologically sensitive forest land. Determining the ecological limits, or ecosystem sensitivity to disturbance rating, for a landscape is the critical and unique foundation of ecosystem-based planning. This information is integral to determining the characteristics of the landscape (see Section 2.1 and Section 3).

Over 50 percent of the Slocan River drainage basin is either not forested or is found in ecologically sensitive forests. In other words, forests on stable and moderately stable terrain constitute islands within a sea of non-forested land and ecologically sensitive forest land. This landscape pattern results in stable and moderately stable terrain constituting unique habitat types within a steep, rugged mountain-valley ecology. Significant portions of the forests on stable and moderately stable terrain need to be protected in order to maintain fully functioning forests at all scales. This requirement results in a limited landbase for ecologically responsible timber management.

In summary, the landscape ecology of the Slocan River drainage basin can be generally described as ecologically sensitive. In order to maintain and, where necessary, restore ecosystem functioning in the Slocan Valley landscape, future human users must pay more attention to respecting ecological limits and protecting ecosystem functioning than has been the case in past activities.

Table 5-3: Land Categories per Silva Forest Foundation

	Area (ha)	Area (ha)	% of Total Area
Total Area of Slocan River Watershed		331,028	100%
Large Class "A" Provincial Parks		77,572	23%
Not Forested		76,682	23%
Ecologically Sensitive Forested Land:			
Upper Elevation Forests	7,397		2%
Riparian Zones	18,633		6%
Steep/Complex Terrain	75,133		23%
Shallow Soils/Complex Terrain	6,089		2%
Wetlands and Wet Sites	2,928		1%
		110,179	
Moderately Stable Terrain		54,614	16%
Stable Terrain		11,981	4%

Table 5- 3: Slocan Valley Drainage Basin Land Categories per Silva Forest Foundation

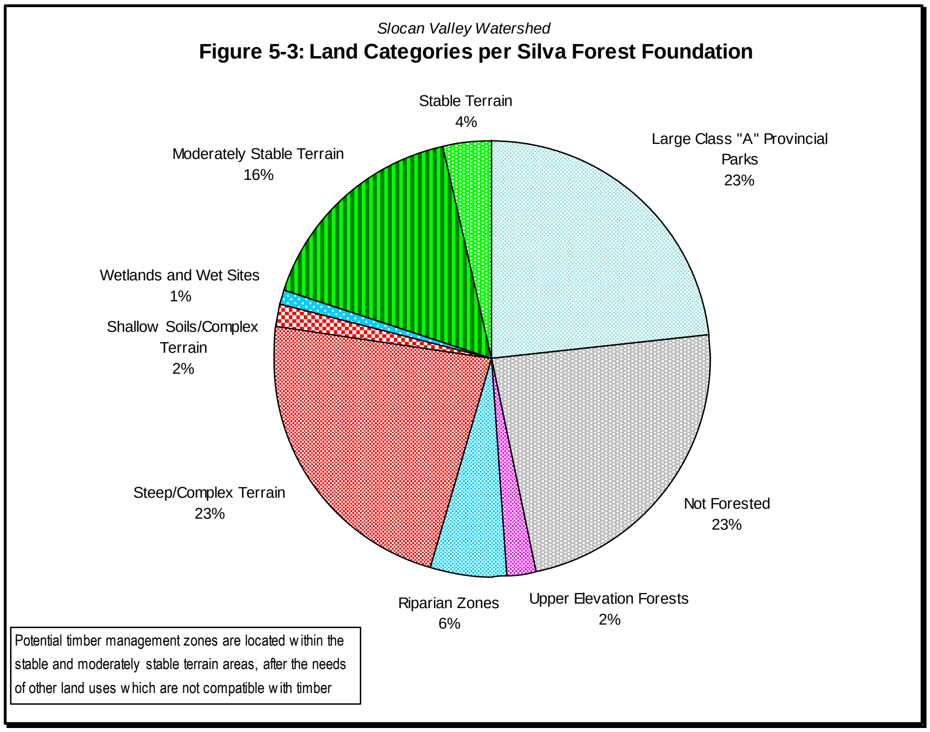


Figure 5- 3: Slocan Valley Drainage Basin Land Categories per Silva Forest Foundation

5.4 Land Categories within the Protected Landscape Network

Silva Forest Foundation land categories within the protected landscape network are listed in Table 5-4 and depicted in Figure 5-4. Included with the SFF land categories in the protected landscape network are the Class A provincial parks within the Slocan River drainage basin.

The protected landscape network, including Class A provincial parks, occupies approximately 48 percent of the Slocan River drainage basin. Just less than half of the area of the protected landscape network is found within the Class A provincial parks. Thus, excluding the Class A provincial parks, or large reserves, the other components of the protected landscape network make up about 25 percent of the total area of the Slocan River drainage basin. The vast majority of the area outside of Class A provincial parks within the protected landscape network (22 percent of the total area of the Slocan River drainage basin) is either non-forested or some category of ecologically sensitive terrain.

Only about 2 to 3 percent of the land within the protected landscape network is on stable, moderately stable, or heli-accessible terrain that, if located outside the protected landscape network, could constitute potential wholistic timber management areas.

Table 5-4: Slocan River Drainage Basin Land Categories within Protected Landscape Network			
	Area (ha)	% of PLN Area	% of Slocan River Drainage Basin Area
Total Area of Protected Landscape Network (1)	157,420	100%	48%
Land Categories within P.L.N.:			
Class "A" Provincial Parks	77,572	49%	23%
Non-Forested Areas (2)	23,791	15%	7%
Clearcut Restoration Zones: ES Terrain	7,084	5%	2%
Clearcut Restoration Zones: Not ES Terrain	1,242	1%	0%
Young Forests			
On Ecologically Sensitive Terrain	25,602	16%	8%
On Stable, Moderately Stable or Heli Access. Terrain	2,338	1%	1%
Old Growth Forests			
On Ecologically Sensitive Terrain	17,793	11%	5%
On Stable, Moderately Stable or Heli Access. Terrain	1,997	1%	1%

Notes:
(1) Includes all cross valley corridors, riparian zones, old growth recruitment areas, and established large reserves (Class "A" Provincial Parks). Excludes all private land, UREP Reserves, Class "C" Provincial Parks, and Recreation Areas.
(2) Includes Non forested areas, alpine forests, non-commercial brush and non-productive brush per MoF forest cover maps.

Table 5- 4: Slocan River Drainage Basin Land Categories within Protected Landscape Network

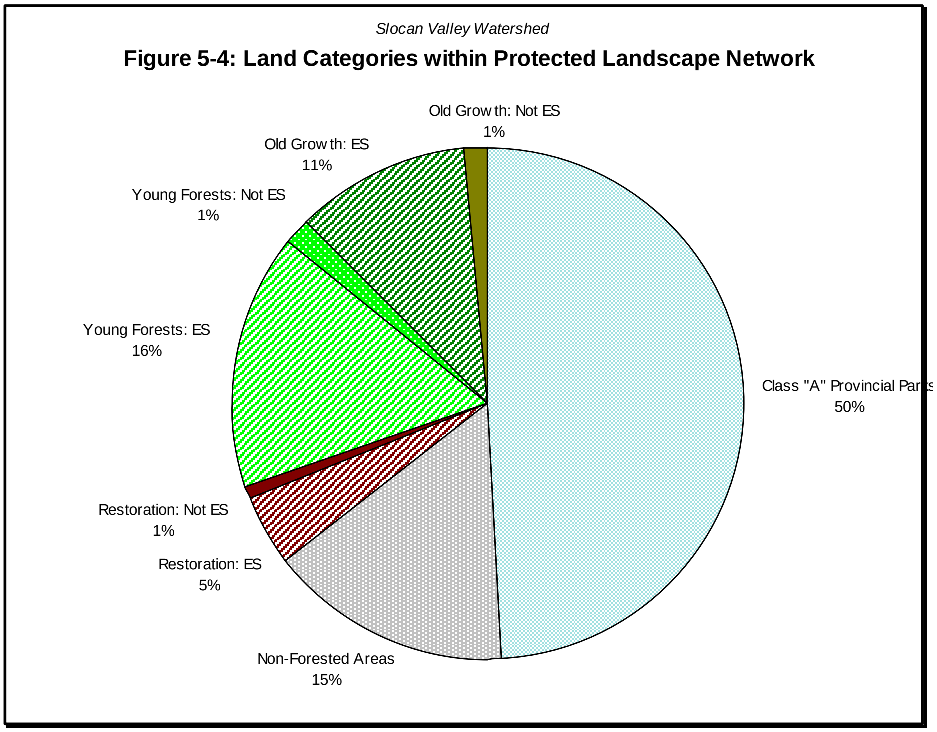


Figure 5- 4: Land Categories within Protected Landscape Network

5.5 Wholistic Forest Use Zones

After designating the protected landscape network in this ecosystem-based landscape plan, wholistic forest use zones were established to respect ecological limits, to balance forest uses across the landscape, and to provide for a diversity of ecologically responsible forest uses in the Slocan River drainage basin. The results of wholistic forest use zoning are described in Table 5-5 and depicted in Figure 5-5.

Section 4.3.6 provides more detailed descriptions of wholistic forest use (i.e. human use, zones) in ecosystem-based planning.

Note that Table 5-5 indicates that 104 percent of the total area of the Slocan River drainage basin is found within private land, the protected landscape network, and/or wholistic forest zones. The area and percent exceed the total area of the Slocan River drainage basin because wholistic timber management zones, commercial tourism zones and a portion of consumptive use watersheds (middle and lower slopes) overlap.

The large overlap of various zones and proposed protected areas with potential SFF wholistic timber landbase does not mean that a larger area is available for wholistic timber management. This data is presented only to provide information about how much of various zones and proposed protected areas had potential for wholistic timber management. With the exception of commercial tourism zones, ecological restoration/future timber zones, and a small portion of consumptive use watersheds (middle and lower slopes), wholistic timber management will not occur the zone types listed in Table 5-5.

Wholistic timber management zones constitute only 7 percent of the total area of the Slocan River drainage basin. This figure illustrates the extreme ecological sensitivity of the landscape ecology of the Slocan Valley.

Figure 5-5 provides a graphic representation of broad categories of land within wholistic forest use zones. As well, this figure shows private land, Class A provincial parks, and other parks and recreation areas. Note that there are no categories of land for the Class A provincial parks because there was no data in the MoF forest inventory database for Valhalla Provincial Park or Kokanee Glacier Provincial Park. We were therefore unable to analyze land within the Class A provincial Parks class.

The broad land categories depicted in Figure 5-5 are:

- Stable, moderately stable, or helicopter accessible terrain—these areas are potentially available for wholistic timber management.
- Forested, ecologically sensitive terrain—these areas have ecological limits that preclude timber management or other aggressive forest uses.
- Non-forest or not MoF controlled

Studying the bar chart in Figure 5-5 shows clearly how little stable, moderately stable, or helicopter accessible terrain is found within the Slocan River watershed.

Slocan Valley Ecosystem Based Plan

Table 5-5: Distribution of Wholistic Forest Use Zones

Wholistic Forest Use Zone Type	Area (ha)	% of Total Area	Area Within MoF Timber Landbase (ha)	% of Total MoF Landbase	Area Within SFF Wholistic Timber Landbase (ha)	% of Total SFF Landbase
Total Area of Slocan River Drainage Basin	331,028	100%	96,287	100%	12,667	100%
Private Land (3)	16,673	5%	N/A	N/A	N/A	N/A
Large Parks or Recreation Areas	77,572	23%	N/A	N/A	N/A	N/A
Small Parks (6)	1,476	0%	N/A	N/A	N/A	N/A
Proposed Protected Areas (6)	9,358	3%	1,755	2%	298	2%
Consumptive Use Watersheds: Headwaters Protection Zones (6)	35,989	11%	11,541	12%	858	7%
Consumptive Use Watersheds: Middle and Lower Slopes	27,720	8%	16,385	17%	2,068	16%
Commercial Tourism Zones (4)	18,887	6%	5,349	6%	672	5%
Ecological Restoration / Future Protection Zones (5)	17,427	5%	13,110	14%	0	0%
Protected Landscape Network (6)	41,573	13%	22,381	23%	2,791	22%
Non Forest or Ecologically Sensitive Younger Forest	71,816	22%	17,323	18%	0	0%
Ecological Restoration / Future Timber Zones (5)	3,330	1%	3,330	3%	3,330	26%
Wholistic Timber Management Zones	23,074	7%	19,954	21%	9,336	74%
Total Area of Wholistic Forest Use Zones:	344,893	104%	111,128	115%	19,353	153%

Notes:

1. All of the Slocan River drainage basin is part of Siniixt Territory. Wholistic forest use zones, and other categories of land are subject to the needs of the Siniixt Nation.
2. The total area of wholistic forest use zones (WFUZ) exceeds the total area of the Slocan River drainage basin, because some zones overlap. When human uses protect forest functioning at all scales, more than one use can occur in many areas. WFUZ denote a primary use. Provided that another use respects the needs of the primary use in a zone, many human and non-human uses can coexist in a particular WFUZ.
3. Private land was not zoned in this ecosystem-based plan. Zoning resulted in private land being surrounded by one or more zones. A complete ecosystem-based plan would include zoning of private land. However, this requires levels of public education and public process beyond the scope of this plan.
4. Commercial tourism zones can be expanded to include such ecologically responsible uses as wildcrafting.
5. Restoration zones are clearcut logged areas which need to have composition and structures re-established, and to have natural succession occur to re-establish forest functioning. Restoration is not a "quick fix" by human beings, and will often require centuries of patience as nature heals human mistakes.
6. **The SFF does not propose logging for these zone types.** We have listed the wholistic timber management landbase within these zones for information purposes only.

Table 5- 5: Distribution of Wholistic Forest Use Zones, Slocan Valley Drainage Basin

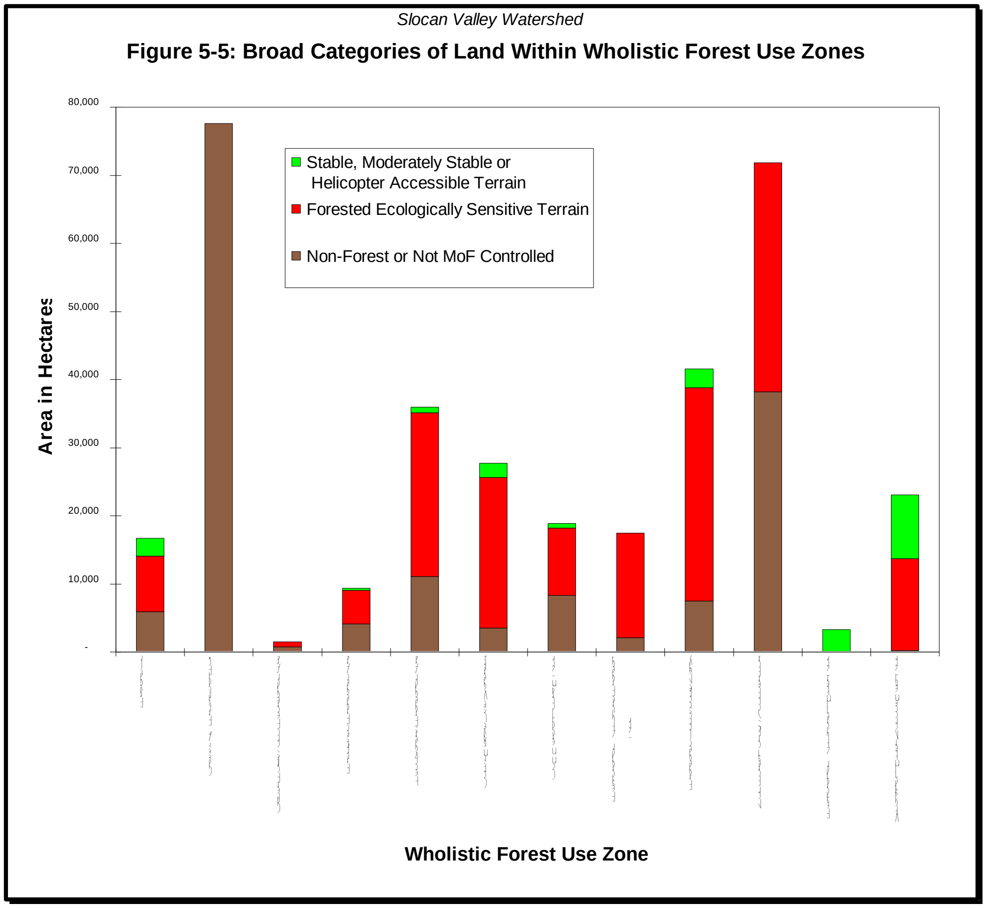


Figure 5- 5: Broad Categories of Land within Wholistic Forest Use Zones

5.6 Timber Management Landbases—Deriving the Ministry of Forests and Silva Forest Foundation Timber Landbases

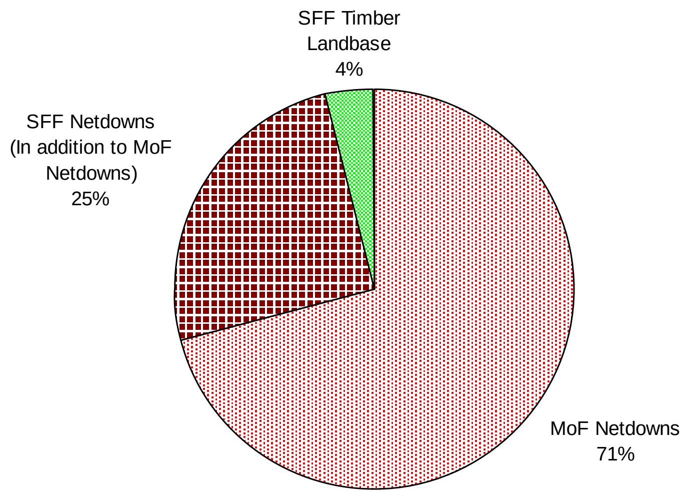
Derivation of the Silva Forest Foundation ecologically responsible or wholistic timber management landbase is described in detail in *Section 4, Methodology and Decisions on Important Issues: A Summary*, and in Section 5.7.

The Ministry of Forests timber landbase was estimated from MoF netdowns defined in the Arrow TSA Timber Supply Analysis by the MoF, September 1994. However, the landbase which SFF modeled for the Ministry of Forests is overstated because SFF was unable to model MoF netdowns for clearcut adjacency, steep slopes, visual management and wildlife management. For more information on this topic, see Appendix 9-E and 9-F.

Figure 5-6 is a pie chart which shows the portions of the Slocan River drainage basin that are netted down to derive the Ministry of Forests timber landbase and the Silva Forest Foundation wholistic timber landbase. Note that about 29 percent of the Slocan River drainage basin is found within the MoF timber landbase, while only 4 percent is found in the SFF wholistic timber management landbase after the SFF netdowns for ecological sensitivity and wholistic forest use zoning.

Slocan Valley Watershed

Figure 5-6: MoF and SFF Netdowns used to derive Timber Management Landbase



Overview of Landbase Netdowns	
Total Area of Slocan River Drainage Basin:	331,028
MoF Netdowns to Timber Landbase:	234,741
MoF Timber Landbase:	96,287
Additional SFF Netdowns to Timber Management Landbase:	**83,605**
SFF Potential Timber Management Landbase:	12,667

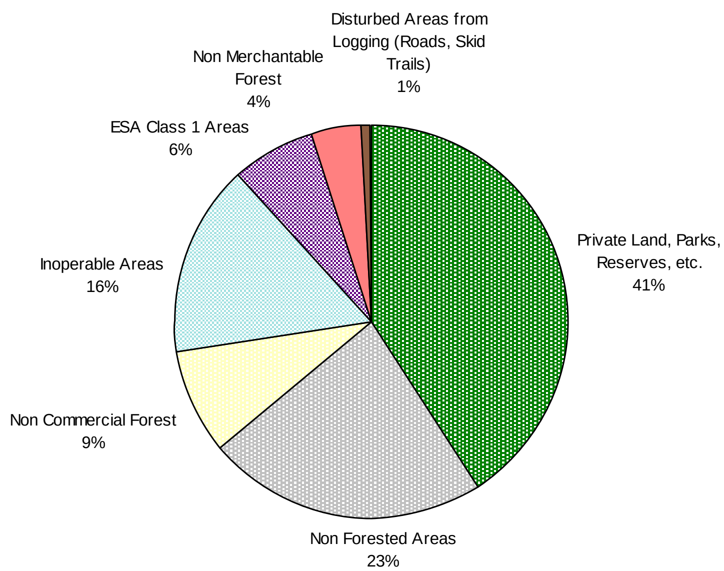
Figure 5- 6: MoF and SFF Netdowns to Slocan Valley Drainage Basin to Derive Timber Management Landbase

Figure 5-7 is a pie chart which shows the distribution of Ministry of Forests netdowns depicted in Figure 5-6. Ministry of Forests netdowns to derive the MoF timber management landbase are distributed between the categories of netdowns shown in Figure 5-7. Note that 64 percent of the netdowns result from private lands, parks, and reserves (41%), and non-forested areas (23%).

Inoperable areas make up about 16 % of Ministry of Forests netdowns to derive the MoF timber management landbase. Inoperable areas are considered to be economically inoperable (as opposed to ecologically inoperable) by the Ministry of Forests. Therefore historically, as timber supplies have become more scarce and timber values have risen, areas classified as inoperable by the MoF are removed from inoperable status and placed in the MoF timber management landbase. This practice has contributed to overcutting and logging ecologically sensitive forest sites throughout British Columbia.

Slocan Valley Watershed

Figure 5-7: Distribution of MoF Netdowns (96,287 ha) to derive MoF Timber Management Landbase



Overview of Landbase Netdowns

Total Area of Slocan River Drainage Basin:	331,028
MoF Netdowns to Timber Landbase:	234,741
MoF Timber Landbase:	96,287
Additional SFF Netdowns to Timber Management Landbase:	83,605
SFF Potential Timber Management Landbase:	12,667

Figure 5- 7: Distribution of MoF Netdowns in Slocan Valley Drainage Basin to Derive MoF Timber Management Landbase

Figure 5-8 shows the distribution of additional (to MoF) Silva Forest Foundation netdowns to derive the SFF wholistic timber management landbase. The largest SFF netdowns in addition to Ministry of Forests netdown are from steep/strongly complex/shallow soil zones (42%) and riparian ecosystems (14%). Cross-valley corridors (10%), consumptive use watershed headwaters (8%), and protected portions of low-elevation consumptive use watersheds (5%) also contribute to SFF netdowns. Also note that sensitive terrain inclusions in stable and moderately stable zones, which include small areas of steep, strongly complex, shallow soils, riparian ecosystems, and other ecologically sensitive areas, contribute 10% of the additional SFF netdowns.

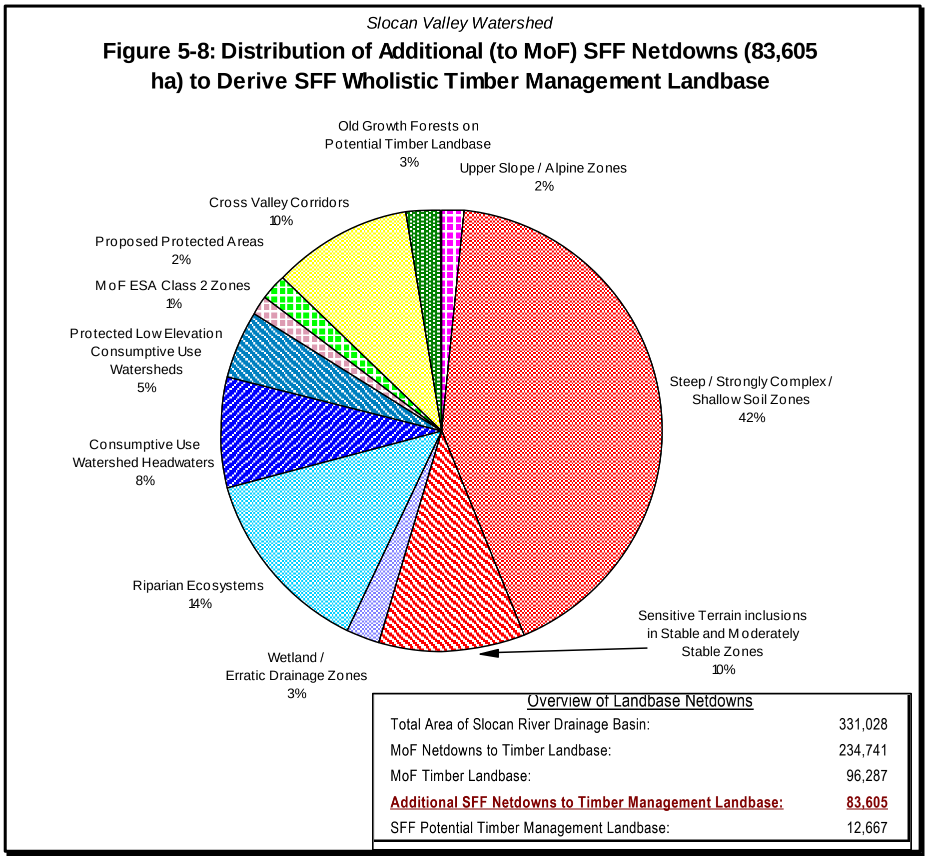


Figure 5- 8: Distribution of Additional (to MoF) Silva Forest Foundation Netdowns to Derive SFF Wholistic Timber Management Landbase

Figure 5-9 depicts the distribution of land types within potential wholistic timber zones. These zones are limited to forests on stable and moderately stable terrain throughout the Slocan River watershed. Areas classed as "helicopter logging areas" are areas of stable terrain that cannot be accessed by road without degrading ecologically sensitive terrain.

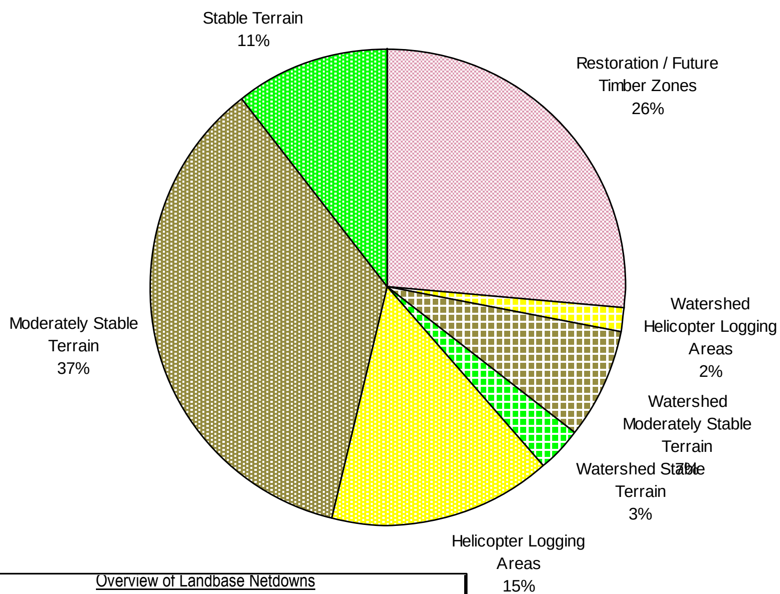
Figure 5-9 distinguishes between stable terrain, moderately stable terrain, and helicopter logging areas outside of consumptive use watersheds and within consumptive use watersheds. The only portions of consumptive use watersheds that are potential wholistic timber zones are areas of stable and moderately stable terrain found in the middle or lower reaches of consumptive use watersheds. Headwaters of consumptive use watersheds are protected zones.

Figure 5-9 also shows that 26% of potential wholistic timber zones is found in current clearcuts on stable or moderately stable terrain. . These sites require restoration, and are zoned as restoration/future timber. The fact that about one-quarter of the SFF potential timber management landbase requires restoration is a large part of the reason that a reduction in the ecologically sustainable AAC is necessary for about the first one hundred years of ecologically responsible timber management in the Slocan River watershed. For more details on this topic, see Sections 5.7, 5.8, and 6.2.1.

Slocan Valley Watershed

Figure 5-9: SFF Potential Timber Management Landbase

(Potential Wholistic Timber Zones)



<u>Overview of Landbase Netdowns</u>

Total Area of Slocan River Drainage Basin:	331,028
MoF Netdowns to Timber Landbase:	234,741
MoF Timber Landbase:	96,287
Additional SFF Netdowns to Timber Management Landbase:	83,605
SFF Potential Timber Management Landbase:	**12,667**

Figure 5- 9: Silva Forest Foundation Potential Timber Management Landbase

5.7 Estimating Gross MoF AAC and SFF Ecologically Sustainable AACs (Short- and Long-Term)

This section describes in detail the process in estimating the Gross MoF AAC and SFF Ecologically Sustainable AACs (short- and long-term). Table 5-9 provides details about the timber management landbase and timber growth by landscape analysis unit. Timber growth as presented in Table 5-9 is equivalent to annual allowable cut. Figure 5-10 is a bar diagram that compares the following for each landscape analysis unit:

- Total area
- Total forested area
- MoF timber landbase
- Wholistic timber landbase

5.7.1 Estimating Gross MoF AAC and SFF Ecologically Sustainable AACs (short- and long-term)

The ecologically sustainable Annual Allowable Cutting rate, or AAC, is a critical output of this ecosystem-based landscape planning process. Unlike conventional clearcut timber management, SFF has used a conservative or precautionary approach. As data resolution improves in operations planning we may find that the ecologically sustainable AAC can be increased. This will not be the case for the conventional AAC, which has dropped significantly in recent years due to overcutting (see Section 6.1.1 and 6.2.1) and is likely to continue to drop as a result of depletion of remaining old growth; social demands to protect non-timber forest values (in particular, water), and site degradation from clearcutting.

The estimated AAC is based on two factors:

1. The annual growth rate, or yield, in forest stands.
2. The area of forest stands which are ecologically and culturally suitable for timber management.

The area times the yield per hectare equals the AAC.

This section of the report outlines the processes and parameters used to estimate these two factors. In addition, the process used to assess the impact of past clearcut logging on the short-term ecologically sustainable AAC is described.

Note, hereafter in this discussion AAC mean the *ecologically sustainable AAC* as determined in this ecosystem-based planning process.

5.7.2 Timber Yield Estimation

The volume of wood which is grown each year on the timber management landbase is one of the two main variables needed to estimate the ecologically sustainable AAC in the study area. The average annual timber growth is often referred to as the yield or the mean annual increment (MAI) in forestry jargon. Average annual growth rate is generally expressed in cubic meters of timber produced per hectare per year (m^3/ha/yr). The annual allowable cut is related to the MAI, but is always lower due to factors such as timber waste, regeneration delays, and ecological protection measures.

We used Variable Density Yield Prediction Version (VDYP) software, Version 6.3c, published by the Ministry of Forests to estimate forest yield for this project. SFF used VDYP in the "batch" mode to estimate the yield for each forested polygon in the forest cover data file for each Landscape Unit. "Forested polygons" were identified as all polygons which had either an Inventory Type Group (ITG)[1] entry or were tagged as logged areas in the MoF data. This process included many areas which are not in the potential wholistic timber landbase, but SFF wished to determine the yield on all forested sites in order to know the timber yield on the land excluded from timber management in this plan, as well as yield on the land included.

VDYP requires a group of variables to run. Table 5-6 lists the information required by the software, and explains the source of data or assumptions used in each case.

Table 5- 6: Variables Required by VDYP Software.

Required Variable	Notes
Species Composition	The makeup of the stand on the site, listing tree species present and percentage of forest cover by species. No tree species are listed in the data files for logged areas which are not yet restocked. In these instances, SFF assumed 100% Engelmann spruce stocking on sites within the EssF biogeoclimatic zone, and 100% Douglas-fir stocking within the ICH biogeoclimatic zone.
Forest Inventory Zone	Administrative designation, from forest cover data file.
Public Sustained Yield Unit (PSYU)	Administrative designation, from forest cover data file.
Utilization Level	The minimum diameter at breast height of "merchantable trees". Set to 12.5 cm for all lodgepole pine leading species stands, and 17.5 cm for all other stands.
Rotation Age	Age at which stand will be logged. This figure exerts a significant control on the predicted yield -- longer rotation ages result in lower annual yields. Table 5-1 shows the rotation ages used.
Site Index	A numeric measurement of the growing capacity of each forested site. This figure was calculated for each forested polygon, as explained below.
Crown Closure	The percentage of the available growing space occupied by the crowns of the overstory trees in a stand. SFF used the VDYP defaults for each species group in the study area. SFF considered using the crown closure listed in the forest cover data file, but decided that basing long-term timber productivity on current crown closure, which in some cases may be more a function of past logging than site capability, and in other cases reflected young forest conditions, was not a suitable methodology.

[1] An Inventory Type Group is a grouping of stands with similar species composition, such as all Hemlock and Balsam forests, or all Douglas-fir forests. Each stand on a forest cover map is assigned to an ITG by the MoF inventory process.

VDYP was run twice for each Landscape Unit data file. The first run calculated the site index for each forested polygon, and the second run calculated the MAI.

VDYP presents the option of calculating site index from the stand age and stand height or from the MoF site class rating, expressed as Good, Medium, Poor or Low. SFF understands that, in theory, using the age/height pair is preferable, but our tests showed a severe problem with this method: the site index calculated by VDYP did not correlate at all with the MoF site class for many stands. SFF infers that the age/height information in the forest cover data files may be the average age and average height of a diverse population of trees in some stands, resulting in erroneous site index output. SFF therefore elected to calculate site index from site class.

VDYP will calculate the stand yield at the culmination of mean annual increment or at a rotation age set by the user. SFF elected to set reasonably long rotation ages to match the ecosystem-based planning goals of maintaining biological diversity and growing large, high quality trees. The rotation ages used are still significantly less than ecological rotation ages, or the age at which old trees would begin dying. However, since significant areas of old growth reserves will be left throughout the landscape in the protected landscape network, and 25% of the trees in a timber zone will be left permanently to grow old and die, these rotations are a reasonable compromise between maintaining forest functioning and producing high quality timber in reasonable periods of time. Table 5-7 shows the rotation ages used.

Table 5- 7: Rotation Ages Used in Yield Prediction

Leading Species	Site	Rotation Age
Lodgepole Pine or	Low or None	250
Deciduous	Poor	120
	Medium or Good	100
All Others	Low or None	250
	Poor	140
	Medium or Good	120

These rotation ages reflect the generally faster juvenile growth, shorter life spans, and more rapid development of old forest characteristics of lodgepole pine and deciduous forests.

The estimated yield, or MAI, calculated by VDYP is an estimate of <u>net</u> timber yield in cubic meters per hectare per year. That is, allowances have been made for losses to decay and for waste and breakage during logging, using standard MoF netdowns.

After the second VDYP run, the predicted net MAI and the rotation age used to calculate that MAI were transferred back to the data file for each Landscape Unit.

5.7.3 Determine Landbase Usable For Ecologically Responsible Timber Management

The area of the ecologically responsible timber management landbase was calculated for each Landscape Analysis Unit by a complex process using an overlay of multiple GIS map layers and a data summary program.

The map information overlain and used was:

- MoF Forest Cover data
- MoF Land Ownership data
- MoF Operability polygons
- Biogeoclimatic subzone
- SFF Ecosystem Sensitivity to Disturbance
- SFF Wholistic Forest Use Zones
- SFF Protected Landscape Network

These layers of information were combined in a single GIS layer, with an associated data file containing key information from each of the source layers. This allowed us to use all of, any part of, or any combination of the above data layers to stratify the land within each landscape unit.

The land stratification used in this summary process mirrors the stratifications on the SFF map set prepared in conjunction with this report, with the exception of one important concept: partial netdowns. A partial netdown occurs when either the MoF or the SFF decide that a part of a polygon class should be removed from the timber landbase, and a part should be left in. For example, this occurs with the MoF Environmentally Sensitive classifications and with the SFF Moderately Stable terrain class, to identify only two of several cases. These polygons can only be shown as either 100% “in” or 100% “out” on the maps. However, in the data summary the exact proportions of each polygon which are in or out of the landbase are respected.

The potential ecologically responsible or wholistic timber landbase is the area remaining after the combination of MoF and SFF netdowns have been applied. SFF applies the MoF netdowns first, and then applies the SFF netdowns to the landbase which remains following the MoF netdowns. The MoF netdowns are based on the Arrow TSA Timber Supply Analysis (MoF 1994). The SFF netdowns are documented in Section 4.3.8 and in Table 5-8 below. Table 5-8 lists the netdowns to the forest landbase in the order in which they were applied, the source of the netdown, the proportion of each polygon within a netdown class which was removed from the landbase, and provides notes where appropriate.

Because some of the netdowns are partial, the area in a single map polygon may be spread over several classes. For example, a 100 ha polygon could have 20 ha allocated to a MoF “Problem” forest type, 72 ha allocated to a SFF Riparian Ecosystem zone, and 8 ha allocated to SFF Old Growth Protection.

Table 5- 8: Source and Extent of Netdowns to Timber Landbase

Netdown	Removed by:	Percent Removed	Notes
Land Not Managed by MoF	MoF	100%	Private land, Provincial Parks, UREP Reserves. (Note: ownership class "Miscellaneous Crown Reserves" not removed from landbase. This class was netted out in the Arrow TSA plan.)
Water		100%	
Non-forested Land	MoF	100%	Alpine, rock, gravel bar, swamp, clearing, urban, meadow, open range
Non-Productive Sites	MoF	100%	
Alpine Forest	MoF	100%	
Non-Commercial Cover	MoF	100%	Allegedly productive sites currently occupied by plant species without commercial value.
Inoperable Areas	MoF	100%	Areas above the MoF logging Operability Line
Low Site Quality	MoF	100%	
"Problem" Forest Type	MoF	100%	Balsam leading species, > 250 yrs old
"Problem" Forest Type	MoF	100%	Deciduous leading species, all ages
MoF Environmentally Sensitive Class 1, Type A or Type S	MoF	90%	Environmentally Sensitive sites, avalanche or soils and steepness concerns.
MoF Environmentally Sensitive Class 1, Type P	MoF/SFF	90%	Environmentally Sensitive Sites, regeneration problems. Removed from landbase only in unlogged areas outside of SFF stable or moderately stable terrain.
"Problem" Forest Type	MoF	90%	Pure lodgepole pine > 80 yrs old but < 20 m tall
"Problem" Forest Type	MoF	80%	Pure hemlock > 140 yrs old
"Problem" Forest Type	MoF	30%	Hemlock leading species, > 140 yrs old
"Problem" Forest Type	MoF	20%	Balsam/spruce, > 140 yrs old
"Problem" Forest Type	MoF	10%	Balsam leading species, 140 - 250 yrs
Disturbed Area from Past Logging	MoF	10.1%	Applied to all forest areas less than 40 yrs old. These younger stands are assumed to logged, and to have non-productive area due to roads, landings and skid trails.
Alpine Ecosystems	SFF	100%	Areas identified as upper elevation forest.
Steep and/or Complex Terrain	SFF	100%	Areas dominated by steep terrain (>60% slope) or complex terrain.
Netdown	**Removed**	**Percent**	**Notes**

	by:	Removed	
Thin, Sensitive Soil	SFF	100%	Areas identified as having shallow or dry soil over bedrock.
MoF Environmentally Sensitive Class 2, Type P	SFF	100%	Environmentally Sensitive Sites, regeneration problems. Removed from landbase only in unlogged areas outside of SFF stable or moderately stable terrain.
Domestic Use Watersheds, Headwaters Areas	SFF	100%	
Proposed Large Protected Areas	SFF	100%	Valhalla and Kokanee Park extensions.
Riparian Ecosystems	SFF	90 - 100%	10% of riparian ecosystems in stable terrain, moderately stable terrain, helicopter accessible areas and large valley bottom riparian ecosystems is “available” for inclusion in the timber landbase. This area is subject to further netdowns (e.g. 50% on moderately stable terrain).
Cross Valley Corridors	SFF	100%	
Old Growth Forests	SFF	100%	All lodgepole pine and deciduous forests > 120 years old, all other forest types > 140 years old.
Old Growth Recruitment Nodes	SFF	100%	Areas set aside to develop old growth forests on low elevation stable or moderately stable terrain.
Helicopter Accessible Terrain, outside consumptive use watersheds	SFF	25%	Reduction to allow for inclusions of unstable, ecologically sensitive terrain.
Moderately Stable Terrain, outside consumptive use watersheds	SFF	50%	Reduction to allow for inclusions of unstable, ecologically sensitive terrain.
Stable Terrain, outside consumptive use watersheds	SFF	0%	
Helicopter Accessible Terrain, inside consumptive use watersheds	SFF	50%	Reduction to allow for inclusions of unstable, ecologically sensitive terrain and extra caution due to domestic water use.
Moderately Stable Terrain, inside consumptive use watersheds	SFF	75%	Reduction to allow for inclusions of unstable, ecologically sensitive terrain and extra caution due to domestic water use.
Stable Terrain, inside consumptive use watersheds	SFF	50%	Reduction to allow for inclusions of unstable, ecologically sensitive terrain and extra caution due to domestic water use.

MoF ESA designations for recreation and wildlife were not considered in this summary. SFF felt that the recreation designation was not respected by conventional forestry planning in the field, and therefore should not be respected in planning. The wildlife classification was omitted in error, but the total area of ESA1 and ESA2 wildlife classification is 1484 ha, of which only 32 ha remains is within the potential wholistic timber landbase after the other netdowns have been applied. SFF believe that the protected landscape network and permanent retention of ecological structures more than adequately protect recreation and wildlife values.

The above netdowns were applied to every polygon on the final data layer, using a dBase summary program. The resultant timber landbase is summarized in the tables in Section 5 of this report.

5.7.4 Netdown to Retain Ecological Structures

Managing for and retaining large ecological structures[2] within the timber management landbase is a requirement of ecologically responsible, ecologically sustainable timber management. Ecological structures are necessary to provide habitat for animals ranging in size from small mammals and birds to microscopic arthropods, to maintain organic inputs into soil, to maintain soil structure, to store and filter water, and to maintain ecosystem health and resiliency. SFF hypothesized that a minimum of 25% of the biological productivity of the site, or the timber yield in this case, must be left on the site for these purposes (remember, natural disturbances leave close to 100%). All timber yield predictions in wholistic timber zones are therefore reduced by 25% in the final summary tables. The yield predictions generated by VDYP and stored in the data files were not reduced. All timber yield predictions for areas outside of wholistic forest use zones throughout this report are also not reduced by 25%.

5.7.5 Short-Term, Ecologically Sustainable AAC—the need for restoration

The procedures described previously in Section 5.7 determine the long-term ecologically sustainable AAC for the SFF potential wholistic timber landbase within the Slocan River watershed. However, in the short term, this level of timber cutting will not be achievable because a substantial proportion of the Wholistic Timber Zone has been logged, often clearcut, in recent years. Wholistic timber management envisions an even flow from partial cutting from all parts of the timber landbase. This is not possible when much of the landbase currently supports only trees less than 40 years old and requires restoration to reestablish forest functioning. A short-term reduction in annual cutting rates is the inevitable impact of past non-sustainable timber cutting in the Slocan River watershed.

SFF constructed a simple model of AAC over time to assess the impacts of recent logging or other disturbance. The model is based on the SFF potential wholistic timber landbase, as described in Sections 4.3.8 and 5.7. SFF assumed that the proportion of the net timber yield available from each stand will vary with age, and as stand tending, commercial thinning, and eventually wholistic timber cutting are carried out. Table 5-9 lists the proportions used. The model increments current forest age class by 20 year intervals to

[2] Large, old standing trees, standing dead trees (snags), and fallen trees.

simulate stand growth while carrying out 10 iterations to calculate the AAC at the present time, and at 20 year intervals for the next 200 years.

	Good & Medium Sites		Poor Sites	
Species Group	Age Class	% of Net Yield Harvestable	Age Class	% of Net Yield Harvestable
Lodgepole Pine or Deciduous Leading Species	< = 2	0%	< = 2	0%
	3	20%	3	20%
	4	30%	4 or 5	30%
	> = 5	75%	> = 6	75%
All Other Species	< = 2	0%	< = 3	0%
	3 or 4	20%	4 or 5	20%
	5	30%	6 or 7	30%
	> = 6	75%	> = 8	75%

Table 5- 9: Proportion of Net Yield Harvestable by Age and Species Group

The results of the analysis of AAC over time are shown in Section 5.8.

Table 5-10: Area, Timber Management Landbase and Timber Growth by Landscape Analysis Unit.

	Area in Hectares				Timber Growth in Cubic Meters per Year		
Landscape Analysis Unit	Total Area	Gross Forested Area (1)	Estimated MoF Timber Management Landbase (2)	Potential SFF Wholistic Timber Management Landbase (3)	Gross Mean Annual Increment (All Forests) (1)	Gross MoF Estimated Annual Allowable Cut (2)	SFF Estimated Ecologically Sustainable Long Term Annual Allowable Cut (3)
Goose	13,059	7,483	5,109	458	13,335	9,289	656
Perry's	11,215	6,516	4,366	340	12,343	8,190	439
Pedro	18,806	11,813	6,701	780	22,047	12,846	1,109
Lemon	41,730	24,931	13,111	1,362	51,515	29,286	2,375
Idaho	37,571	19,337	8,325	830	42,516	21,521	1,680
Wilson	59,254	23,951	12,215	1,951	51,668	30,009	3,655
Hills	22,377	14,024	7,722	1,485	30,461	19,181	2,983
TFL 3	79,458	50,737	38,738	5,461	122,219	96,349	10,125
Valhalla (4)	47,558	N/A	N/A	N/A	N/A	N/A	N/A
Sum:	331,028	158,791	96,287	12,667	346,103	226,670	23,022

Notes:

(1) Excludes Class A Provincial Parks, private land and nonforested, non-productive and non-commercial cover sites per the MoF.
(2) The Ministry of Forests timber management landbase and estimated sustainable annual cut shown above include areas which the Ministry of Forests will remove from the timber landbase due to clearcut adjacency, steep slopes, visual management and/or wildlife management considerations. We were not able to model these netdowns within the scope of this project. Therefore, the MoF figures are somewhat larger than will occur after operational planning.
(3) The estimated SFF sustainable annual cut excludes 25% of the average annual timber growth on wholistic timber management site to maintain large old trees, large snags and large fallen trees.

The estimated SFF timber management landbase and sustainable annual cut includes:

- 10% of the stable and moderately stable terrain within riparian ecosystems within wholistic timber management zones.
- 25% of the moderately stable terrain within lower elevation consumptive use watersheds.
- 50% of the stable and helicopter accessible terrain within lower elevation consumptive use watersheds.
- 50% of the moderately stable terrain within wholistic timber management zones.
- 75% of the helicopter accessible terrain within wholistic timber management zones.
- 100% of the stable terrain within wholistic timber management zones.

(4) Digital forest cover data was not available for the Valhalla Provincial Park or for Kokanee Glacier Provincial Park. Therefore, all Class A Provincial parks were excluded from the analysis.

Table 5- 10: Area, Timber Management Landbase and Timber Growth by Landscape Analysis Unit

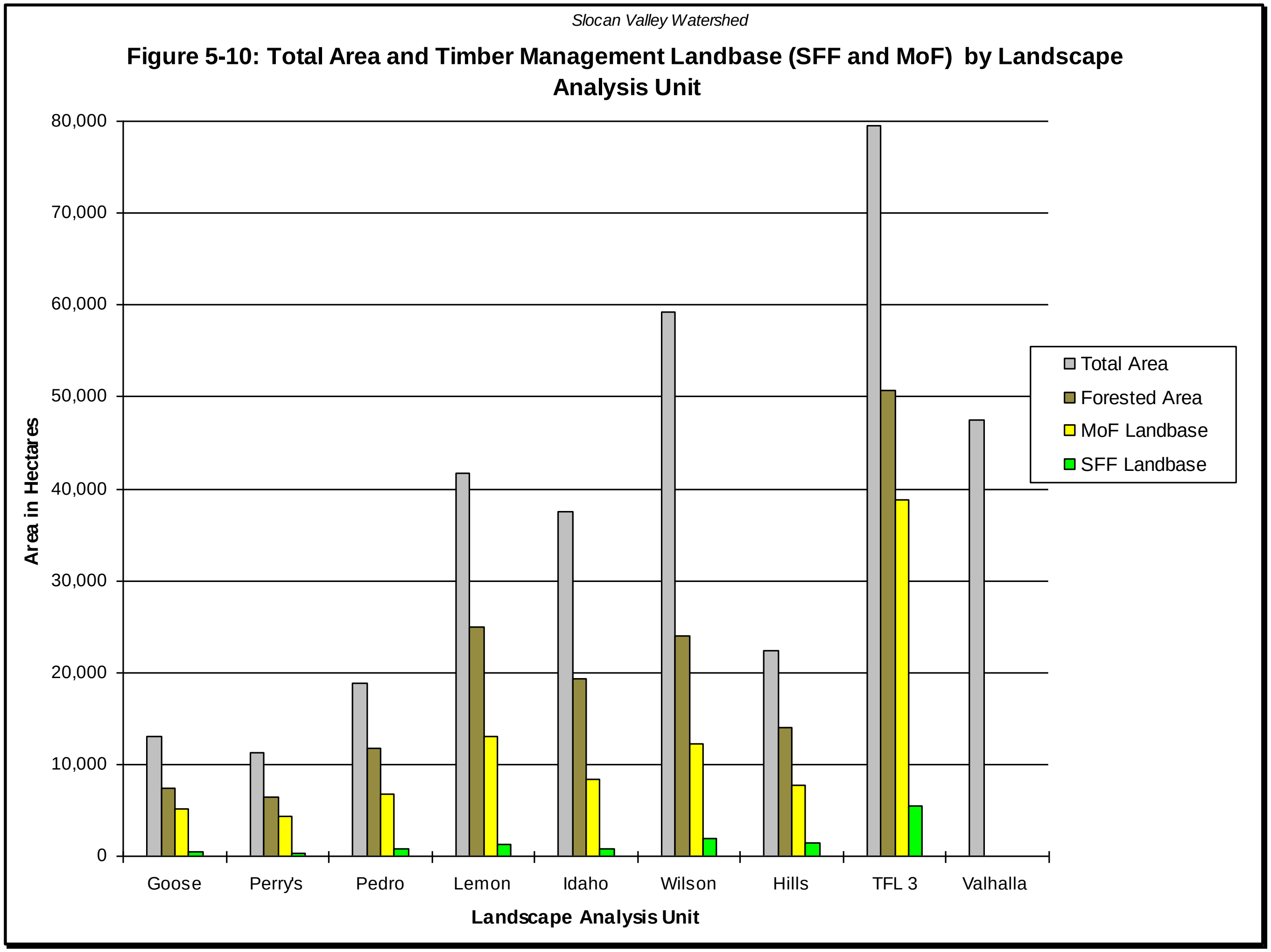


Figure 5- 10: Total Area and Timber Management Landbase (MoF and SFF) by Landscape Analysis Unit

5.8 SFF Ecologically Sustainable AAC—Short- and Long-Term AAC

Ecologically responsible timber cutting rates, or ecologically sustainable annual allowable cuts (AACs), have been estimated for the short and long terms in this ecosystem-based landscape plan for the Slocan River watershed. The short-term ecologically sustainable AAC is significantly lower than the long-term AAC because:

1. At the current time, significant portions of wholistic timber zones have been either logged or are young forests. These areas either need forest restoration or need to grow older before ecologically responsible timber cutting can occur.
2. Conventional timber management would compensate for the problems described in 1) above by logging mature forests in other parts of the landscape until logged or young forests reach maturity. However, ecosystem-based approaches/ecologically responsible timber management remove many mature forest areas from consideration for timber management because of ecological limits, inclusion in the protected landscape network, and zoning for non-timber forest uses. Thus, the landbase for ecologically responsible timber management is significantly smaller than that used in conventional timber management
3. Restoration of forests degraded by clearcutting requires long time periods and the results of restoration efforts are uncertain. Thus, short-term ecologically sustainable AACs must consider both the length of time necessary for restoration and the uncertainty of the success of restoration efforts.

The SFF Short-term Ecologically Sustainable AAC is estimated to be 10,288 m^3 which will steadily move upward to the Long-term Ecologically Sustainable AAC of 23,022 m^3 over a period of approximately 100 years.

As explained in Section 5.9, ecologically sustainable AACs must be determined and applied for small watersheds within the Slocan River watershed. An overall ecologically sustainable AAC is presented here only to serve as a comparison to the estimated conventional timber management AAC (see Sections 5.7 and 6.2.1).

Table 5-11 shows the transition from the short-term to the long-term ecologically sustainable AAC. The precautionary principle (see Section 2.7) has been applied to the estimation of the SFF Ecologically Sustainable AACs. Therefore, the Silva Forest Foundation believes that AACs developed in actual ecosystem-based operation plans may be slightly higher than those indicated in Table 5-10 and elsewhere in this plan.

Figure 5-11 graphically represents the data provided in Table 5-11, showing the transition from the Short-term to the SFF Long-term SFF Ecologically Sustainable AAC.

Table 5-11: SFF Ecologically Sustainable AAC
The transition from
Short Term AAC to Long Term AAC

Landscape Unit	Ecologically Sustainable Annual Allowable Cut in m3 of Timber per Year										
Date	1995	2015	2035	2055	2075	2095	2115	2135	2155	2175	2195
Goose	243	451	575	621	641	658	665	685	685	685	685
Perry's	256	376	437	447	463	463	463	463	463	463	463
Pedro	765	1,054	1,060	1,146	1,146	1,148	1,148	1,148	1,148	1,148	1,148
Lemon	1,368	1,545	1,742	1,851	2,019	2,253	2,399	2,409	2,411	2,411	2,411
Idaho	1,253	1,586	1,655	1,678	1,689	1,708	1,734	1,738	1,738	1,738	1,738
Hills	1,513	2,023	2,473	2,565	2,713	3,011	3,022	3,044	3,044	3,044	3,044
Wilson	1,830	2,160	2,603	2,726	2,881	3,509	3,656	3,692	3,700	3,700	3,700
TFL #3	3,061	4,922	7,348	8,176	9,042	10,021	10,232	10,284	10,284	10,284	10,284
Total:	10,288	14,118	17,893	19,209	20,594	22,772	23,022	23,022	23,022	23,022	23,022

Note:
The SFF short term AAC reflects the time span needed to partially restore areas degraded by clearcutting, and to wait for young forests and timber plantations to mature sufficiently to allow partial cutting of timber products to commence. Approximately 100 years is required to make the transition form the SFF short term AAC to the SFF long term AAC.

Table 5- 11: SFF Ecologically Sustainable AAC: the Transition from Short-term to Long-term AAC

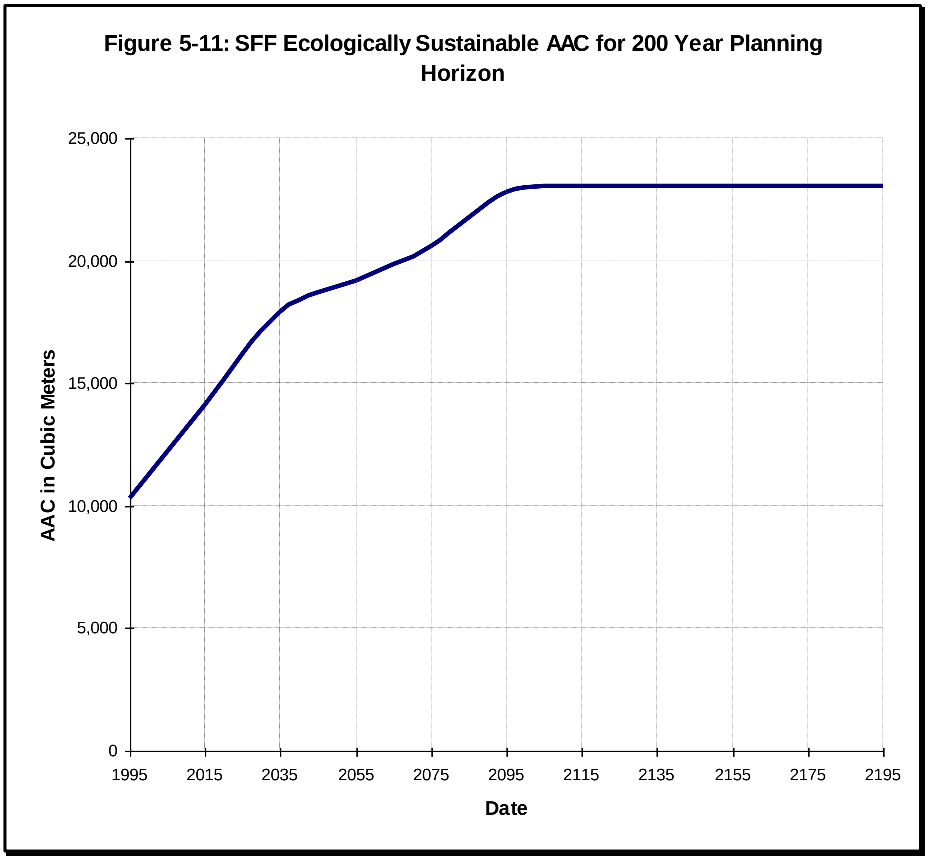


Figure 5- 11: SFF AAC for 200 Year Planning Horizon

5.9 Small Watersheds -- the Basis For Determining Ecologically Sustainable AAA's

Small Watersheds are the landscape units used to determine and to apply ecologically sustainable annual allowable cuts (AACs) in ecosystem-based timber management. The size of "small watersheds" generally ranges from 4 square kilometres or 1.5 square miles (400 ha or 1000 acres) to 15 square kilometres or 5.8 square miles (1500 ha or 3700 acres) depending upon the landscape ecology. For purposes of this initial list of small watersheds we have identified drainage basins that are about 6 square kilometres or 2.3 square miles (600 ha or 1500 acres) in area.

Small watersheds which are wholly within the protected landscape network, or do not include any timber zones are not included. This is truly an *initial* list. Further air photo and GIS landscape analysis is necessary to finalize small watersheds which will form the landscape units to determine and to apply ecologically sustainable AACs in the Slocan River watershed. Ecologically sustainable AACs or annual cutting rates must be determined and applied for small watersheds in order to avoid degradation associated with applying an AAC for a large area in small areas, within the large area i.e. concentrating the cut. This matter is discussed in more detail in section 4.1.2.1.

Table 5-12 below summarizes the number of small watersheds within each Landscape Analysis Unit for which an ecologically sustainable AAC will be calculated in the Slocan River watershed. Appendix 8 provides detailed lists of small watersheds for each landscape analysis unit.

Table 5- 12: Small Watersheds Requiring an AAC Determination

Landscape Analysis Unit	**Number of Small Watersheds (requiring an AAC determination) within each Landscape Analysis Unit**
Hills	26
Wilson	25
Idaho	29
Lemon	37
Perry's	12
Pedro	19
T.F.L. 3	69
Goose	13
Total Small Watersheds (requiring an AAC determination) within the Slocan Valley	**230**

5.10 High Elevation Forests

High or upper elevation forests have definite limits to tree growth which include slow nutrient cycling, cold soils, and very slow tree growth rates. A small amount of forest land was removed from the SFF ecologically responsible timber landbase as upper elevation forests. However, the full extent of ecologically limited high or upper elevation forests cannot be accurately identified through map and air photo interpretation.

The conditions which create ecological limits to tree growth (described above) and define high or upper elevation forests vary significantly with elevation, aspect, and local climatic conditions. Therefore, SFF recommends that ecosystem-based operations plans for the Slocan Valley specifically determine the location of high or upper elevation forests, and remove these ecologically limited forests from the wholistic timber/ecologically responsible timber management landbase.

One way of estimating a netdown to the wholistic timber management landbase and the SFF ecologically sustainable AAC is to remove a portion or all of the land or AAC attributable to the Engelmann spruce/subalpine fir (ESSF) biogeoclimatic zone. Table 5-13 below shows the effect of removing wholistic timber zones in the ESSF biogeoclimatic zone on the SFF long-term AAC. This table shows the effect of removing 50 percent and 100 percent of the AAC attributable to the ESSF. As can be seen from Table 5-13, only 3,384 m^3 per year are removed if 100 percent of the wholistic timber zones in the ESSF are removed from the ecologically responsible timber management landbase. If only 50 percent of the wholistic timber zones in the ESSF are removed, the SFF Long-term AAC would be reduced by 1,692 m^3 per year.

Both of the reductions modeled for removing wholistic timber zones in the ESSF are reasonably small. Thus, due to the extreme ecological sensitivity of high or upper elevation forests, SFF recommends that these forests be removed from the ecologically responsible/wholistic timber management landbase. However, a precise netdown for high or upper elevation forests in the SFF Ecologically Sustainable AAC must await the refinement of this ecosystem-based landscape plan and the development of ecosystem-based operations plans for wholistic timber management zones in the Slocan River watershed.

Table 5-13: Effect of Removing Wholistic Timber Zones in ESSF Biogeoclimatic Zone on SFF Long Term AAC.

Landscape Unit	SFF Long Term AAC from All Wholistic Timber Zones (m3/yr)	SFF Long Term AAC from Wholistic Timber Zones in ESSF Biogeoclimatic Zone (m3/yr)	SFF Long Term AAC with 50% of ESSF AAC Removed (m3/yr)	SFF Long Term AAC with 100% of ESSF AAC Removed (m3/yr)
Goose	656	60	626	596
Perry's	439	0	439	439
Pedro	1,109	15	1,102	1,094
Lemon	2,375	149	2,300	2,226
Idaho	1,680	16	1,672	1,664
Hills	2,983	347	2,809	2,636
Wilson	3,655	296	3,507	3,359
TFL #3	10,125	2,500	8,875	7,625
Total:	23,022	3,384	21,330	19,638

Table 5- 13: Effect of Removing Wholistic Timber Zones in EssF Biogeoclimatic Zone on SFF Long-term AAC

5.11 Old Growth

As discussed in Sections 2.6.1, 2.6.2, and 4.3.2, old growth forests are vital to protect in order to maintain fully functioning forests throughout the landscape of the Slocan River watershed. As explained in Section 4.3.2, the SFF analysis of old growth in the Slocan River watershed revealed that current levels of old growth are significantly below the historical range or variation of old growth throughout the landscape. The lack of old growth is particularly acute in low elevation forests, and on stable and moderately stable terrain. Therefore, this ecosystem-based landscape plan calls for the full protection of all remaining old growth forests on stable and moderately stable terrain. Old growth forests situated on ecologically sensitive terrain are, by definition, protected.

The bar chart in Figure 5-12 compares old growth forests on protected stable terrain and ecologically sensitive terrain with young forests on protected stable terrain, young forests on ecologically sensitive terrain, and timber zones. The comparisons in Figure 5-12 are made by landscape analysis unit, and show clearly that young forests on ecologically sensitive terrain are the dominant forest type in all landscape analysis units. In contrast, old growth on protected stable terrain is the least common forest type in all landscape analysis units. The lack of old growth throughout the Slocan River watershed, on either stable or ecologically sensitive terrain, is clearly evident in Figure 5-12.

Table 5-14 compares old growth forests and logged areas by terrain class with total forest area by terrain class. Table 5-14 shows that overall in the Slocan River watershed, only 26 percent of the total forested area is old growth, including old growth on ecologically sensitive terrain and on stable/moderately stable terrain. One would expect that the historical range of variation of old growth, even following a large wildfire, would not have gone below 30 percent. Therefore, protecting all remaining old growth forests in the Slocan River watershed is essential to maintain and restore forest functioning.

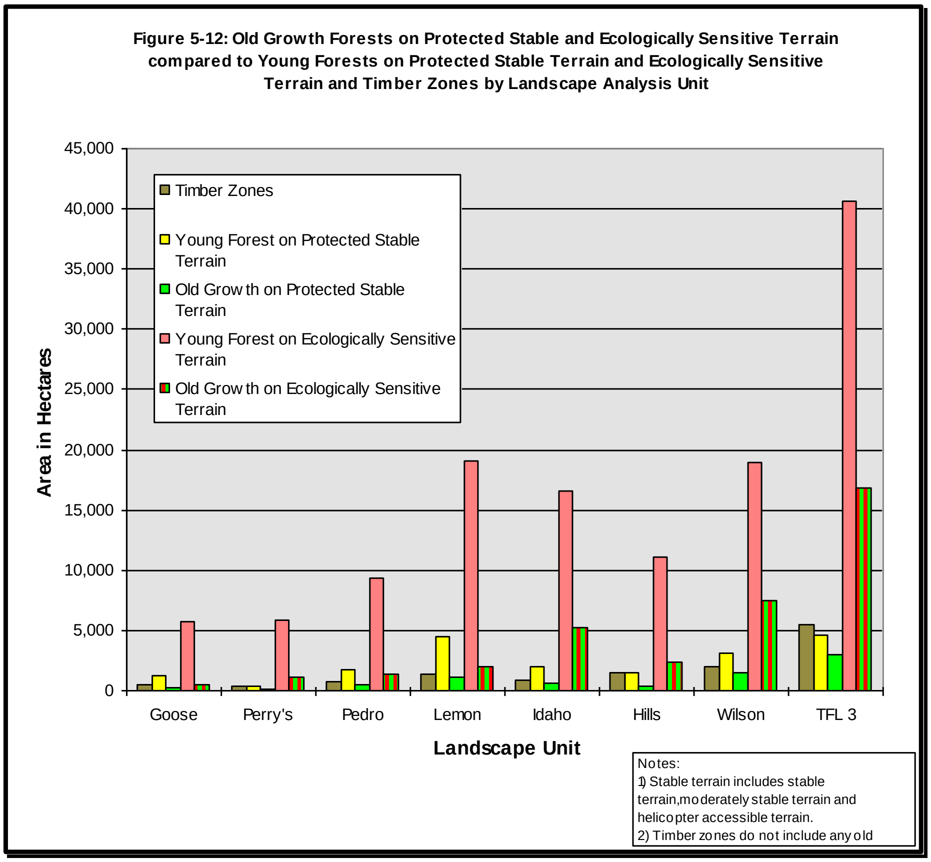


Figure 5- 12: Old Growth Forests Compared to Young Forests on Protected Stable Terrain and Ecologically Sensitive Terrain by Landscape Analysis Unit

Table 5-14: Old Growth Forest and Logged Area by Terrain Class Compared to Total Forest Area by Terrain Class and by Biogeoclimatic Subzone

		Total Forested Area						Logged Area						Remaining Old Growth Forests				
Landscape Analysis Unit	Biogeoclimatic Subzone	On Stable and Moderately Stable Terrain in Timber Zones (ha)	Percent of MS and S Terrain in Timber Zones	On Stable and Moderately Stable Terrain in Protected Landscape Network (ha)	Percent of MS and S Terrain in Protected Landscape Network	On MoF and SFF Ecologically Sensitive Terrain (ha)	Percent of Total Forested Area in ES Terrain	On Stable and Moderately Stable Terrain in Timber Zones (ha)	Percent of MS and S Terrain in Timber Zones which is Logged	On Stable and Moderately Stable Terrain in Protected Landscape Network (ha)	Percent of MS and S Terrain in Protected Landscape Network which is Logged	On MoF and SFF Ecologically Sensitive Terrain (ha)	Percent of ES Terrain which is Logged	On Stable and Moderately Stable Terrain in Protected Landscape Network (ha)	Percent of MS and S Forested Area in Protected Landscape Network which is Old Growth	On MoF and SFF Ecologically Sensitive Terrain (ha)	Percent of ES Forested Area which is Old Growth	**Percentage of Total Forested Area which is Old Growth**
Goose	ATESSFwcp	0	0%	1	1%	60	99%	0	0%	0	0%	0	0%	1	100%	56	94%	**94%**
	ESSFwc4	47	2%	972	45%	1,131	53%	35	75%	252	26%	369	33%	220	23%	281	25%	**23%**
	ICHdw	238	10%	89	4%	1,951	86%	2	1%	0	0%	39	2%	4	4%	22	1%	**1%**
	ICHmw2	173	6%	203	7%	2,618	87%	34	20%	34	17%	476	18%	37	18%	133	5%	**6%**
Sub-total		458	6%	1,265	17%	5,760	77%	71	15%	287	23%	884	15%	261	21%	492	9%	**10%**
Perry's	ESSFwc4	1	0%	133	6%	1,970	94%	0	0%	0	0%	0	0%	100	75%	983	50%	**51%**
	ICHdw	286	11%	142	5%	2,277	84%	25	9%	0	0%	214	9%	18	13%	94	4%	**4%**
	ICHmw2	53	3%	72	4%	1,584	93%	0	0%	0	0%	13	1%	36	50%	96	6%	**8%**
Sub-total		340	5%	346	5%	5,830	89%	25	7%	0	0%	228	4%	154	45%	1,174	20%	**20%**
Pedro	ESSFwc4	0	0%	1	1%	94	99%	0	0%	0	0%	1	1%	1	100%	73	78%	**78%**
	ESSFwc4	9	0%	786	25%	2,326	75%	0	0%	254	32%	200	9%	386	49%	801	34%	**38%**
	ICHdw	614	14%	338	8%	3,317	78%	33	5%	0	0%	121	4%	19	6%	102	3%	**3%**
	ICHmw2	157	4%	584	14%	3,587	83%	5	3%	73	12%	87	2%	106	18%	434	12%	**12%**
Sub-total		780	7%	1,709	14%	9,323	79%	38	5%	327	19%	410	4%	513	30%	1,410	15%	**16%**
Lemon	ATESSFwcp	0	0%	12	1%	1,302	99%	0	0%	1	10%	14	1%	10	81%	611	47%	**47%**
	ESSFwc4	91	1%	3,226	28%	8,098	71%	72	79%	1,291	40%	651	8%	817	25%	2,727	34%	**31%**
	ICHdw	369	14%	339	12%	2,016	74%	89	24%	17	5%	294	15%	157	46%	374	19%	**19%**
	ICHmw2	902	10%	938	10%	7,637	81%	364	40%	168	18%	1,379	18%	132	14%	985	13%	**12%**
Sub-total		1,361	5%	4,515	18%	19,054	76%	525	39%	1,478	33%	2,337	12%	1,115	25%	2,021	11%	**13%**
Idaho	ATESSFwcp	0	0%	3	0%	832	100%	0	0%	0	0%	3	0%	3	100%	710	85%	**85%**
	ESSFwc4	7	0%	728	1%	6,464	99%	0	0%	274	38%	237	4%	365	50%	3,314	51%	**51%**
	ICHdw	380	1%	603	28%	1,514	71%	58	15%	12	2%	115	8%	37	6%	319	21%	**14%**
	ICHmw2	443	14%	616	12%	7,743	74%	29	6%	109	18%	335	4%	160	26%	909	12%	**12%**
Sub-total		830	4%	1,950	10%	16,553	86%	87	10%	395	20%	689	4%	565	29%	5,251	32%	**30%**

Table 5- 14: Old Growth Forest and Logged Area by Terrain Class Compared to Total Forest Area by Terrain Class

Hills	ATESSFwcp	4	1%	0	0%	542	99%	4	100%	0	0%	32	6%	0	0%	404	75%	**74%**
	ESSFwc4	214	1%	248	0%	2,999	99%	157	100%	67	0%	381	6%	116	47%	1,286	43%	**41%**
	ICH mw2	1,266	13%	1,248	12%	7,500	75%	353	28%	158	13%	715	10%	238	19%	657	9%	**9%**
Sub-total		1,485	11%	1,495	11%	11,042	79%	515	35%	225	15%	1,128	10%	354	24%	2,347	21%	**19%**
Wilson	ATESSFwcp	0	0%	3	2%	179	98%	0	0%	0	0%	0	0%	3	100%	127	71%	**72%**
	ESSFwc4	178	2%	857	10%	7,236	87%	105	59%	221	26%	512	7%	539	63%	3,947	55%	**54%**
	ICH mw2	1,773	11%	2,199	14%	11,541	74%	622	35%	750	34%	2,104	18%	958	44%	3,424	30%	**28%**
Sub-total		1,951	8%	3,059	13%	18,955	79%	727	37%	971	32%	2,616	14%	1,501	49%	7,498	40%	**38%**
TFL #3	ATESSFwcp	18	1%	74	2%	3,210	97%	14	78%	10	13%	45	1%	55	74%	2,515	78%	**78%**
	ESSFwc4	1,408	6%	2,594	11%	19,813	83%	703	50%	545	21%	2,024	10%	1,784	69%	10,245	52%	**51%**
	ICH dw	1,339	22%	296	5%	4,341	73%	346	26%	8	3%	537	12%	117	40%	352	8%	**8%**
	ICH mw2	2,695	15%	1,663	9%	13,278	75%	731	27%	278	17%	1,829	14%	1,010	61%	3,743	28%	**27%**
Sub-total		5,461	11%	4,627	9%	40,642	80%	1,795	33%	841	18%	4,434	11%	2,965	64%	16,855	41%	**39%**
TOTAL:		**12,666**	**8%**	**18,966**	**12%**	**127,159**	**80%**	**3,781**	**30%**	**4,522**	**24%**	**12,726**	**10%**	**6,313**	**33%**	**35,027**	**28%**	**26%**

Notes:

1) The class *Stable and Moderately Stable Terrain in Timber Zones* includes forested land on SFF Stable Terrain, SFF Moderately Stable Terrain, and SFF Helicopter Logging Terrain in Wholistic Timber Management Zones and Lower Elevation Consumptive Use Watersheds. The proportion of each zone included in this class varies with terrain type and WFUZ type.

2) The class *Stable and Moderately Stable Terrain in Protected Landscape Network* includes forested land within SFF Cross Valley Corridors, SFF Old Growth Protection Areas, SFF Proposed Protected Areas, SFF Restoration/Timber Zones, and SFF Protected Headwaters Zones.

3) The class *MoF and SFF Ecologically Sensitive Terrain* includes portions of forested land within MoF Inoperable Areas, MoF Low Site Quality and Problem Forest Types, MoF Environmentally Sensitive Class 1 Areas, SFF Alpine Zones, SFF riparian Zones, SFF Steep/Complex Zones, SFF Shallow Soil Zones, SFF Wetland Zones, MoF Environmentally Sensitive Class 2 Areas, and the portions of Ecologically Sensitive Terrain excluded from Wholistic Timber Management Zones and Lower Elevation Consumptive Use Watersheds.

4) Logged Areas include both clearcut and partially cut areas.

5) Old growth includes all stands over 140 years old, plus all cottonwood or lodgepole pine leading species stands over 120 years old.

5.12 Distribution of Past and Planned Logging in the Slocan River Watershed

Using a digital forest inventory database derived by SFF from Ministry of Forests' digital data, from Slocan Forest Products' digital data for TFL #3, and from updating logging to 1994 from 1994 to 1999 Five Year Development Plan maps, the Silva Forest Foundation developed an analysis of past logging through March 1994 and planned logging from 1994 to 1999. The earliest logging dates in the data bases are from the 1950's. We know that logging occurred in the Slocan River watershed before 1950, but the records of early logging have apparently been lost. All references to logged area in this report therefore refer to logging between approximately 1950 and March 1994.

This analysis shows that 24,847 hectares have been logged in the Slocan River watershed. In addition, 3,917 hectares of logging, virtually all clearcutting, is planned for between 1994 and 1999. Table 5-15 summarizes this information.

The three-dimensional bar chart in Figure 5-13 shows the distribution of past and planned logging on Crown land in the Slocan River watershed by three general land categories:

- MoF environmentally sensitive land (all of this land is classed as ecologically sensitive by SFF)
- MoF timber land base/SFF ecologically sensitive land
- SFF stable, moderately stable, and helicopter-accessible land

The first two land types listed above are both SFF ecologically sensitive land types. Over 50 percent of the land logged to date in the Slocan River watershed is ecologically sensitive according to the Silva Forest Foundation. The logging of SFF ecologically sensitive land is planned to increase, with over 60 percent of planned logging on SFF ecologically sensitive land. Clearly, logging substantial and increasing amounts of ecologically sensitive forest lands represents a non-sustainable cut. This not only degrades future timber productivity on these lands, but also degrades non-timber forest values on, adjacent to, and downstream from these logged ecologically sensitive forests.

Figure 5-14 is a pie chart illustrating the distribution of existing logging by landscape unit in the Slocan River watershed. The three landscape analysis units that have been the most heavily impacted by logging are TFL #3 (32% of existing logging), Lemon (20% of existing logging), and Wilson (20% of existing logging). Goose, Perry's, Pedro, and Hills landscape analysis units have been lightly logged to this point. These four landscape analysis units contain large numbers of consumptive use watersheds. For more than 15 years, water user groups have opposed logging, particularly clearcutting, in consumptive use watersheds of the Slocan Valley.

Figure 5-15 is a pie chart showing the distribution of planned logging between 1994 and 1999 in the Slocan River watershed. Extensive cutting continues to be planned in TFL #3 (36% of the planned logging 1994-1999). Lemon and Wilson also are scheduled for heavy cutting, with 20% and 11% respectively of the planned logging from 1994 to 1999. Some logging is planned for the Perry's landscape analysis unit, but is not shown in Figure 5-15 because this area is within the Small Business Enterprise Program and development plan maps for 1994 to 1999 showed no logging. However, 1996 development plans indicate logging in the Perry's landscape analysis unit. SFF recommends that annual updates of existing and planned logging be performed to keep this ecosystem-based landscape plan for the Slocan River watershed up to date.

Slocan Valley Ecosystem Based Plan

Table 5-15: Past and Planned Logging by General Land Category

General Land Category	Existing Logging as of March (ha)	% of Total Area Logged	Planned Logging for 1994 to (ha)	% of Total Area Planned
MoF Environmentally Sensitive	3,682	15%	1,302	33%
MoF Timber Landbase / SFF Ecologically Sensitive	8,207	33%	1,101	28%
SFF Stable, Moderately Stable and Helicopter Accessible	11,177	45%	1,515	39%
Private Land:	1,780	7%	N/A	N/A
Total Area Logged as of March 1994:	24,847	100%	3,917	100%

Notes:
(1) Existing logging per MoF Forest Cover Maps, updated to 1994 from 1994 to 1999 Five Year Development Plan Maps.
(2) Planned Logging per Five Year Development Plan maps for 1994 to 1999.
(3) *MoF Environmentally Sensitive* includes the MoF classes: ESA 1 Terrain, Low Site Quality, Inoperable Areas, Non Commercial Cover, Non Productive Site, an Non Forest Area.
(4) *MoF Timber Landbase / SFF Ecologically Sensitive* includes MoF ESA 2 Terrain, SFF Steep, Complex and Shallow Soil Ecologically Sensitive Sites, SFF Riparian Ecosystems and Wet Sites, and SFF Upper Slope Sites.
(5) *SFF Stable, Moderately Stable and Helicopter Accessible* includes the identified SFF land classes, regardless of Wholistic Forest Use Zone designation. Much of the logging in this category has occurred or is planned for areas which we have zoned for protection of watersheds, biodiversity, or other reasons.

Table 5- 15: Past and Planned Logging by General Land Category

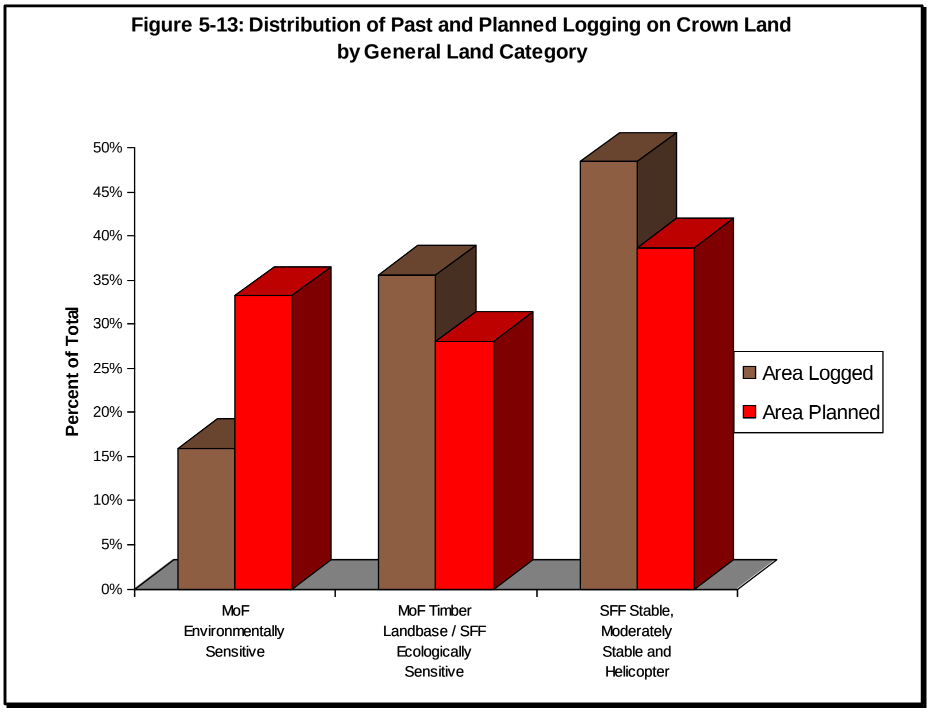
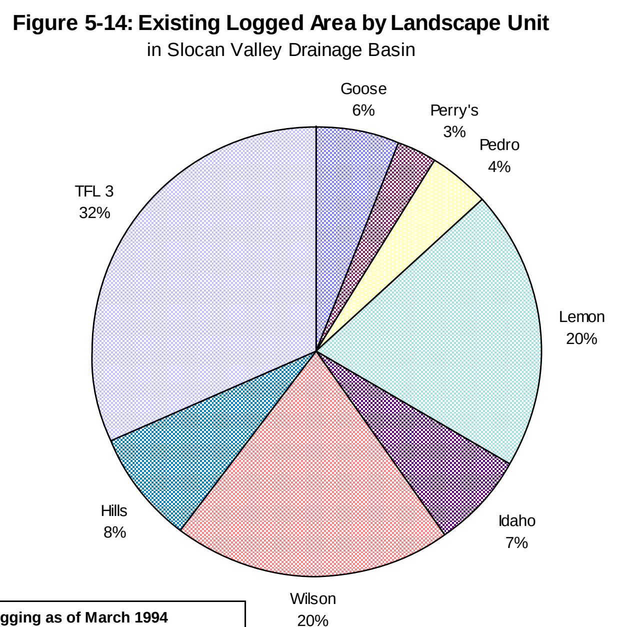


Figure 5- 13: Distribution of Past and Planned Logging on Crown Land by General Land Category



Existing Logging as of March 1994

MoF ESA Land:	3,682
MoF Timber Landbase / SFF ES Land:	8,207
SFF Stable, Mod. Stable and Heli Terrain:	11,177
Private Land:	1,780
Total Area Logged as of March 1994:	24,847

Figure 5- 14: Existing Logged Area by Landscape Unit

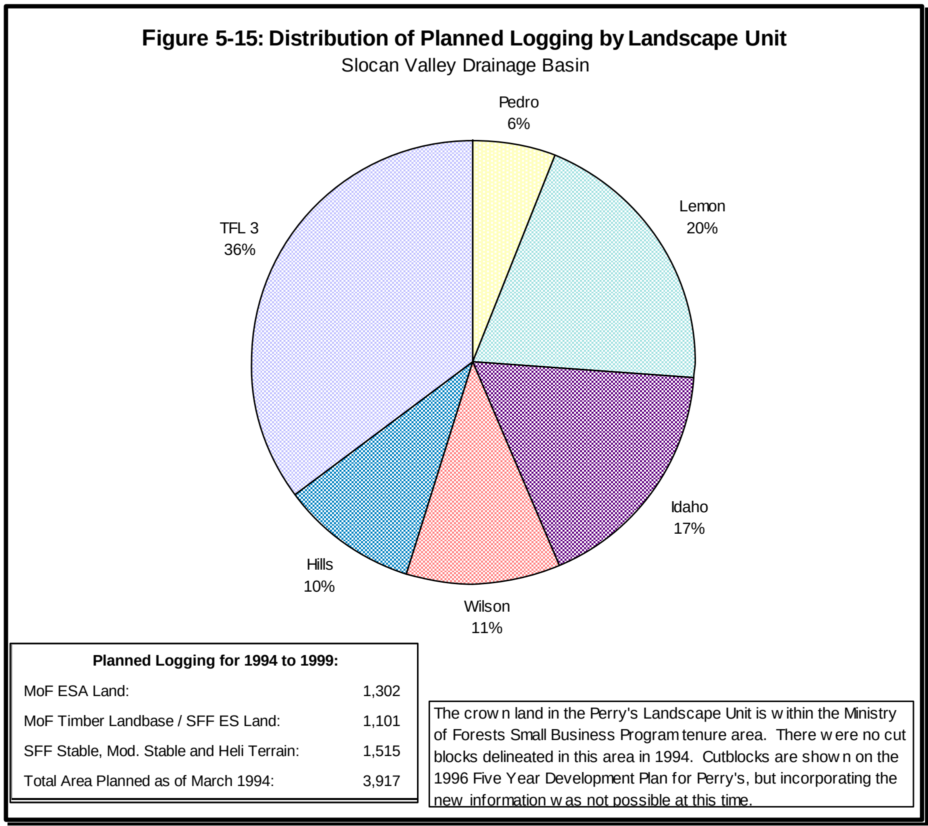


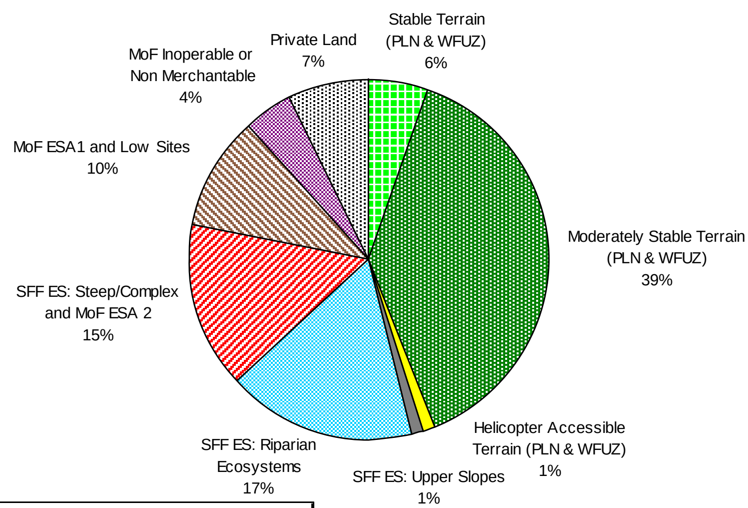
Figure 5- 15: Distribution of Planned Logging by Landscape Unit

The pie chart in Figure 5-16 shows the distribution by category of land of existing logging within the entire Slocan River watershed. Approximately 32 percent of past logging has occurred on steep/complex slopes (15%) and in riparian ecosystems (17%). As well, 10% of Ministry of Forests environmentally sensitive sites have also been logged.

Figure 5-17 shows the trend towards logging ecologically/environmentally sensitive (per MoF) sites to be continuing. Between 1994 and 1999, 21% of the planned logging will be on SFF steep/complex terrain, and 18% of the logging will be on MoF high environmentally sensitive sites (also SFF ecologically sensitive sites). Once again, increased logging of ecologically sensitive sites is symptomatic of a non-sustainable timber cutting rate.

Figure 5-16: Distribution of Existing Logging by Land Category

Slocan River Drainage Basin



Existing Logging as of March 1994	
MoF ESA Land:	3,682
MoF Timber Landbase / SFF ES Land:	8,207
SFF Stable, Mod. Stable and Heli Terrain:	11,177
Private Land:	1,780
Total Area Logged as of March 1994:	24,847

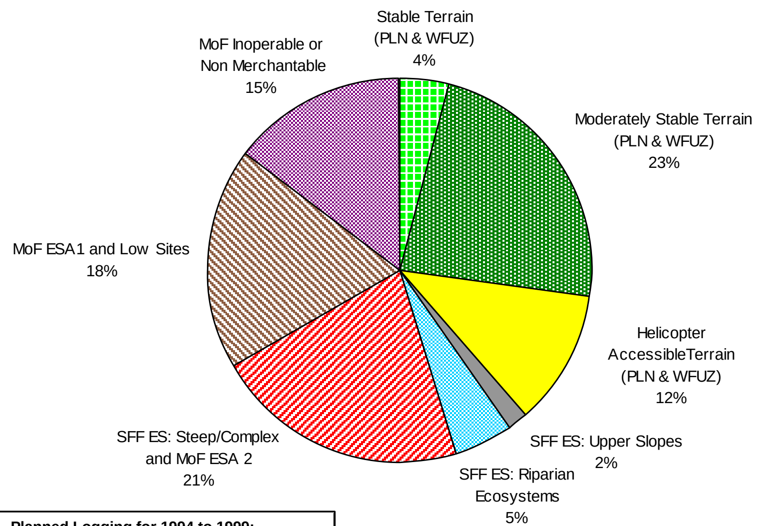
SFF Potential Timber Landbase

Stable Terrain, Moderately Stable Terrain, and Helicopter Accessible Terrain

	Total Area (ha)	Logged Area (ha)	Percent of Total Logged
Gross Area:	35,794	11,177	31%
In Wholistic Timber Zones:	9,351	3,659	39%

Figure 5-16: Distribution by Land Category of Existing Logging

Figure 5-17: Distribution by Land Category of Planned Logging
Slocan River Drainage Basin



Planned Logging for 1994 to 1999:	
MoF ESA Land:	1,302
MoF Timber Landbase / SFF ES Land:	1,101
SFF Stable, Mod. Stable and Heli Terrain:	1,515
Total Area Planned as of March 1994:	3,917

SFF Potential Timber Landbase
Stable Terrain, Moderately Stable Terrain, and Helicopter Accessible Terrain

	Total Area (ha)	Logged Area (ha)	Percent of Total Logged	Planned Logging (ha)	Percent of Total Planned / Logged
Gross Area:	35,794	11,177	31%	1,515	35%
In Wholistic Timber Zones:	9,351	3,659	39%	443	44%

Figure 5-17: Distribution by Land Category of Planned Logging

5.13 Restoration

Sections 6.1.1.3 and 6.2.1.4 of the *Emerging and Proposed Economy* describe in some detail the need for restoration of forests degraded by past road construction and clearcutting in the Slocan River landscape. These sections not only describe the principles of forest restoration, but also provide information about specific kinds of forest restoration that will be necessary on logged areas in the Slocan River watershed.

A significant portion of the land degraded by past logging has been placed in a wholistic forest use zone entitled, “Restoration—Future Timber Zones.” These areas require prompt restoration because they are scheduled to be part of the SFF Ecologically Sustainable AAC in future years. As well, the wholistic forest use zone of “Restore—Future Protection” consists of clearcut areas on ecologically sensitive sites. Restoring these areas is a high priority in order to reduce ongoing ecological degradation within the Slocan River watershed.

Table 5-16 provides a summary of ecological restoration cost and employment estimates by restoration task for landscape analysis units in the Slocan River watershed. This table indicates that 20,758 clearcut hectares require restoration. This area does not include logging on private land (1,780 ha) or partial cutting (2,309 ha), and therefore the total area to be restored is less than the 24,847 ha of logging shown in Table 5-15. Hence, the restoration costs and employment estimates in Table 5-16 are conservative. Indeed, until an active program of forest restoration is put in place in the Slocan River watershed, restoration costs and employment requirements will grow in proportion to the area clearcut annually in the Slocan River watershed.

Table 5-16 indicates that, for clearcut logging through 1991, more than $194 million are necessary to carry out forest restoration. This restoration is estimated to require 1,390 person years of employment (assuming 100 days per year for restoration work) or, to put this in perspective, the restoration described in Table 5-16 would require 24 people (four 6-person crews) 58 years to complete. This is a conservative estimate because the person days per hectare to carry out restoration activities used in Table 5-16 are conservative.

The Silva Forest Foundation has developed a detailed methodology for estimating the time and costs required for restoration. When this methodology is edited and in a publishable form, it will be available as an addendum to this ecosystem-based plan.

The costs of forest restoration in the Slocan River watershed due to overcutting and past/ongoing clearcutting are extremely high and growing. However, if future generations are to have options, this restoration must be funded and carried out as soon as possible. Funding for this restoration should come from not only Forest Renewal BC, but also from Slocan Forest Products and other timber companies that are responsible for the degraded state of forests in the Slocan River watershed.

When considering the enormous task of restoring degraded forests in the Slocan Valley, remember the words of Paul Hawken (1994):

> *But sooner or later we must recognize that despite the protestations of industry, it is completely lacking in ecological principles, and that what is good for business is almost always bad for nature.*

Hawken also indicates that restoration costs should be the responsibility of the individual or organization that profits from resource exploitation. In the case of the Slocan River watershed, the organization responsible for restoration costs is Slocan Forest Products.

Table 5-16: Summary of Ecological Restoration Cost and Employment Estimates by Restoration Task for Landscape Analysis Units in Slocan River Watershed

Landscape Analysis Unit	Area Clearcut (ha)	Restoration Activity: Rip Trails and Landings	Re-Contour Roads and Trails	Re-Vegetate Disturbed Sites	Add Coarse Woody Debris to Site	Add Standing Snags to Site	TOTAL
Goose	1,319	$154,128	$770,640	$2,022,930	$4,856,910	$1,997,003	$9,801,611
Perrys	39	$3,964	$19,820	$52,028	$161,978	$59,207	$296,996
Pedro	676	$77,104	$385,520	$1,011,990	$2,915,768	$1,192,597	$5,582,978
Lemon	4,398	$462,748	$2,313,740	$6,073,568	$25,088,314	$8,234,542	$42,172,911
Idaho	1,022	$105,752	$528,760	$1,387,995	$6,363,439	$1,826,552	$10,212,497
Hills	1,481	$142,396	$711,980	$1,868,948	$8,370,821	$2,498,178	$13,592,323
Wilson	4,218	$403,024	$2,015,120	$5,289,690	$28,462,414	$7,336,591	$43,506,839
TFL 3	7,604	$654,332	$3,271,660	$8,588,108	$43,784,209	$12,691,136	$68,989,444
Total Estimated Restoration Costs		**$2,003,448**	**$10,017,240**	**$26,295,255**	**$120,003,851**	**$35,835,804**	**$194,155,598**
Area to be Treated (ha)		2,504	2,504	3,756	6,957	12,148	27,870
Employment per Hectare (ha/person day)		0.5	0.2	0.1	0.3	0.2	n/a
Total Employment (person days)		**5,009**	**12,522**	**37,565**	**23,189**	**60,739**	**139,023**

Assuming that there are 100 days per year in the restoration work season, there are 1,390 person years of restoration work as a result of clearcut logging through 1994.

If 24 people (4 crews of 6 people) work on restoration, restoration work will take 58 years to complete.

Notes:
(1) The person days per hectare to carry out restoration activities are conservative, because multiple processes; like hauling logs for snags and coarse w oody debris, and grow ing large seedlings for regeneration; are not considered in time estimates.
(2) SFF has developed a methodology for estimating the time required for and costs of restoration. When this methodology is edited and in a publishable form, it w ill be available as an addendum to this plan.

Table 5- 16: Summary of Ecological Restoration Cost and Employment Estimates by Restoration Task for Landscape Analysis Units in Slocan River Watershed

6. THE EMERGING AND PROPOSED ECONOMY

In 1975, a group of Slocan Valley residents produced the *Slocan Valley Community Forest Management Project Final Report*. This far-sighted analysis states,

> *We began, and we finish, on the premise that good ecology is good economics.*

Twenty years later, the emerging field of ecological economics echoes this common sense approach in a flood of technical papers and publications (Costanza 1991, Hawken 1994). SFF's ecosystem-based plan is an effort to further define how the Slocan Valley can create and maintain a viable economy within the valley's ecological limits—an ecosystem-based economy. In doing so, the community will need to ask itself questions like: "What kind of activities will protect the forest and, in turn, sustain us? What can we do now to get there?"

Economics often seems a mysterious field to many. It may be helpful to remember that economies just mean people relating to people. Therefore, anything that is both physically possible and socially desirable is economical. Nozick (1992) suggests a different way of thinking about economics:

> *Rather than seeing wealth as created by mass output of centralized industries, we need to see that wealth is generated by the thousands of economic exchanges which occur within a community and focus on increasing these local exchanges.*

It is widely recognized that current timber extraction rates and methods have not operated within ecological limits and that a change in the economy, particularly in resource extraction industries, is inevitable (CORE 1994, Slocan Valley Final Report 1976, Vancouver Sun March 17, 1995). In cutting trees at a nonsustainable rate over the past number of years, we have foolishly been depleting the natural capital instead of learning to live off the interest. While learning to live within ecological limits means a change in the kinds of jobs available, it need not mean a reduction in the number of jobs, or in the quality of life.

One rationalization for continuing non-sustainable resource extraction activities is that we must be competitive in the global marketplace and that current ways of doing business are required in order to survive. Rural people often feel that they have no control over the roller coaster nature of the global economy. To a large extent globalization is perpetuated by interests external to local communities in order to control local people and resources. The global economy thrives by degrading both local economies and local ecosystems.

However, there is another option: diverse, ecologically responsible local economies that build sustainable regional and global economies from the ground up. British Columbia in general and the Slocan Valley in particular have quality and scarcity on their side. From the quality of the natural environment to the quality of the wood in remaining natural forests, these resources do not exist in most of the rest of the world.

There is much that can be done to strengthen the local economy and to make it resilient to the whims of the global economy. This doesn't mean that all industries competing in the global marketplace are banned from rural areas, but rather that by developing a diverse, sustainable local economy, rural areas are less susceptible to the inevitable downturns of more global industries. When thinking about the economy of the Slocan Valley, one may also want to keep in mind the words of Paul Hawken (1994):

> *But sooner or later we must recognize that despite the protestations of industry, it is completely lacking in ecological principles, and that what is good for business is almost always bad for nature.*

Hawken goes on to point out that if we place both the responsibility and the cost of mitigation of potential problems or restoration of damaged ecosystems with the originator of the problem, industry then has tremendous incentive to redesign their businesses and processes so that ecosystems are not damaged. Hawken warns that companies must be strongly encouraged to make significant changes:

> *Without effective means of cost internalization—green taxes or their counterpart—companies are required to focus as much of their attention on the manipulation of money as on the production of goods and services. Either way, the sheer size of the largest corporations tends to grant them the political and economic power to externalize costs that should be properly be absorbed by the company and therefore be factored into the price it sets for its product. For example, when a forest products company buys logging rights at pennies to the dollar and then clear-cuts the area, leaving it degraded for the next hundred years, the 'profit' from the sale of the wood goes to the corporation, but the loss of habitat and biodiversity is borne by society.*

In his book, *The Economic Pursuit of Quality*, economist Thomas Power explains the limitations of standard economic analysis and points out the importance of including values that are traditionally not considered when determining the economic status of an area. Economists determine the "base" for an area, which means the industries that provide export products. These "base case" industries are assumed to be the underpinnings of the economy. Power says that this focus on the base:

> *...suggests that local economic well-being is tied to the dollar volume of exports—that an area's wealth is enhanced by scraping and clawing at the earth to obtain valuable resources, which are then fashioned into some usable form with the sweat of the local population and sent away for others to enjoy. The opposite is closer to the truth: its ability to obtain from others those things it cannot easily produce. Local production and imports, not exports, determine how well off a community can be.*

Power goes on to state that the more self-sufficient an area is, the less it must rely on externally produced goods and services. As we look at the emerging economy and propose a future economy for the Slocan Valley, we will bear in mind Power's definition of the real economic base of a local economy:

> *The real economic base of a local area consists of all those things that make it an attractive place to live, work, or do business. That means the economic base includes the quality of the natural environment, the richness of the local culture, the security and stability of the community, the quality of the public services and the public-works infrastructure, and the quality of the workforce. None of these are things produced by the commercial economy or produced for export. They are provided for outside the commercial economy. Yet they are the local area's economic base. Protecting the natural, cultural, and human-made environment is most certainly productive economic activity.*

The ability to develop an increasingly diverse economy in the Slocan Valley depends upon maintaining the natural characteristics of the area. Repeatedly residents of the Slocan Valley have indicated that maintaining the beauty and integrity of their natural surroundings is of critical importance. Thomas Power has studied the economy of places where traditional resource extraction industries are no longer the dominant contributor to the economy, and where the area is noted for the quality of its natural surroundings. His studies show that the economy of these areas is far more stable and diverse than the previous boom and bust cycles of resource extraction. He concludes that quality of life and natural surroundings are important to people and that people are often willing to accept lower wages and fewer services in order to maintain their quality of life and to remain in an area.

Power's findings are substantiated in the example of Nelson, British Columbia. By the mid 1980s Nelson was reeling from the closure of its university, sawmill and plywood plant, and the downsizing of government services. Many proclaimed that Nelson was a dying town. However, in 1996 Nelson is a growing, vibrant town with a diverse economy that includes light manufacturing, electronics, a Japanese college, and many new retail businesses and services. The reason for Nelson's healthy state is in large part due to its beautiful location on Kootenay Lake amidst the mountains of the West Kootenay (Copeland 1994).

Retaining as much capital as possible within the community will also strengthen the local economy. As illustrated in Section 6.1, the emerging economic trends are small, locally based enterprises that are likely to do most or all of their purchasing locally and whose profits are more likely to stay within the community. The extensive profits currently being made in the timber industry are primarily exported to the company's headquarters and shareholders. Participants in a June 1994 seminar in Winnipeg (Pollock Shea 1994) on opportunities for employment and sustainable development in Canada discussed how to create stronger local economies:

> *Adding economic value to raw materials, more efficiently using resources produced elsewhere, and substituting local products for imported ones allows communities to expand employment opportunities and reap the multiplier effects of recirculating funds. Many forestry, fishery, and agricultural commodities are shipped to distant markets with little or no local processing.*

The mapping analysis in this project has defined the ecological limits for economic planning in the Slocan Valley by proposing a protected landscape network and zoning. This part of the report looks at emerging economic trends (Section 6.1) and at ecological limits to human activities in order to propose a sustainable ecosystem-based economy (Section 6.2). Keep in mind the words of Paul Hawken and Thomas Power when thinking about the current and future Slocan Valley economy.

This ecosystem-based landscape plan does not provide precise details, including employment levels, for an ecosystem-based economy. However, it does describe the types of economic activities and general employment requirements that would occur in the Slocan Valley with the implementation of ecologically responsible activities. In the case of the timber and wood products sectors, we have determined that employment losses from a significant reduction in the annual allowable cut (AAC) can be made up by replacing clearcutting with ecologically responsible partial cutting, and by implementing more value-added wood products manufacturing. Further practical planning is a high priority to provide the details necessary to fully implement a diverse, sustainable ecosystem-based economy.

6.1 The Emerging Economy

Current trends within the West Kootenay region and within the Slocan Valley indicate that changes and economic diversification are already taking place. These trends have been documented in several recent studies (Copeland 1995, CORE 1994, Gower 1989, Holman 1994). In addition, the population of the entire West Kootenay area is projected to increase steadily for the foreseeable future, in part due to the diverse economy of the region (BC Central Statistics Branch). This population increase is, in large part, due to the current high quality environment that exists in this area.

The traditional dependence on timber extraction and mining activities in the Slocan Valley is decreasing, while economic initiatives in tourism, home-based businesses, service businesses, organic agriculture, and wildcrafting are increasing. Timber-based activities can be expected to continue as an important part of the economy, but the nature of this industry will need to change significantly. The primary timber operator in the Slocan Valley has built an industrially efficient sawmill that employs fewer people, but processes more wood than in the past. Like other mills in the Kootenays, Slocan Forest Products is capable of processing more wood than is available, even with current levels of timber cutting (CORE 1994, Ministry of Forests 1995). Slocan Forest Products cannot cut enough timber from its forest licences and tree farm licence to keep its Slocan mill running at capacity. In 1994, the Slocan Division obtained 42 percent of the mill's wood from private sources (Kootenay Express 1995).

In addition, decreases in the allowable annual cut are expected due to implementation of the Forest Practices Code (FPC), and increasing pressure (both social and economic) for non-timber forest uses. Since the FPC, if applied to its full extent, and public pressure for more balanced forest use will reduce the amount of timber available, now is the time to go one step further and base the amount of timber cut and the way it is cut on ecological limits. Protecting forests through this step will not only maintain and, where necessary, restore fully functioning forests, but also will encourage continued diversification within the economy.

6.1.1 The Timber Industry

Overcutting of timber in the Slocan Valley was recognized twenty years ago in the Slocan Valley Final Report (1976):

> *Ever more efficient technology and the demands of a world market have placed us, as forest users, in a much more significant and perilous position than before. We find that, unless we create and enforce guidelines based on Nature's ability to regenerate, we now have the capability to destroy both our forests and the Slocan Valley community it supports in a relatively short period of time.*

Unfortunately, the warning of twenty years ago was not heeded and today there are fewer options available within the Slocan Valley. In 1993, Slocan Forest Products (SFP) reduced its allowable annual cut in Tree Farm Licence #3 (TFL 3) by nearly 50 percent, from 108,000 m^3 to 65,000 m^3, because adequate the timber volumes simply do not exist (SFP 1993). In theory, the previous allowable annual cut was to be sustainable in perpetuity. With the reduction in the cut for Tree Farm Licence #3, additional pressure is placed on timber remaining on the valley walls and in sensitive domestic watersheds and viewscapes.

Slocan Forest Products (SFP) and the Ministry of Forests have institutionalized forest degradation in both TFL 3 and Forest Licence A20192. SFP commits to logging 25% of its AAC on steep slopes (greater than 50%) in TFL 3 (SFP 1993). In Forest Licence A20192, "at least 33% of the AAC will be harvested from areas designated as steep slopes as approved by the District Manager" (SFP 1995). These requirements to log on ecologically sensitive slopes reflect the past highgrading of the best, most easily accessed timber, and are symptomatic of a nonsustainable cutting rate. As SFP attempts to log steeper, more sensitive, and more visible areas, there will be mounting public pressure to further reduce their cut to protect water, visual aesthetics, tourism, wildcrafting, home-based businesses, and the ecological integrity of the Slocan Valley.

The state of Oregon provides an interesting case study regarding reductions in the amount of logging permitted and the associated loss of jobs. Oregon has a population similar in size to British Columbia and has been historically heavily dependent upon the timber industry. When the Endangered Species Act was invoked to protect the spotted owl and prevented further cutting in Oregon's old growth forests, financial disaster for the state was predicted. However, three years after cutting was substantially reduced, the state has posted its lowest unemployment rate (5%) in more than 15 years. The unemployment rate never tops 7.8% and in many towns it is less than 2%. A 5% unemployment rate is considered by economists to represent full employment (Egan 1994).

The forest sector in Oregon lost 15,000 jobs over the three year period from about 1988 to 1991, when the spotted owl decision was implemented. But, during the same period

100,000 new jobs were created in the state, 20,000 of them in high tech companies. The state provided an excellent retraining program that placed 90% of those trained in jobs paying an average hourly wage of only about $1 less than their previous positions in the forests or mills. The reality in Oregon is far different than the gloomy predictions of 100,000 former forest workers flipping hamburgers. Instead, the retrained workers are entering fields like auto mechanics, accounting, cabinet making, and health care. The success of the retraining program is attributed to giving those provided with retraining the power to decide what they wanted to do and where they wanted to receive training, rather than imposing specific retraining on everyone.

Mayor Bill Morisette of Springfield, historically a timber industry town, said, “Owls versus jobs was just plain false. What we’ve got here is quality of life. And as long as we don’t screw that up, we’ll always be able to attract people and business” (Egan 1994).

The Slocan Valley now has a choice:

- continue to cut timber using conventional clearcutting and high timber cutting rates, while degrading forest functioning, further depleting the amount of future timber available, and negatively impacting non-timber forest values, **or**
- learn to operate in ecologically responsible ways within ecological limits, knowing that the amount of timber cut each year is truly sustainable and has a minimum impact on non-timber forest values and other kinds of economic activity.

Choosing to operate within ecological limits will mean changes in how we cut and process timber, but many of these changes are already taking place.

Direct employment by Slocan Forest Products has declined significantly over the past number of years, primarily due to automation of milling processes. During the period of 1977-1981, the Slocan Division employed an average of 425 people in logging and milling to process an average of 372,000 m^3 of wood per year. In 1993, the Slocan Division provided direct jobs for about 316 workers and processed about 424,000 m^3 of wood per year. The number of jobs per 1,000 m^3 of timber has declined from 1.14 in 1981 to 0.75 in 1993 (Copeland 1995).

Economists attribute a certain number of indirect jobs in service and other industries to major industries like Slocan Forest Products. Horne (1994), in calculating potential job losses at Slocan Forest Products, used a multiplier of 1.38 jobs. This means that for every 100 direct jobs lost, an additional 38 indirect jobs may be expected to be lost. If the Slocan Division currently provides 316 direct jobs, then using the 1.38 multiplier, we can estimate that the total number of jobs attributable to the timber industry in the Slocan Valley is 436 jobs (316 jobs X 1.38). Copeland (1995) uses census statistics to show that the total number of people employed in the Slocan Valley in 1991 was 2,014. Based upon this total employment, Slocan Forest Products would then be contributing 21% of the jobs (both direct and indirect) in the Slocan Valley. However, a number of the people employed by Slocan Forest Products do not live in the Slocan Valley and are therefore not represented by the census statistics. This discrepancy is likely offset by the number of workers included in the census data as living in the Slocan Valley, but who are actually employed outside the valley.

While SFP is responsible for about 20% of the direct and indirect jobs in the Slocan Valley, the impacts of these jobs affect virtually 100% of the landbase. The majority of the forest is a "timber supply," held by Slocan Forest Products under long-term tenure arrangements (a tree farm licence and a forest licence) with the government. The fragmentation caused by SFP's clearcutting threatens wildlife populations, even those in Valhalla Park, White Grizzly Park, and Kokanee Park. Their aggressive clearcut approach to forestry, coupled with nonsustainable cutting rates, put consumptive use watersheds at risk and threaten to foreclose on growing non-timber, forest-based businesses. Perhaps a more balanced approach to forest use in the Slocan Valley, and consistent with supplying about 20% of the jobs, would be to lease SFP about 20% of the landbase and require them to practice ecologically responsible timber management.

In 1994 Slocan Forest Products made $97 million in profit from all of its divisions. The profit figures for the Slocan Division are not known.

6.1.1.1 Ecologically Responsible Timber Management

Most of the easily accessed, high quality timber outside the main valley walls has already been cut. The remaining timber that SFF's analysis has zoned as appropriate for cutting is found in areas where non-timber forest values can conflict with timber management. Using less intrusive, ecologically responsible partial cutting methods is required to protect biodiversity and meet the needs of other forest users. Ecologically responsible means activities that protect and maintain fully functioning forests at all scales through time. This is achieved through maintaining forest composition and structures such as large living trees, large snags (standing dead trees), and large fallen trees on all logged areas. Appendix 5 provides more detailed principles and standards for ecologically responsible timber management.

Partial cutting requires smaller, more ecosystem-sensitive machinery and is more labour-intensive than clearcutting. Thus, more workers are employed cutting less wood with partial cutting methods (Hammond 1991, M'Gonigle and Parfitt 1994). Jim Smith, Small Business Program forester with the Ministry of Forests in Vernon, has implemented a variety of partial cutting systems through small business sales in forest ecosystem types similar to those in the Slocan Valley. Smith's work has shown that these methods are both ecologically and economically sound: "I think we've proven beyond a shadow of a doubt that you can do these alternate silvicultural [logging] systems and make money" (Jim Smith, as quoted by M'Gonigle and Parfitt 1994). When partial cutting is combined with open log markets (see Section 6.2), the opportunities for profit and employment increase even more.

Clearcutting produces about one-half job for every 1000 m^3 of timber that is logged. Conservatively, about one additional job per 1000 m^3 is created through ecologically responsible partial cutting instead of clearcutting. Additional employment associated with partial cutting includes jobs associated with planning, designing, and carrying out logging, and with pruning and thinning to improve timber quality. Depending upon the logging system used and the type of forest in question, more than one additional job can be created per 1000 m^3 of timber cut.

Partial cutting is well suited to the ecology of Slocan Valley forests, but has been restricted in the past because clearcutting appears to maximize short-term profits from logging. However, when companies determine the economics of clearcutting, they do not have to consider the costs of restoring degraded water, soil, and ecosystem functioning; of damage to non-timber forest values; and many of the costs of regenerating trees. When all of these costs are considered, clearcutting is a more costly choice than partial cutting (see Section 6.2.1.1 for more details). Timber companies do not consider these costs when comparing clearcutting and partial cutting because they are not held accountable for these costs. These costs are borne by non-timber interests, by taxpayers, and by future generations.

While regeneration costs are "out-of-pocket" costs for timber companies, a significant portion of some regeneration costs are indirectly covered by government, through an allowance for regeneration costs that is deducted from timber cutting fees (i.e. stumpage) paid to the government. In other words, a portion of regeneration costs are covered through artificially low stumpage fees. Forest Renewal B.C. (FRBC), established in 1995 to improve management of forests in B.C., is funded by increased timber cutting fees for timber companies. However, much of FRBC money is returned to timber companies to fix problems caused by clearcutting in order to plant and grow short-term timber crops. Thus, nonsustainable timber industry practices are supported by subsidies from timber cutting revenues.

Slocan Forest Products has been working towards setting up an alternate harvesting crew to log in what it calls contentious areas. According to the Nelson Daily News (March 17, 1995), Slocan Forest Products has been awarded $83,000 under the Forest Renewal Plan to further develop its alternate harvesting crew. In order to be effective in the emerging economy, this crew needs to be trained to perform ecologically responsible logging so that the company has a true model of alternatives to clearcutting. The company needs to expand the amount of training provided to woods workers and to convert all of its operations to ecologically responsible partial cutting. This is a reasonable public expectation since significant monies from public revenues (i.e. Forest Renewal B.C.) are being spent by Slocan Forest Products to train their personnel and to restore areas damaged by SFP's road building and clearcutting.

6.1.1.2 Value-added Wood Products

The Winnipeg seminar on Employment and Sustainable Development stated:

> *Exporting wood with little or no processing essentially exports Canadian jobs. With most of Canada's wood harvest going to sawmills and pulp plants, many employment-generating opportunities are missed. Adding value to the resource starts in the forest with careful harvesting and proper sorting of high-value species.* (Pollock-Shea 1994)

Adding value to wood before it leaves the region creates more jobs from less wood cut. In British Columbia the timber industry creates less than 1 job for every 1,000 m^3 of timber cut (about 0.5 job in logging and 0.5 job in milling), while in Switzerland, where value-added industries are highly developed, there are 11 jobs for each 1,000 m^3 of wood. The Select Standing Committee on Forests, Energy, Mines and Petroleum Resources (1993) found that an average of 4.5 additional jobs could be created in value-added industries from the amount of wood required to create one sawmilling job (about 2,000 m^3). This average represents a range from 1.7 additional jobs in remanufacturing industries to 25 additional jobs in millwork industries.

If we created an average of 4.5 additional jobs in value-added wood manufacturing for each existing sawmill job, we would be able to significantly reduce the current timber cutting rate and still employ the same number of people as today in timber production and wood products manufacturing. This approach not only provides for timber interests, but also protects the growing non-timber aspects of the economy.

Prior to 1970, a variety of value-added wood products were made in the Slocan Valley. Between 1970 and the early 1990s, little value-added industry has taken place in the Slocan Valley and the vast majority of lumber is exported from the region as construction lumber (Slocan Valley Final Plan 1976, Slocan Forest Products 1995). Much of this material is of high quality and is well suited to value-added manufacturing. In fact, a portion of these lumber exports are remanufactured in the United States and exported back to Canada. The current British Columbia government encourages the development of value-added wood products industries as an important means of providing a transition from current overcutting to a more sustainable timber industry.

With the concentration and centralization of the control of land and resources in long-term forest tenures, usually held by large timber companies owned outside of local areas, community economies in British Columbia and Canada have become like a leaky bucket. A lot of money passes through communities to generate raw materials and to import goods and services. However, little money circulates within communities for locally produced goods and services. Adding more value to wood before it leaves the area plugs some of the holes in the leaky bucket and means that more money circulates in the community through the purchase of local goods and services.

Slocan Forest Products is an example of a timber company owned outside of the local area. SFP exports unfinished wood products to other regions (primarily the United States) to be manufactured into finished, value-added wood products.

Copeland (1995) has identified a number of value-added initiatives currently taking place within the Slocan Valley.

> ***Goose Creek Lumber*** in South Slocan produces window and door components. Lumber is purchased from Slocan Forest Products and Pope & Talbot. The remanufactured products are then marketed outside Canada by the primary manufacturing companies. The company employs 30 workers.

> ***Perry Ridge Panel*** in Winlaw manufactures cedar, fir/larch, and birch siding, paneling and flooring. The company also assembles lattice panels and railing sections. Products are marketed within the region to contractors and end users. Owner Phil Kabatoff employs one other person.
>
> ***Stanley Woodcrafts*** near Summit Lake uses waste wood, mostly cedar and pine, from nearby sawmills in Nakusp to manufacture garden supplies such as window boxes, flower pots, vegetable tubs, rose fans, cedar boxes, lawn chairs, and coat racks. Maggi and Doug Stanley operate this business, and are the only employees.
>
> ***Ian Crichton*** of New Denver makes custom cabinets and employs two additional workers.
>
> ***Bob Barkley*** of Slocan is a cabinet maker who sells his work primarily in Nelson and the lower Slocan Valley. He plans to hire a cabinet maker and an apprentice to work with him.
>
> ***Playmor Woodworks*** of South Slocan makes custom cabinets sold in the Nelson, Castlegar, and Slocan Valley area. This is a one-person operation.
>
> ***Kootenay Wood Spoons*** in Passmore makes a variety of wooden spoons for cooking and has been very successful marketing their bear claw salad spoons. In addition to selling within the local market, products are sold throughout western Canada. This family business employs three full time and three part-time workers.
>
> ***Tracy Skead*** operates a portable sawmill in Vallican and also has a woodworking shop. He supplies lumber to Selkirk Cedar in Brilliant. This is a one-person operation.
>
> ***Slocan Valley Manufacturing*** in the south valley makes finished windows and custom finished wood products. The firm employs from one to five people.

This list of value-added industries indicates that there are currently approximately 48 people employed within the Slocan Valley in various kinds of businesses that add value to wood products. The wood supply for these value-added wood products businesses depends in large part upon local timber companies that hold forest tenures, or the rights to log public forests. In the absence of a local open log market, wood supplies for value-added manufacturers are subject to the discretion and objectives of the forest tenure holders, and are often inadequate.

A small portion of Kalesnikoff Lumber's timber comes from a forest licence within the southern Slocan Valley. Kalesnikoff's sawmill is located just outside the boundaries of the Slocan Valley. Kalesnikoff is evaluating the possibility of further diversifying its secondary manufacturing and value-added products, which currently consist of birch flooring. Future possibilities include furniture manufacturing and other manufactured products. Kalesnikoff Lumber has a small forest tenure, or government timber quota, compared to other timber companies in the region. Ken Kalesnikoff, manager of the company, believes that the future success of their operations depends upon socially acceptable timber management and increased manufacturing of value-added wood products.

Throughout the province, the need to increase the amount of value-added wood products is recognized. The government has funded studies to assess the problems and opportunities facing valued added wood products manufacturers (Standing Committee 1993), to evaluate the performance of the value-added wood products industry (Price Waterhouse 1992), and to analyze the structure and significance of the value-added wood products industry (Forintek and McWilliams 1993). In the West Kootenays, Ian Fraser (1993) produced a report on value-added wood products. Corky Evans, MLA for Nelson-Creston, initiated the first Kootenay value-added wood forum in fall 1994. This event permitted those in the value-added wood products industry to meet together to discuss problems and remedies, and also permitted the showcasing of value-added wood products made by a large number of producers throughout the East and West Kootenay regions. All of this interest in value-added indicates that the current trend province-wide is similar to the interest in value-added wood products manufacturing within the Slocan Valley.

The success of further value-added wood products initiatives depends in large part on the availability of a dependable wood supply and good marketing strategies (Standing Committee 1993). West Kootenay value-added manufacturers, like others throughout the province, have long suffered from the inability to obtain the kind of wood they need. Forest Renewal BC will establish an electronic bulletin board so that wood users and sellers can find markets and suppliers for their products. The goal of the project is to match up value-added wood products manufacturers with wood sources (Nelson Daily News, March 17, 1995). However, if value-added wood products manufacturing is to reach its potential, the control of timber resources by large forest tenure holders must be substantially reduced or eliminated.

6.1.1.3 Restoration

The provincial government and, to some degree, Slocan Forest Products recognize that ecological damage has been caused by logging and road construction activities. SFP was awarded more than $200,000 in late 1994 under the Forest Renewal Plan to attempt to rehabilitate a small portion of one road in one small watershed (Airy/Tindale) in Tree Farm Licence #3. The Airy/Tindale watershed has been seriously damaged by SFP's logging practices. This example is typical of other logged drainages in the Slocan Valley, which clearly demonstrates that restoration is going to be an important component of the economy over the next years. The area requiring restoration and the estimated cost of restoration have been described earlier in Section 5.13.

Restoration needs to assist Nature to re-establish natural forest functioning wherever feasible. Some of the restoration activities that will be required include:

a. Soil restoration

Processes required to restore soil composition, structures, and functioning may include:

- breaking up compacted soil surfaces,
- introducing vegetation to stabilize soil, build physical soil structures, build soil nutrient levels, and restore water-holding capacity, and
- reestablishing natural contours, without further degradation of soil profiles.

b. Re-establish natural drainage patterns

Natural drainage in forest ecosystems is diffuse, occurring throughout the soil until water comes to the surface in a spring, wetland, creek, river, lake, pond, or other waterbody. Maintaining the naturally diffuse nature of forest drainage patterns and maintaining the flow of water in natural water courses is critical to restoring fully functioning forest ecosystems. Therefore, where roads, ditches, skid roads, and other components of forest use have changed water movement patterns (usually by concentrating it), natural drainage patterns need to be reestablished.

c. Revegetation

- Encourage natural diversity of vegetation by reseeding (instead of replanting) naturally occurring herb, shrub, and tree species. As much as possible, seeds should be collected from the local landscape within which forest restoration is being carried out.
- Plant trees and shrubs where required for soil/slope stabilization and diversification of degraded forest ecosystem types. Due to local extirpation of plant species and/or to the need for well developed rooting systems to stabilize soil and slopes and to colonize disturbed areas, planting trees and shrubs may be necessary to prevent colonization by exotic or non-indigenous species. As well, planting trees and shrubs may also be necessary to provide for more rapid development of a seed source for indigenous plants that may have been extirpated locally.

d. Reintroduction of animals and microorganisms

Reintroduce animal and microorganism species that may have been locally extirpated. This process may be particularly necessary with soil microorganisms, which have a limited capability to move throughout the forest landscape. As with plants, care must be taken to be sure that the introduced species and genotype are as close as possible to the species and genotype that was extirpated from a local area.

e. Restoration of riparian ecosystems

Restore riparian ecosystems, including riparian zones and riparian zones of influence by:

- restoring composition and structures throughout the watershed that is the source for the riparian ecosystem,
- reestablishing streamside vegetation, including herbs, shrubs, and trees,

- stabilizing stream banks and diversifying stream channels by reintroducing large logs (until natural fallen trees are available) and by rearranging, as required, key rocks and boulders in the streambed,
- standing logs vertically to mimic snags in the riparian ecosystem, until large natural snags develop through long-term forest succession.

f. Existing natural composition and structures

Protect natural composition and structures where they continue to exist in clearcut, logged, or otherwise degraded areas; and reintroduce composition and structure in clearcut, logged, and other degraded areas. The primary composition and structures that need to be reintroduced into clearcut areas are large fallen trees and large snags. Reintroducing large snags and large fallen trees into a clearcut is recognized as an interim, artificial process to supply *limited* composition and structures that will take hundreds of years to develop through natural successional processes.

g. Reintroduction of fire

Reintroduce natural fire and human-induced fire (as used by Indigenous people) by:

- Reestablishing forest composition and structures that were typical of areas that burned *before* starting or encouraging fire. This is a critical first step, because some stand structures, such as tree density or the depth of soil organic matter, are “unnatural” in the sense that they have developed as a result of fire suppression. If these compositions and structures are not modified before fire is reintroduced, extensive ecosystem degradation may result.
- Limiting the practice of fire suppression to specified areas (near human dwellings and in some parts of ecologically responsible timber management zones in order to protect human lives and investments**.**

Restoration is required in order to begin healing the mismanagement of the past; to restore water and soil functioning; to re-establish plants, animals, and micro-organisms; and to provide a sustainable supply of timber for future generations in the Slocan Valley. In other words, restoration is the price of exploitation.

While restoration is an ecological imperative and a moral obligation to future generations, it is not a quick fix. In most cases, human restoration activities can only assist natural processes that will require long time periods to heal the abuses of industrial exploitation. Thus, people must ensure that ecologically responsible activities replace industrial exploitation so that restoration is not required from future activities.

Restoration costs should be the responsibility of the individual or organization that profits from resource exploitation (Hawken 1994). Currently restoration is a cost to taxpayers and, if it continues to grow, can result in serious economic difficulties for society as a whole. These economic difficulties are compounded by the realization that without restoration we are jeopardizing the ability of future generations to meet their needs from both timber and non-timber values.

6.1.2 Mining

Historically, mining has provided significant employment in the Slocan Valley, but is subject to world prices for and a finite supply of minerals. During the past five years, mining has shut down almost entirely in the area. However, there are currently a few people earning income from small-scale gemstone mining in the south end of the valley. In 1994, a significant amount of area in the Passmore and Vallican areas was staked for gemstone mining.

A proposal by Industrial Mineral Park Mining Corporation was approved for bulk sampling and a pilot mill facility on Hoder and Koch Creeks within the boundaries of Tree Farm Licence #3. The proposal is for the mining of an apparently high quality of graphite. The results of the bulk sampling will determine if the quantity and quality of graphite present would warrant a large-scale operation.

At a public meeting in March 1995, members of the community expressed concerns about potential adverse impacts to water quality and from increased heavy truck transport on residential roads.

Proponents of the graphite mine proposal were vague about the number of potential jobs to be created or what the duration of the mine would be if bulk sampling and the pilot mine indicated that a full-scale mine would be feasible.

Any permitting at this point is for bulk sampling or a pilot mill only. A full-scale mine would require assessment under the Environmental Assessment Act.

While the potential for employment from graphite mining and processing exists, it is currently unknown whether any of this potential will be realized.

6.1.3 Tourism

Consistent with most of British Columbia, the Slocan Valley is experiencing a dramatic increase in tourism, particularly in the north end of the valley where the Valhalla Park, the newly created White Grizzly Park, and Slocan Lake provide many opportunities for outdoor recreation and tourism.

According to Copeland (1995), in 1993 there were 200 people, or approximately 10% of the total labour force, directly employed in the tourism industry in the Slocan Valley. This number compares with approximately 89 people employed in tourism in 1982. Copeland notes the recent increase in bed and breakfast accommodations, restaurants, and retail stores and services catering primarily to tourists. With tourism expected to experience continued healthy growth, existing tourism-related businesses can expect to remain secure and new businesses will no doubt be established. However, the growth of tourism is very sensitive to the protection of existing environmental quality throughout the Slocan River landscape.

Tourism is not without potential negative impacts to ecosystems. Residents have noted that hikers in the Valhalla Park have caused impacts such as trampling fragile alpine plants, improper human waste disposal resulting in waste contaminating streams, garbage left in the wilderness, and noise pollution from motorized boats on Slocan Lake. Education of tourists and regulation of tourism densities in wilderness situations are important considerations if tourism expansion is to be ecologically responsible.

6.1.4 Retirement

Mayor Gary Wright of New Denver has noted the economic importance of people who retire to the area. The quiet, more relaxed pace of life increasingly attracts people who no longer seek full time employment. These people do not require jobs, but contribute to the local economy by purchasing goods and services.

Apart from a facility to care for the aging in New Denver, most Slocan Valley residents must move out of the valley and away from their friends when they are no longer able to maintain their rural home due to aging. As the population that moved into the Slocan Valley in the late 1960s and early 1970s enters their fifties, people are talking about creating both communal types of housing for seniors and longer-term care facilities for those no longer able to care for themselves. If people are successful in establishing these facilities, more retirement income will remain within the Slocan Valley as the provision of services to retired people grows.

6.1.5 Home-Based and Small Businesses

The increase in home-based and small businesses throughout the valley has been substantial during the early 1990s. Gower (1989) and Holman (1994) conducted informal surveys to determine the extent of employment provided by home-based and small businesses. Gower's study pointed out the growing importance of home-based businesses. Holman's study notes that 49 of the 83 firms, or 60%, responding to his survey were home-based businesses, accounting for about 20% of employment in the sample.

As part of the research for the SFF project, an informal study was conducted in February 1995 of small and home-based businesses in the area from Perry Siding to Slocan Park. A small business was defined as one with less than 15 employees. The study area coincides roughly with Statistics Canada electoral areas 11304 (Passmore/Slocan Park), 11305 (Lemon Creek to Vallican, east side) and 11306 (Slocan to Vallican, west side). In 1991 (the most recent statistics available), the number of people employed in these three electoral areas was 890, or 44% of the total number of employed people in the Slocan Valley.

The SFF survey, while not able to canvass for every existing home-based business, shows that a total of approximately 244 people are employed in home-based or small businesses. This would mean 27% of the 1991 employed labor force for electoral areas 11304, 11305 and 11306. Such a direct comparison lacks precision because the electoral and survey areas do not coincide exactly, not all of the people who work in the small businesses tallied necessarily live within the boundaries of the sample area, and the census numbers are from 1991, while survey numbers are from 1995. However, it is fair to state that a significant portion of the workforce from Perry Siding to Slocan Park is employed in home-based or small businesses. Assuming that a similar survey in other portions of the Slocan Valley would indicate a similar trend, small and home-based businesses constitute a growing and significant portion of the Slocan Valley economy.

As a point of comparison, the 1991 census indicates that 230 people in the three electoral areas sampled were employed in logging, forestry and manufacturing (presumably sawmilling). This means that 25% of the labour force works in these industries. Thus, small and home-based businesses employ similar numbers of people to those employed in the timber industry within the three areas sampled.

Table 6.1 summarizes home-based and small business employment data gathered for the sample area.

Table 6-1: Employment in small and home-based businesses—Perry Siding to Slocan Park

Type of Business	Number Employed
Farming	14
Greenhouses/Landscaping	6
Building Contractors	20
Trades Contractors (electricians, plumbers, carpets, drywall...)	15
Contractors/Machinery	4
Professional Services (consultants, legal, design, accounting, scientific, publishing...)	47
General Services (hairdressers, cleaning, catering, massage & physiotherapy, appliance & vehicle repairs...)	25
Artists and Writers	29
Retail Businesses and Restaurants	54
Community Education (private school & daycare)	6
Small Manufacturing (wooden spoons, soaps, paneling & flooring)	9
Tourism	5
Non-timber forest products	10
Total	244

The rapid increase in small and home-based businesses is illustrated by the fact that 21 of the businesses in the survey have started since January 1993. Total current employment from these 21 new businesses is 32 (13% of employment in small and home-based businesses), indicating that the majority are single person enterprises. New businesses include an organic food store, bakery and bistro, an auto parts store, scientific testing laboratory, mountain bike touring services, a consignment store, two gift shops, and various services such as physiotherapy, notary public, plumbing, and electrical.

Holman (1994) noted that some home-based businesses yielded lower incomes than other kinds of businesses. He also noted that the most frequently cited reasons for establishing a business in the Slocan Valley involved the desirability of the area as a home and for raising a family. Gower (1989) noted that respondents to study questionnaires frequently cited the natural beauty of the area as the primary reason for locating in the Slocan Valley. It seems accurate to say that many people living in the Slocan Valley will accept lower than average incomes because they want to live in an area with a high quality environment.

6.1.6 Wildcrafting

Wildcrafting is a term used for the harvest of non-timber forest products such as mushrooms, ferns, floral greens, medicinal herbs, berries and other wild edibles.

Currently, mushrooms provide the greatest economic return from wildcrafting activities in the Slocan Valley. According to Hans Fuhrmann, wildcrafting sector representative to the Slocan Valley CORE Pilot Project, in 1993 there were three companies buying mushrooms in the valley. It is estimated that approximately 40 full-time and 60 casual seasonal harvesters earn about $200,000 per year harvesting pine mushrooms in the Slocan Valley. During the 1993 season, full-time harvesters earned an average of $2,000 per month, or about $100 per day.

Molina et al (1993) reported that in 1988 British Columbia exported about 500 tons of matsutake mushrooms to Japan with an estimated value of about US$9 to 10 million. De Geus (1993) reported that the 1992 British Columbia harvest of pine mushrooms (matsutake) was valued at CDN$ 4.5 million. From these two reports, it is clear that the harvest level varies widely. Production depends on weather conditions, with a combination of rain and sun required during the autumn months to maximize growth of mushrooms (deGeus 1992). Pine mushrooms are associated with mature to old-growth forests of western hemlock, lodgepole pine, and Douglas-fir. According to Fuhrmann, pine mushrooms in the Slocan Valley are found mainly in older hemlock forests. DeGeus (1993) states that pine mushrooms are found in the New Denver and Slocan Lake areas within the EssF (Engelmann Spruce/ Subalpine Fir) and ICH (Interior Cedar Hemlock) biogeoclimatic zones.

Furhmann says that 10,000 pounds of matsutake mushrooms were harvested in the Slocan Valley in 1993. Fuhrmann claims that mushrooms provide up to ten times the annual income per hectare compared to the income generated from periodic timber cutting that takes place only once every 80 to 120 years. These figures are difficult to substantiate since the collection and sale of mushrooms is unregulated and there are no records that show how many pounds of mushrooms can be attributed to a specific area of land. However, since matsutake (pine) mushrooms are dependent upon old trees, and grow in mature to old-growth forests, disturbance of this habitat by logging, particularly clearcutting, would negatively affect or, in the case of clearcutting, destroy the economic returns possible from collection of mushrooms.

The Washington State University Extension Service (1993) estimated that the annual wholesale value of floral greens, wild edibles, and medicinal plants was $95 million for the area encompassed by British Columbia, Washington, Oregon, Idaho, and northern California. Retail value ranges from 6 to 22 times the wholesale value. This study indicates that the wildcrafting industry is significant and growing throughout the Pacific Northwest.

According to Fuhrmann, the Slocan Valley contains more than 200 species of plants that can be harvested for food, herbal medicines, basket and furniture making, dyes, and floral greenery. Few of these species are currently utilized commercially. In addition to mushrooms, there is some local harvest and sale of fiddlehead ferns and fern fronds. Two operators harvest materials for furniture making.

Many non-timber forest products can be harvested annually, but in order to be viable, wildcrafting requires healthy, fully functioning forest ecosystems, and some products require undisturbed mature or old-growth forest conditions. The viability of wildcrafting is therefore directly affected by logging practices, particularly clearcutting.

In contrast to conventional timber management, wildcrafting is sustainable, provided wildcrafters do not overharvest or degrade ecosystem functioning during harvest. Employment and revenue are generated each year from wildcrafting in a particular forest, versus once every 80 to 120 years in conventional timber management. Therefore, wildcrafting is a better ecological, economic, and social choice than conventional timber management in forests where non-timber forest products are found.

6.1.7 The Arts, Culture, Recreation, and Continuing Education

The Slocan Valley has long attracted as permanent residents many who are involved in the arts: writers, artists, skilled craftspeople, actors, and musicians. While the employment in the arts has been included in the section on home-based and small businesses, their importance to the quality of life and the economic well-being of the Slocan Valley needs to be further emphasized. The work of many local artists is internationally known and respected and many artists rely on their art for their income. Resident artists include those who produce water colours and oil paintings, sculptors, weavers, basket makers, fine woodworkers, potters, stained glass artists, poets, novelists, writers of non-fiction, singers, musicians, and actors. The percentage of artists to total population is high in the Slocan Valley.

The richness of the arts community adds to the quality of life experienced by all residents and has the potential to diversify tourism offerings in the valley.

In the southern Slocan Valley, the Recreation Commission provides a wide variety of opportunities for people to participate in both sports and artistic endeavours. The number and variety of opportunities has grown over the past few years. Local artists frequently share their skills and perspectives through the Recreation Commission courses. Organized recreational events and courses also provide opportunities for people from throughout the community to get to know each other and to feel part of the community.

Selkirk College provides Continuing Education services throughout the Slocan Valley. Residents can upgrade their formal education to high school equivalency through the Adult

Basic Education program, while remaining at home during the time of their studies. This service means that many who did not succeed within the public school system have an opportunity to upgrade their education and increase their opportunities for both further education and employment. The Continuing Education program also offers a wide variety of courses of interest to community members, from baby-sitter training to computer literacy. This well-established continuing education system can play an important role in retraining as a part of the economic transition strategy (see Section 7).

Arts, culture, recreation, and community education add to the quality of life experienced by all residents and thus form a critical part of any sustainable economy and economic analysis. As Thomas Power has pointed out, these kinds of "quality of life" indicators are critical to the health of local economies. A thriving arts community is extremely dependent upon maintaining a high quality, natural environment in the Slocan Valley. Without a high quality, natural environment, much of the source of inspiration and creativity for local artists would be gone.

6.1.8 Agriculture

Agriculture has always been a part of the Slocan Valley economy and began when Europeans first came to the area in the late 19th century. However, distance from markets made most farming uneconomical by the 1940s and 1950s. Since that time, subsistence and organic farming remain important to many families in the Slocan Valley. Most households grow a substantial amount of their own food.

A number of farming enterprises currently operate in the valley and others are starting up. Most are mixed fruit and vegetable growers, with some small scale meat production. Organic fruit and vegetable growers sell either directly from their homes or through local organic food outlets. An operation in Krestova raises turkeys and chickens on a custom order basis. Some growers are investigating growing plants for dyes.

Farmers whose land includes both agricultural and forest land are investigating the potential of combining sale of cultivated crops with harvest of non-timber forest products from their forested land.

Permaculture seeks to work with the land to produce agricultural products. A trained permaculturist practices and teaches in the Slocan Valley.

Several growers have planted ginseng in moist, shaded, forest areas and are just beginning to harvest their plantings. Other crops include echinacea, berries, apples, plums, pears, garlic, honey, and a wide variety of vegetables. Some local farmers add value to their products by selling cheeses, garlic braids, and other higher value products.

There are two greenhouse operations selling bedding plants in the south end of the valley, one of which also sells ripe cucumbers, tomatoes, and other vegetables. A nursery and landscaping enterprise operates in the north valley.

Agriculture often is able to provide only part of the income of farming families. Ways to increase the economic viability of farming are important, especially since local sales mean that less needs to be imported and money stays within the community. Both equipment cooperatives to share expensive processing equipment, and marketing cooperatives to expand niche markets would help the viability of agriculture in the Slocan Valley. As well, the organic, small-scale kind of agriculture preferred by most farmers in the valley is consistent with the principles of ecological responsibility that guide the economic activity proposed in this plan.

6.1.9 Barter and Trade Systems

Barter and trade systems are frequently referred to as part of the informal economy. Since no currency changes hands, there are no hard numbers for evaluating the contribution these activities make to the overall economy. However, barter and trade have always been an important part of the Slocan Valley community and show every indication of maintaining an important role in the economy.

Both the north and south Slocan Valley have established programs that encourage trading services among local residents. While straight barter transactions require an equal trade between two parties, these programs expand barter to a larger group of people. Bob can get a haircut from Lisa, who in turn can get help from Joan in pouring a concrete slab. All transactions are recorded in the central system through debits and credits. When someone provides a service, she/he “banks” an amount that can be redeemed later when she/he needs a service. When someone uses a service, the value of that service is deducted from the amount in her/his account. The official currency is “clams,” although no actual currency circulates. Members provide and receive services at a specified number of clams and are permitted a maximum line of credit of 500 clams.

The local trading systems enable exchange when money is in short supply and it keeps local energy local. The Southern Slocan Valley Community Exchange (SSVCE) began in spring 1992 and currently has an active membership of 80 with an ever-increasing level of activity. Joel Russ, an active participant in the SSVCE, reports that approximately one-quarter of trades are products and three-quarters are services.

Although smaller, the North Slocan Valley Community Exchange also began in 1992. Participant David Badke reports a total of 35 members. The group has been somewhat inactive for a year, but Badke planned to reactivate the organization in spring 1995.

The SSVCE sponsors a seed exchange and puts on a spring and fall community fair. According to Russ, the program means that people on fixed or low incomes are able to obtain skilled help to complete projects they would not be able to find the cash for; people in the community get to know each other and to value each other’s skills; and a sense of community is built as people learn to trust other community members and to be part of the give and take of community. Clearly the exchange systems contribute not only to the economy, but also to community building.

6.1.10 Employment in Government, Education, and Health Care Services

Census data from 1991 indicates that a total of 399 people, or 19% of the total labour force, were employed in the Slocan Valley in government, education, and health care services.

This number compares to 366 in 1986. Census data does not indicate how many of these people live within the valley, but are employed in these services located in the larger centres of Castlegar and Nelson.

If the population of the West Kootenay region continues to increase as projected, additional people can be expected to be employed in various government services.

6.1.11 Summary of the Emerging Economy

The emerging economy indicates that diversification is already taking place in the Slocan Valley. Direct timber industry jobs have declined significantly over the past number of years due to automation of milling processes and increased reliance on mechanized logging in the woods. Additional traditional timber jobs are likely to be lost due to reductions in the allowable annual cut anticipated by the initiation of the Forest Practices Code, the West Kootenay land use plan which zones the main Slocan Valley as Special Management, and social requirements to protect non-timber forest values.

Although existing jobs may be lost in traditional logging and sawmilling activities, job increases are likely to continue in value-added wood products industries, in more labour-intensive, ecologically responsible partial cutting methods, and in restoration of degraded forest land.

Mining currently provides few jobs in the Slocan Valley and its future base of employment is uncertain. In order to be an acceptable part of the ecosystem-based economy, mining must be carried out in ecologically responsible ways. A set of guidelines and standards for ecologically responsible mining needs to be developed and incorporated into future versions of the ecosystem-based plan for the Slocan Valley.

Diversification of the overall economy is taking place through tourism, small and home-based businesses, retirement immigration, wildcrafting, and the arts. In addition to this diversification, increased employment in general and specialized services—as well as in health care, education, and government services—can be expected as the projected population increase in the Slocan Valley takes place. However, continuation and expansion of this economic diversification depends upon protecting and/or restoring the natural environmental quality throughout the Slocan River watershed.

6.1.12 Links between the environment and the economy: a study in the Pacific Northwest

Dr. Thomas Power, chair of the economics department at the University of Montana, edited a 1995 consensus report by more than 30 Pacific Northwest Economists entitled, *Economic well -being and environmental protection in the Pacific Northwest.* The entire report can be referenced in Appendix 10. The report documents that the economies of the five Pacific Northwest states have consistently outperformed the rest of the United States over the past decade, and should continue this trend for the foreseeable future. Growth in the Pacific Northwest states has been two to four times that of the national economy. This healthy economic situation is attributed in large part to the high quality of the natural environment throughout the region.

The economic strength of the region is the more remarkable because it has taken place while two industries that have historically dominated the region's economy—timber and aerospace—were dramatically downsized. As massive job losses in aerospace and timber were taking place, the Pacific Northwest led the nation in job creation, income generation, and success in attracting new businesses and residents. Although many still believe that the five states remain dependent on a natural resource economy that is threatened by loss of access to raw materials, the reality is that the region's economy is more balanced, diversified, and resilient than is commonly believed.

In the past, resource extraction in the Pacific Northwest was considered to be the economic base for the rest of the economy, providing the source of most changes in employment and incomes throughout the region. While resource extraction industries are expected to continue to be an important element of the economy, they are not expected to be the source of new jobs and higher incomes. Power and his colleagues predict that growth in the overall economy will occur independent of these industries and in value-added processing of the resources extracted.

The region's economists assert that one of the factors driving the current economy is that the region is perceived as providing a superior, attractive environment in which to live, work, and do business. The natural environment appears to be especially important. While it is difficult to document and quantify the role of the region's amenities in supporting its ongoing economic development, the economists are firm that this does not justify ignoring them and assuming they are of zero importance. People move to the region, and stay there, because they want to enjoy the high-quality living environment. The attractiveness of the region assures an adequate and attractive labor supply and growing markets for goods and services.

The report points out that the economic growth is occurring both within and outside the region's metropolitan areas. Growth in smaller communities takes place because "technology, changing industrial composition, and falling communication and transportation costs are reducing the economic impact of distance and allowing a dispersion of economic activity."

The economists acknowledge that the shift in the region's economy, away from natural resources industries and towards industries that depend on the region's attractive environment, has been painful to individuals and communities directly affected by the changes. Support needs to be provided to mitigate the economic and social distress suffered by these people. However, relief for those adversely affected will not be found by increasing timber extraction levels at the expense of the quality of the environment. Instead, displaced workers require education and training to help them cope with a rapidly changing economy where new jobs require higher levels of education and/or training.

The report cautions that policies and actions that significantly diminish the natural environment may threaten the region's economic future:

> *In many instances, the highest-value use of a forest, river, or other resource will be to protect and enhance it so that it reinforces the region's natural environment, because doing so also will strengthen one set of forces that is creating new jobs and higher incomes.*

Job losses, particularly in the timber industry, are frequently blamed on environmental protection. However, the economists state that job losses in natural resources have had little to do with environmental protection, but rather are due to technological developments that have dramatically raised productivity and reduced labor requirements, and due to competition and fluctuations in international markets. The record also shows that most of the employment reduction in the timber industry over the past decade has occurred because past levels of logging could not be sustained.

Power and his associates point out that natural resource industries will remain important to the region's economy for the foreseeable future, but that these industries will not be the source of increased employment through increased levels of extraction. Instead, new jobs will be generated in new value-added resource activities, or outside the natural resource industries altogether.

The important relationship between the economy and the environment is stressed in the report:

> *Because people care where they live and because businesses care where people choose to live, environmental quality has a positive impact on the local economy. Put negatively, degraded environments are associated with lower incomes and depressed economic conditions.*
>
> *...In short, the linkage between environmental protection and economic development arises because the decisions facing us are not between jobs and the environment, but between two sets of jobs: one with environmental protection and another without it. This jobs-versus-jobs reality is inescapable. Environmental degradation in pursuit of jobs and incomes in the agriculture, fishing, mining, and timber industries must be weighed against the damage that the degradation will do to the amenity-driven part of the economic development now underway that is adding considerable vitality to the local economies.*

The economists point out that overpopulation can overwhelm the environment with congestion and environmental degradation that destroys the very amenities that contributed to growth in the first place, degrading both the economy and the environment.

The report closes with a clear statement:

> *Political forces, even powerful special interests, cannot bring back the economy of a past era. The unique natural resources of the Pacific Northwest remain among its most important economic assets. But the new jobs and income that are vital to the region's economic future will depend more on the <u>protection</u> of those assets than on their degradation.*

Many of the conclusions reached in the consensus statement by economists in the five Pacific Northwest states apply to British Columbia as a whole and to the Slocan Valley as a specific case. This ecosystem-based landscape plan documents changes in the Slocan Valley economy that parallel many of the changes in the consensus report. Like our neighbors to the south, the communities of the Slocan Valley will need to make informed decisions about how to creatively manage the economic changes that are already taking place so that neither uncontrolled population growth nor destructive resource extraction activities are allowed to degrade the quality of the natural environment, and with it the emerging, diverse ecosystem-based economy. As resource extraction industries continue to change, education and training must be provided for any workers displaced by these changes.

6.2 The Proposed Ecosystem-Based Economy

When proposing an economy for the Slocan Valley, the primary considerations are:

- ***whether the proposed activity fits within the ecological limits identified in the landscape analysis, and defined by the protected landscape network and wholistic forest use zone interpretive maps, and***
- ***how to carry out the activity in an ecologically responsible way.***

If the proposed activity will cause unacceptable adverse impacts to forest ecosystem functioning and/or to existing ecologically responsible forest uses or users, then it does not meet the criteria of respecting ecological limits. If the proposed activity can assist natural processes to restore degraded areas, can be carried out in ecologically responsible ways, and/or can co-exist with existing ecologically responsible land uses, then it may be an appropriate economic venture.

Balance in human uses within the Slocan River watershed is also a critical objective for the proposed ecosystem-based economy. From an ecological standpoint, balance means being part of and maintaining a fully functioning ecosystem. From a social standpoint, balanced use means providing a fair and protected landbase for all ecologically responsible forest uses. From an economic standpoint, balance means diversification and stability in a local economy.

Ecological economics, which is compared to conventional economics and conventional ecology in Table 6-2 below, is the foundation for developing an ecosystem-based economy in the Slocan Valley.

Table 6-2: Ecological economics compared to conventional economics and conventional ecology

	Conventional Economics	**Conventional Ecology**	**Ecological Economics**
Basic World View	Mechanistic, Static, Unconnected fragments	Evolutionary, Unconnected fragments	Dynamic, systems evolutionary
Time Frame	Short	Multiscale	Multiscale
Space Frame	Local to international	Local to regional	Local to global
Species Frame	Humans only	Non-humans only	Whole systems including humans
Primary Macro Goals	Growth of National Economy	Survival of Species	**Ecological Economic System sustainability**
Primary Micro Goals	Max Profits (firms) Max Utility (individuals)	Max Reproductive Success	Must be adjusted to reflect system goals
Assumptions About Technical Progress	Very optimistic	Pessimistic or no opinion	Prudently skeptical
Academic Stance	Disciplinary	Disciplinary	Trans-disciplinary

Adapted from: Costanza, Robert. 1991. Goals, Agenda, and Policy Recommendations for Ecological Economics. In Ecological Economics The Science and Management of Sustainability. Columbia University Press, New York.

In order to encourage and develop an ecosystem-based economy, an ecosystem-based decision-making process must be followed. The elements of that decision-making process are shown in Figure 6-1. By reviewing the decision-making flow chart in Figure 6-1, the reader will understand that this ecosystem-based plan has developed decisions for the large landscape and human use zones. However, before it can be implemented, decisions on large landscape plans and human use zones must be reviewed by Slocan Valley residents. Also, development of operations plans is imperative in order to check interpretations at the landscape level, to develop a workable ecosystem-based economy, and to maintain stand level ecosystem functioning. In the interim, while these steps occur, ecologically responsible activities can occur in non-contentious, stable and moderately stable ecosystem types while operations and economic plans are completed.

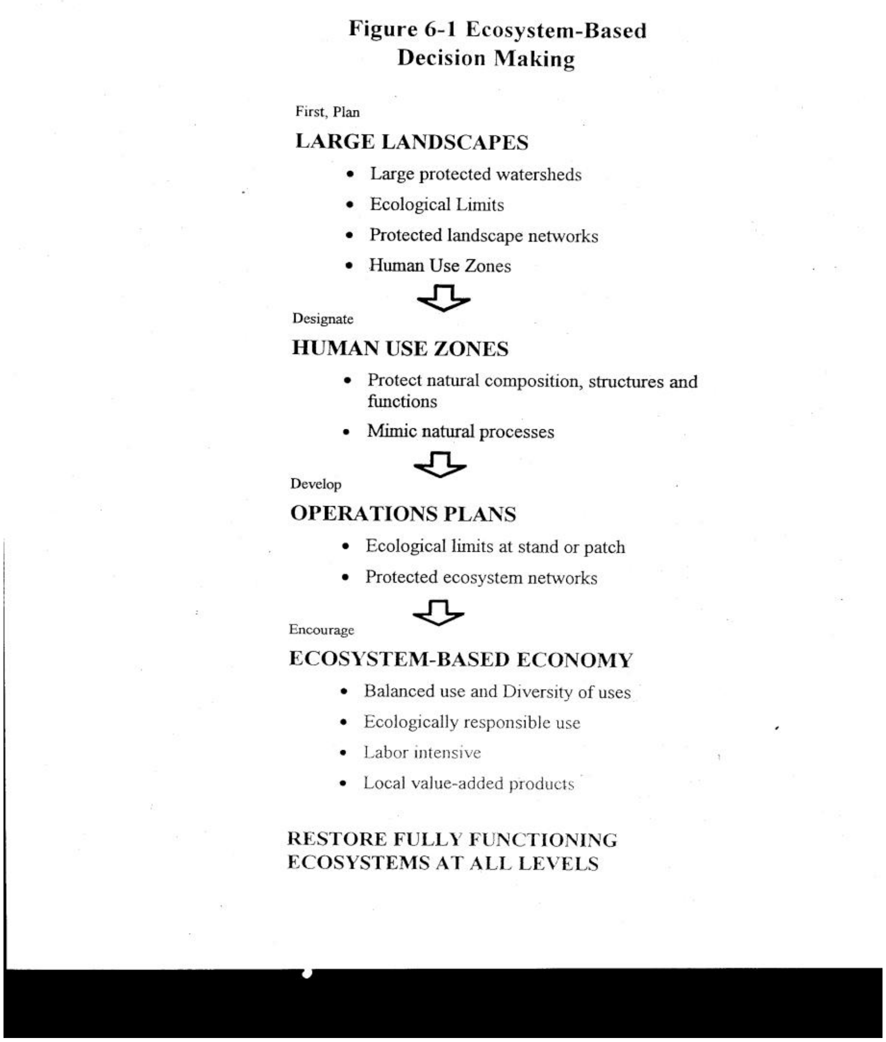


Figure 6-1: Ecosystem-based decision making

The current diversification of the Slocan Valley economy can be expected to develop as long as the conditions necessary for this diversification are not compromised. These conditions include protecting and maintaining biological diversity, fully functioning forests at all scales, existing water quality, high quality viewscapes; and control of noise pollution—all factors in the quality of life that attracts people to the region. In other words, a high quality natural environment must be maintained and, where necessary, restored, if economic diversification is to continue and an ecosystem-based economy is to develop.

Along with degradation from clearcut logging and from uncontrolled human settlement, noise pollution is a major threat to the environmental quality of the Slocan Valley watershed. Until 1990, Highway #6, which runs the length of the Slocan Valley (north-south), had limited truck traffic because a portion of the highway was a winding, one-lane road north of the Village of Slocan. However, that part of the road has been reconstructed into a major highway. As a result, and in combination with a doubling in production of the pulp mill in Castlegar, Highway #6 has now become a major chip truck route, with chip trucks (loaded or unloaded) passing through approximately every 10 minutes. A cost-benefit analysis performed in 1992-93 showed that the most cost-effective way to transport chips was down the Arrow Lakes (Columbia River) from Nakusp to Castlegar (see Figure 3-1), and that transporting chips on Highway #6 creates safety problems as well as noise pollution.

At the date of publication of this plan, the British Columbia government had failed to redirect chip transport from Highway #6 to barges on the Arrow Lakes from Nakusp to Castlegar. Continued chip truck traffic on Highway #6 degrades environmental quality in the Slocan Valley and will limit development of an ecosystem-based economy. Resolution of this problem is as urgent as ending clearcutting to prevent foreclosing upon the emerging diverse, community-based economy in the Slocan Valley.

The Oregon example (see Section 6.1.1) illustrates that predicted losses in timber-related jobs may be far less than expected, despite drastic reductions in cutting rates, and that the economy can diversify quickly to compensate for job losses. As well, with effective retraining programs, the pain of job losses can be mitigated. In the Oregon example, little preplanning took place, yet the economy appears to be rebounding well. With thoughtful and careful planning, the Slocan Valley can do even better.

The Slocan Valley should not require high-tech industries (as Oregon experienced), but instead can establish an ecosystem-based economy founded on the protection, maintenance, restoration, and ecologically responsible use of the forest. Thus, we can use what we have always used in a slightly different way. This makes the transition from the existing economy to the ecosystem-based economy easier, both in social and economic terms, than if totally new industries have to be created.

The viability of most economic activities and of domestic households in the Slocan Valley depends on a reliable supply of quality water. Since the population is spread throughout the long, narrow valley, the most viable source of water is the many streams and springs on the forested mountainsides. Ground water supplies through wells are often of unpredictable (and frequently poor) quality and quantity. Many proposed economic activities—from logging to tourism to wildcrafting—have the potential to negatively impact water quality, quantity, and timing of flow. Any proposed land based activity, in order to be ecologically responsible, must meet the needs of domestic and agricultural water users.

The best water—considering water quality, quantity, and timing of flow—comes from old growth forests. This is due in part to the large accumulations of decayed wood that store and filter water, and to the multi-layered canopies of old growth forests which intercept, hold, and redistribute water. Therefore, as explained in Section 4.3.6, the sensitive headwaters of consumptive use watersheds have been zoned as protected areas to ensure the protection of water (the essential ecological foundation of an ecosystem-based plan), and to permit the development of old growth forests.

As the future direction of the economy is decided, consider the words of Paul Hawken, in his book *The Ecology of Commerce.* Hawken points out the errors in the way economists have traditionally looked at the "economics" of activities:

> *Without doubt, the single most damaging aspect of the present economic system is that the expense of destroying the earth is largely absent from the prices set in the marketplace. A vital and key piece of information is therefore missing in all levels of the economy. This omission extends the dominance of industrialism beyond its useful life and prevents a restorative economy from emerging.*

Hawken has also defined the principles of sustainable businesses:

- Replace nationally and internationally produced items with products created locally and regionally.
- Take responsibility for the effects that products have on the natural world.
- Do not require exotic sources of capital in order to develop and grow.
- Engage in production processes that are human, worthy, dignified, and intrinsically satisfying.
- Create objects of durability and long-term utility whose ultimate use or disposition will not be harmful to future generations.
- Change consumers to customers who purchase services and goods that protect Earth, through education.

Changes in the Slocan Valley economy are already taking place. The community now has the opportunity to focus that change in directions that protect the short-term and long-term stability of the ecosystem and, in turn, the economy. The following ideas represent a starting point for further discussion and action within the community.

6.2.1 Ecologically Responsible Timber Management

As noted in Section 6.1.1, the timber industry is already experiencing tremendous change and has laid off many workers due to mechanization of both milling and woods operations. Unless ecologically responsible timber management replaces conventional clearcut timber management, employment losses are likely to continue to occur. When remaining natural timber supplies are depleted and/or non-timber forest users force more balanced forest use in the Slocan River watershed, the timber industry will face far fewer options to adapt and change than exist today. Therefore, the time for change to ecologically responsible approaches is now.

The change to ecologically responsible timber management will involve some specific and immediate actions:

- implement ecologically responsible partial cutting, and stop clearcutting, or modifications to clearcutting (see Appendix 5 for details).

- implement a broad program of forest restoration to begin re-establishing fully functioning forests across the Slocan Valley landscape. Restoration needs to be a high priority, because the short-term ecologically sustainable AAC is lower than the long-term ecologically sustainable AAC due to the extensive ecosystem degradation that has resulted from clearcutting. The longer restoration is postponed, the longer it will be before the long-term ecologically sustainable AAC can be logged. See Section 5.13 for discussion of short- and long-term ecologically sustainable AACs.

- encourage and expand the emerging trends in value-added wood products manufacturing. Among other things, achieving this goal will require access to suitable wood sources at fair prices for value-added wood manufacturers.

Achieving these goals requires broad-based, socially and ecologically responsible control of forests. This has not been achieved through the tree farm licence and forest licence tenures under which timber management has occurred in the Slocan Valley in the past. These tenures, held by industrial timber interests, have resulted in stand and landscape level forest degradation, an inadequate supply of timber to value-added wood manufacturers, and unnecessary loss of employment through mechanization of milling and woods operations.

Therefore, SFF recommends development of a community forest tenure, operated by a Community Forest Board (CFB) under standards of ecological responsibility. The Community Forest Board would have a seat for all <u>community-based</u> interests, but central government and industrial interests that are controlled outside the local community would not have a seat on the Board. The CFB would have a paid technical staff that would plan, administer, and monitor timber management in the Slocan Valley. Revenues from the sale of timber would fund the operation of the CFB.

As well, we recommend establishing an open log market using the Ministry of Forests Lumby log sort yard as a model for marketing logs. Timber would be sold by competitive bid on a weekly basis. A wide variety of log sorts including, but not limited to, premium sawlogs, log building logs, decorative logs, musical instrument wood, and oversized logs will assist in recovering top market value and stimulate value-added manufacturing.

Certification of wood products and timber extraction operations (eco-labeling) that ensure ecologically responsible timber management provides another means of adding value to wood products for both local and export markets. SFF recommends that certifiers be invited to certify logs and wood products produced through ecologically responsible means in the Slocan Valley.

A conceptual economic analysis of clearcutting and ecologically responsible partial cutting is presented in Section 6.2.1.1 in order to clearly define the reasons for shifting from clearcutting to ecologically responsible partial cutting. This is followed by a comparison of employment and timber requirements for ecologically responsible timber cutting versus conventional timber cutting in Section 6.2.1.2. Ideas for implementing increased value-added wood products manufacturing are discussed in Section 6.2.1.3. Specific areas to begin restoration are proposed in Section 6.2.1.4

As well, an open log market and certification of wood products are discussed in Sections 6.2.1.5 and 6.2.1.6, respectively.

6.2.1.1 The economics of clearcutting versus ecologically responsible partial cutting

As stated in Section 6.1, ecologically responsible timber management is required within timber zones identified in the ecosystem-based landscape plan. This will mean adopting partial cutting methods that leave natural composition and structures on each logged area, and ensure reseeding (i.e. regeneration) of the natural variety of tree species indigenous to a particular site (see Appendices 4 and 5 for more details). Ecologically responsible partial cutting will mean more detailed planning, and more labour intensive, forest sensitive logging. More employment will be generated for each tree cut in ecologically responsible partial cutting compared to clearcutting. Not only does ecologically responsible partial cutting produce more employment than clearcutting, but it is also more economically viable.

True economic analysis of timber cutting options is usually never done in British Columbia. When "economic" analysis of clearcutting does occur, it is usually a financial analysis that compares the value of logs and lumber with only the short term, out-of-pocket costs of road construction, logging, stumpage fees (payments to government for cutting trees on public land), hauling logs to the mill, and milling costs. Financial analysis, which is often confused with economic analysis, compares only the monetary value received for logs and/or lumber with the out-of-pocket costs, or part of the direct costs, of producing the logs and lumber. A financial analysis is used to determine the short-term profit picture for an organization, and does not determine the overall costs or benefits of clearcutting to society as a whole. Furthermore, financial analysis is only valid for a short timeframe, usually one year or less, and does not consider any long-term costs and benefits.

In a financial analysis, direct costs associated with clearcutting that are not out-of-pocket costs to the logging and milling companies, are not considered. In a typical clearcutting operation these direct costs would include costs of slash burning, site preparation for planting trees, tree planting, chemical or mechanical control of competing vegetation, and road maintenance. The primary reason that these direct costs are not necessary to include in a financial analysis is that they are paid for by public subsidies to the timber industry, directly through such programs as the past Forest Resource Development Agreements (FRDA) and the current Forest Renewal B.C. (FRBC), or indirectly through the stumpage appraisal system (i.e. the way that government fees are determined for cutting timber on public land).

Financial analysis not only does not consider all direct costs, but it also ignores all of the indirect costs associated with clearcutting. Indirect costs include the costs of soil degradation; water degradation; loss of plant, animal, and microorganism habitat and populations; loss of ecological communities; plantation failures; poor root form in planted trees; devaluation of property near or adjacent to clearcuts; and damage to non-timber forest uses and values. Correction of these problems, or forest restoration, if possible, is extremely expensive (for more information see Section 5; and Balisky et al 1995, Hammond 1991, Hammond 1988, Utzig and Walmsley 1988). One has only to look at the $200,000 granted under the Forest Renewal B.C. program to Slocan Forest Products for rehabilitation of one part of one poorly constructed road in one small drainage basin to realize that the costs of continuing to clearcut and build poor roads are indeed very high. Thus, financial analysis does not provide a useful tool to compare clearcutting with other forms of timber management, like ecologically responsible partial cutting. Nor should financial analysis of timber cutting operations be used to justify that clearcutting or any type of logging is the best economic use of a forest.

Ecological economic analysis is the appropriate means, within the economic component of forest use planning, to compare various systems of timber management and forest use options. Ecological economic analysis not only considers all of the short-term direct and indirect costs and benefits, but it also takes into account all of the long-term direct and indirect costs and benefits of a system of timber management or other forest use options. Non-dollar or “unpriced” costs and benefits are also included, and are given equal consideration to dollar costs and benefits in ecological economic analysis

The table below compares clearcutting and ecologically responsible partial cutting using a conceptual ecological economic analysis. It would be misleading to include actual numbers here without referring to specific cutting plans for a particular area. However, the conceptual analysis reveals that ecologically responsible partial cutting has far more benefits, and far fewer costs than clearcutting when viewed from the perspective of society as a whole, and from the perspective that protection of ecosystem functioning at all scales through time is necessary to sustain human societies and the various economies which are part of human societies.

Costs and benefits in the table are listed as “yes” or “no” , depending on whether or not they apply to clearcutting or ecologically responsible partial cutting. Where a “+” occurs next to a “yes” this means that the cost or benefit occurs for both clearcutting and ecologically responsible partial cutting, but the cost or benefit is higher for the type of timber management that has the “+”.

Table 6-3: Conceptual ecological economic analysis of clearcutting versus ecologically responsible partial cutting

COSTS AND BENEFITS	CLEARCUTTING	ECOLOGICALLY RESPONSIBLE PARTIAL CUTTING
Direct Costs:		
Planning--assessing ecosystem sensitivity to disturbance, designing and laying out roads and cutting	Yes	Yes+ Additional planning to protect ecosystem functioning
Road Construction	Yes	Yes+ Less road constructed, but roads built to higher standards
Logging--felling, bucking to log length, skidding/yarding	Yes	Yes+ Additional care necessary to protect ecosystem functioning
Log Hauling	Yes	Yes
Silviculture--site preparation for tree planting, tree planting, brushing and weeding, fertilization	Yes	No Natural succession of shrub species and reseeding of trees from permanent leave trees necessary to maintain full forest functioning
Restoration--assisting Nature to re-establish natural composition, structures, and forest functioning. In many cases restoration is not possible without waiting hundreds or thousands of years for natural processes to heal problems, for example, damaged soil and lack of large old fallen trees. Restoration is always expensive.	Yes. Very High costs	No

NOTE: Additional direct costs associated with planning, logging, and road construction in ecologically responsible partial cutting are more than recovered, because there are no silviculture, site preparation, tree planting, and brushing costs, or restoration costs.

COSTS AND BENEFITS	CLEARCUTTING	ECOLOGICALLY RESPONSIBLE PARTIAL CUTTING
Indirect Costs:		
Loss of Ecosystem Composition, Structure, and Function--the parts of the forest, the arrangement of the parts, and how the parts work together. Particular concerns are loss of large living trees, large standing dead trees (snags), and large fallen trees.	Yes The cost increases as continued cropping removes forest composition and structure	No
Loss of Biological Diversity--the genetic, species, and ecological community diversity that is necessary to maintain short-term and long-term forest functioning.	Yes Local extirpation of species results. Tree planting reduces the natural gene pool of trees, which are the most genetically diverse plants in a forest.	No
Soil Degradation--loss of diversity of soil microorganisms, landslides, other types of soil erosion, and damage to overall soil structure.	Yes Related to logging machinery operating in inappropriate places, to loss of forest composition and structures, particularly large fallen trees, and to slash burning.	No By maintaining composition and structures, soil is protected.
Water Degradation--loss of water quality, quantity, and/or timing of flow. Closely associated with soil degradation.	Yes Removal of forest canopy in clearcutting results in flooding, which increases as clearcut area increases. Loss of old growth forests and large accumulations of decaying wood results in poor water quality and erratic timing of flow	No Forest canopies are maintained, even in logged areas. Old growth forests are maintained throughout the landscape.

COSTS AND BENEFITS	CLEARCUTTING	ECOLOGICALLY RESPONSIBLE PARTIAL CUTTING
Indirect Costs:		
Reduced Wood Quality and Wood Value--loss of high value, high quality mature wood.	Yes Clearcut systems of timber management intend to replace old trees (high quality, high value wood) with young trees (low quality, low value wood)	No Most of the forest sites in the Slocan Valley (and much of BC and the rest of Canada) cannot compete with other parts of the world in growing wood "fibre." Slow growth of trees means that we are better off to grow high quality wood by maintaining old trees in the forest.
Degradation of Non-Timber Forest Values and Uses--from spiritual values and medicinal plants to commercial mushroom picking and tourism.	Yes Clearcuts degrade both the specific area and the larger landscape within which they occur. This cost is magnified the more clearcuts occur, and the more clearcuts are spread across the landscape.	No Forest composition, structures, and functioning are maintained at all scales. Many non-timber uses are compatible with ecologically responsible partial cutting. Timber cutting only occurs in certain parts of the landscape to ensure that forest uses are **balanced** throughout the forest.
Employment Losses--over time result from mechanization to increase timber company logging production and profits.	Yes Clearcutting is highly mechanized	No Ecologically responsible partial cutting results in significant **employment gains** compared to clearcutting.

Partial cutting methods have proven to be both economically and ecologically viable for Merv Wilkinson on Vancouver Island and for Menominee Tribal Enterprises in Wisconsin. Merv has been using selection cutting methods in his 160 acre forest for the past 50 years. His forest currently contains more volume than when he started and he has entered each part of the forest for cutting up to five times. His forest also contains examples of old-growth trees that are up to 1700 years old. The forest is diverse and healthy, with little incidence of insect or disease damage. Merv makes approximately one-third of his income from his forest.

The Menominee have been managing 232,000 acres of forest in Wisconsin since 1850. They started with an inventory of 1.2 billion board feet. They have used selection systems to cut 2 billion board feet and still have a diverse, healthy forest containing 1.5 billion board feet, or more volume than when they first started cutting the forest.

Merv Wilkinson and Menominee are two examples that show that partial cutting methods can provide a continuous supply of wood while maintaining a healthy, diverse forest.

6.2.1.2 Employment and Financial Considerations—Ecologically Responsible Timber Management Compared to Conventional Timber Management

As described earlier in this report, applying an ecosystem-based approach to forest use in the Slocan River watershed necessitates a shift from conventional timber management to ecologically responsible timber management. This shift is a move away from clearcutting that degrades forest functioning, reduces long-term timber productivity, and forecloses upon non-timber forest values; towards a system of timber management that maintains fully functioning forests at all scales through time. Due primarily to ecological degradation from past clearcutting and to the currently established mechanized logging infrastructure, this shift will not be without some short-term stress. Specifically, as the initial analysis below indicates, some employment losses are inevitable in the shift from conventional timber management to ecologically responsible timber management. However, as the analysis also demonstrates, these employment losses are inevitable if conventional timber management continues, because current timber cutting rates are not biologically sustainable (the MoF Arrow TSA Supply Analysis projects a 32% decline in AAC in the long term), and because of the need to balance non-timber forest uses with timber management. Thus, the choice is simple:

> Shift to ecologically responsible timber management now while options still exist for an ecologically responsible annual allowable cut as part of a diverse, ecosystem-based economy founded upon balanced, ecologically responsible forest use across the Slocan Valley landscape.
>
> \- or -
>
> Continue to practice conventional timber management and foreclose upon the emerging diverse ecosystem-based economy that depends upon maintaining a high quality environment by maintaining fully functioning forests across the entire Slocan Valley landscape.

In the shadows behind this choice is also a choice of who controls the land, the resources, and the economy in the Slocan Valley. Ecologically responsible timber management is unattractive (“unrealistic”) to large corporations and large governments who wish to control local communities and local ecosystems in order to export capital and other benefits from local areas, while leaving local communities with the costs of ecosystem degradation and, eventually, degraded economies. On the other hand, ecologically responsible local control of ecosystems recognizes that the first priority must be protection of fully functioning ecosystems in order to sustain human cultures and economies. This understanding leads to sustainable, community-based economies that are founded upon diverse, balanced forest uses, all of which protect ecosystem functioning.

Thus, the discussion that follows illustrates the results of a paradigm shift from an industrial, short-term economic expediency ethic to an ecosystem-based ethic. The data presented is initial, and needs to be refined through field checking and further analysis. However, the data presented here provides a foundation from which the ecologically responsible timber management component of an ecosystem-based economy can be developed for the Slocan Valley landscape.

In proposing ecologically responsible timber management for the Slocan Valley landscape, and comparing it to conventional timber management, there are four important variables to consider:

1. The ecologically sustainable timber cutting rate (i.e. annual allowable cut or AAC) compared to the conventional timber cutting rate (AAC).
2. The volume of timber required to produce one job in ecologically responsible timber management versus conventional timber management.
3. The capital required to produce one job in ecologically responsible timber management compared to conventional timber management.
4. Employment levels (considering logging and wood products manufacturing) with ecologically responsible timber management compared to conventional timber management.

In many respects, the discussion of these variables below will bring the reader back to the issue of who controls what. Under conventional timber management, high daily and annual timber cutting rates are necessary to service large capital debts, and to employ a modest to low number of people. In contrast, under ecologically responsible timber management, small daily and annual timber cutting rates are all that is necessary to service small debts and employ a large number of people for each tree cut compared to conventional timber management. In conventional timber management, the need for large amounts of capital means that critical decisions are directly or indirectly controlled by large financial institutions far removed from local communities. However, with ecologically responsible timber management, the lack of need for large amounts of capital permits local control of decisions that affect land and local communities.

As described in Sections 4.3.6 and 5.7, ecologically sustainable timber cutting rates or annual allowable cuts (AAC) have been estimated for the short term and long term. The short-term ecologically sustainable AAC is significantly lower than the long-term AAC, because:

1. At the current time, significant portions of wholistic timber zones have either been logged or are young forests. These areas either need forest restoration or need to grow older before ecologically responsible timber cutting can occur.

2. Conventional timber management would compensate for the problem described in 1) above by logging mature forests in other parts of the landscape until logged or young forests reached maturity. However, ecosystem-based approaches/ecologically responsible timber management remove many mature forest areas from consideration for timber management, because of ecological limits, inclusion in the protected landscape network, and zoning for non-timber forest uses. Thus, the landbase for ecologically responsible timber management is significantly smaller than that used in conventional timber management, particularly in landscapes that have been degraded by past clearcutting or contain large areas of young natural forest. Both of these situations exist in the Slocan River watershed.
3. Restoration of forests degraded by clearcutting requires extensive periods of time and the results of restoration efforts are uncertain. Thus, short-term ecologically sustainable AACs must consider both the length of time necessary for restoration and the uncertainty of success of restoration efforts.

The short-term ecologically sustainable AAC is estimated to be **10,288 m^3** which will steadily move upward to the long-term ecologically sustainable AAC of **23,022 m^3** over a period of approximately 100 years.

As explained earlier in Section 4, ecologically sustainable AACs must be determined and applied for small watersheds within the Slocan River watershed. A summary list of the number of small watersheds by landscape analysis unit is found in Section 5.9, and a more detailed listing of small watersheds for determining and applying an ecologically sustainable AAC in the Slocan River watershed is found in Appendix 8. Because ecologically responsible timber management requires that AACs be determined and applied for small watersheds, an overall ecologically sustainable AAC is presented here only as a comparison to the estimated conventional timber management AAC.

In order to compare cutting rates from conventional timber management with cutting rates from ecologically responsible timber management, the Silva Forest Foundation estimated a ***Gross MoF AAC*** for the Slocan River watershed. Since neither the British Columbia Ministry of Forests nor Slocan Forest Products determine and administer an allowable annual cut specifically for the Slocan River watershed, we were unable to directly compare our conventional AAC with an AAC determined by government or industry. However, we used standard Ministry of Forests assumptions (i.e. netdowns) to estimate the Gross MoF AAC for the Slocan River watershed (Ministry of Forests 1994). These results are described in more detail in Section 5.7.

Because we were unable to model MoF netdowns for cut block adjacency, steep slopes, visual management, and wildlife management, the Gross MoF AAC for the Slocan Valley is likely overstated by at least 25%. Tree Farm Licence #3 (TFL 3) or the Little Slocan River drainage basin, is the only landscape analysis unit within the Slocan River watershed for which a conventional or Ministry of Forests AAC has been determined by the Ministry of Forests, Slocan Forest Products, and the Silva Forest Foundation. In this particular landscape analysis unit, SFF's calculation of the Gross MoF AAC is 32% larger than the conventional AAC as determined by the Ministry of Forests and Slocan Forest Products. Therefore, we developed a ***Net MoF AAC*** by deducting 25% from the Gross MoF AAC for the Slocan River watershed. Based upon the comparison of AACs for TFL 3, this is a conservative reduction. In our modeling process, we believe that the Net MoF AAC provides the best estimate of the current conventional timber management AAC for the Slocan River watershed.

The Silva Forest Foundation believes that the Net MoF AAC must be further reduced to account for conventional timber cutting assumptions that lead to a nonsustainable cutting rate, due to Forest Practices Code requirements, due to long-term site degradation from clearcutting and overcutting, and due to required protection of non-timber forest values. We estimate that reduction to be 50% of the Net MoF AAC. **If one were to attempt to carry out truly sustainable timber management under conventional approaches, the *MoF AAC After Falldown* (50% of Net MoF AAC) would be a good estimate of the AAC.** Thus, if the Ministry of Forests and Slocan Forest Products were serious about a sustainable timber cutting rate, even under conventional timber management, they would reduce the net MoF AAC to the MoF AAC After Falldown. The MoF Arrow TSA Timber Supply Analysis projects a 32% decline in AAC in the long term to account for current nonsustainable cutting rates in old growth and young natural forests. Therefore, the SFF reduction of 50% of the Net MoF AAC to determine the MoF AAC After Falldown is reasonably consistent with Ministry of Forests estimates for the conventional long-term AAC.

The three conventional timber management AACs are:

- **Gross MoF AAC: 226,670 m^3--**assumes 100% of the Gross MoF AAC calculated by the SFF for the MoF landbase will actually be logged. This is unrealistic, because we were unable to model MoF netdowns for cut block adjacency, steep slopes, visual management, and wildlife.
- **Net MoF AAC: 170,002 m^3--**reduces Gross MoF AAC by 25% (current AAC for TFL 3 is 32% less than the Gross MoF AAC as determined by SFF)
- **MoF AAC After Falldown: 85,001 m^3--**50% of Net MoF AAC due to Forest Practices Code requirements, long-term site degradation from clearcutting and overcutting, and due to required protection of non-timber forest values.

Three tables below compare the three conventional timber management AACs with the Silva Forest Foundation's short- and long-term ecologically sustainable AACs for the Slocan River watershed:

- Table 6-4: Gross MoF AAC vs. SFF Ecologically Sustainable AAC
- Table 6-5: Net MoF AAC vs. SFF Ecologically Sustainable AAC
- Table 6-6: MoF AAC After Falldown vs. SFF Ecologically Sustainable AAC

Tables 6-4, 6-5, and 6-6 use the three estimated conventional timber management AACs and SFF's ecologically sustainable AACs, in combination with various logging methods, to compare capital requirements, daily/annual timber requirements, and employment generated. Equipment and capital costs for the various types of logging operations compared in Tables 6-4, 6-5, and 6-6 were obtained from equipment estimates from logging equipment dealers, and are detailed in Appendix 11. Logging employment is based upon estimated employment levels for various types of logging operations which are also detailed in Appendix 11. Employment levels for various logging systems are based upon a 210 day working year, and the employment to timber volume ratios are consistent with those described in Section 4.3.8.

Conventional timber management as described in Tables 6-4, 6-5, and 6-6 assumes that only primary wood products manufacturing occurs. If secondary and tertiary wood products manufacturing occurs with conventional timber management, proportionately more jobs can be generated through conventional timber management approaches. However, the SFF believes that conventional timber management is inherently nonsustainable and, therefore, value-added wood products manufacturing jobs associated with conventional timber management are not sustainable. As well, conventional timber management companies operating in British Columbia have resisted development of diverse value-added wood products manufacturing.

Table 6-4: Gross MoF AAC vs. SFF Ecologically Sustainable AAC

Comparison of Employment Potential from Conventional Timber Management and Ecologically Responsible Timber Management
(assumes **100%** of gross MoF AAC is available (1))

	Conventional AAC from MoF Landbase		SFF Short Term AAC (due to Ecological Degradation from Past Clearcutting)		SFF Long Term AAC	
	Conventional Ground Skidding	Conventional Skyline Logging	Small Cat	Horse Logging	Small Cat	Horse Logging
Daily Timber Production (m3)	350	125	30	15	30	15
Capital Employed	$1,757,800	$1,221,300	$120,000	$59,000	$120,000	$59,000
Average daily charges on capital employed	$3,230	$2,244	$283	$108	$283	$108
Rental and Principal Payments on Capital Employed per m3 cut	$9.23	$17.95	$9.43	$7.23	$9.43	$7.23
Loggers Employed	7	7	3	2	3	2
Daily Rental and Principal Payments on Capital Employed per Job	***$461***	***$321***	***$94***	***$54***	***$94***	***$54***
m3 of Timber per Job per Day	50.0	17.9	10.0	7.5	10.0	7.5
m3 of Timber per Job per Year	10,500	3,750	2,100	1,575	2,100	1,575
Capital Employed to Create 1 job	$251,114	$174,471	$40,000	$29,500	$40,000	$29,500
AAC Attributable to MoF Landbase in Slocan Valley Watershed	226,670	226,670				
AAC attributable to SFF Landbase in Slocan Valley Watershed			1,253	1,253	23,022	23,022
Logging Jobs	22	60	1	1	11	15
Milling Jobs (at .5 jobs per 1000 m3)	113	113				
Primary and Secondary Wood Manufacturing Jobs (at 3 jobs per 1000 m3)			4	4	69	69
Total Jobs	**135**	**174**	**4**	**5**	**80**	**84**
Primary, Secondary and Tertiary Wood Manufacturing Jobs (at 6 jobs per 1000 m3)			8	8	138	138
Total Jobs	**135**	**174**	**8**	**8**	**149**	**153**

(1) Assuming 100% of the gross MoF AAC calculated by the SFF for the MoF landbase will actually be logged is unrealistic because we were unable to model MoF netdowns for cutblock adjacency, steep slopes, visual management and wildlife management.

Table 6-5: Net MoF AAC vs. SFF Ecologically Sustainable AAC

Comparison of Employment Potential from Conventional Timber Management and Ecologically Responsible Timber Management
(assumes **75%** of predicted MoF AAC is available (1))

	Conventional AAC from MoF Landbase		SFF Short Term AAC (due to Ecological Degradation from Past Clearcutting)		SFF Long Term AAC	
	Conventional Ground Skidding	Conventional Skyline Logging	Small Cat	Horse Logging	Small Cat	Horse Logging
Daily Timber Production (m3)	350	125	30	15	30	15
Capital Employed	$1,757,800	$1,221,300	$120,000	$59,000	$120,000	$59,000
Average daily charges on capital employed	$3,230	$2,244	$283	$108	$283	$108
Rental and Principal Payments on Capital Employed per m3 cut	$9.23	$17.95	$9.43	$7.23	$9.43	$7.23
Loggers Employed	7	7	3	2	3	2
Daily Rental and Principal Payments on Capital Employed per Job	***$461***	***$321***	***$94***	***$54***	***$94***	***$54***
m3 of Timber per Job per Day	50.0	17.9	10.0	7.5	10.0	7.5
m3 of Timber per Job per Year	10,500	3,750	2,100	1,575	2,100	1,575
Capital Employed to Create 1 job	$251,114	$174,471	$40,000	$29,500	$40,000	$29,500
AAC Attributable to MoF Landbase in Slocan Valley Watershed	170,002	170,002				
AAC attributable to SFF Landbase in Slocan Valley Watershed			1,253	1,253	23,022	23,022
Logging Jobs	16	45	1	1	11	15
Milling Jobs (at .5 jobs per 1000 m3)	85	85				
Primary and Secondary Wood Manufacturing Jobs (at 3 jobs per 1000 m3)			4	4	69	69
Total Jobs	**101**	**130**	**4**	**5**	**80**	**84**
Primary, Secondary and Tertiary Wood Manufacturing Jobs (at 6 jobs per 1000 m3)			8	8	138	138
Total Jobs	**101**	**130**	**8**	**8**	**149**	**153**

(1) Reducing the gross MoF AAC calculated by the SFF for the MoF landbase by 25% yields a result which is probably close to the actual MoF AAC for the Slocan River watershed. We believe our estimate of current MoF AAC is overstated by at least 25% due to our inability to model MoF netdowns for cutblock adjacency, steep slopes, visual management and wildlife management. Note that the AAC for TFL 3 is 65,000 m3, a 32% reduction in the gross MoF AAC for the "Conventional AAC from the MoF Landbase" as determined through he SFF modeling process. Unfortunately neither the MoF nor Slocan Forest Products are able to provide an estimate of the conventional AAC for the Slocan River watershed.

Table 6-6: MoF AAC After Falldown vs. SFF Ecologically Sustainable AAC

Comparison of Employment Potential from Conventional Timber Management and Ecologically Responsible Timber Management
(assumes **50%** of Net MoF AAC is available (1))

	Conventional AAC from MoF Landbase		SFF Short Term AAC (due to Ecological Degradation from Past Clearcutting)		SFF Long Term AAC	
	Conventional Ground Skidding Logging	Conventional Skyline Logging	Small Cat	Horse Logging	Small Cat	Horse Logging
Daily Timber Production (m3)	350	125	30	15	30	15
Capital Employed	$1,757,800	$1,221,300	$120,000	$59,000	$120,000	$59,000
Average daily charges on capital employed	$3,230	$2,244	$283	$108	$283	$108
Rental and Principal Payments on Capital Employed per m3 cut	$9.23	$17.95	$9.43	$7.23	$9.43	$7.23
Loggers Employed	7	7	3	2	3	2
Daily Rental and Principal Payments on Capital Employed per Job	***$461***	***$321***	***$94***	***$54***	***$94***	***$54***
m3 of Timber per Job per Day	50.0	17.9	10.0	7.5	10.0	7.5
m3 of Timber per Job per Year	10500	3750	2100	1575	2100	1575
Capital Employed to Create 1 job	$251,114	$174,471	$40,000	$29,500	$40,000	$29,500
AAC Attributable to MoF Landbase in Slocan Valley Watershed	85,001	85,001				
AAC attributable to SFF Landbase in Slocan Valley Watershed			1,253	1,253	23,022	23,022
Logging Jobs	8	23	1	1	11	15
Milling Jobs (at .5 jobs per 1000 m3)	43	43				
Primary and Secondary Wood Manufacturing Jobs (at 3 jobs per 1000 m3)			4	4	69	69
Total Jobs	**51**	**65**	**4**	**5**	**80**	**84**
Primary, Secondary and Tertiary Wood Manufacturing Jobs (at 6 jobs per 1000 m3)			8	8	138	138
Total Jobs	**51**	**65**	**8**	**8**	**149**	**153**

(1) Assuming 50% of the Net MoF AAC calculated by the SFF for the MoF landbase is available to log in the long term is a realistic assessment of coming cut reductions. The MoF Arrow TSA Timber Supply Analysis projects a 32% decline in AAC in the long term to account for current nonsustainable cutting rates in old growth and young natural forests. There will be further reductions required due to Forest Practices Code requirements, due to long term site degradation from clearcutting and overcutting, and due to required protection of non-timber forest values.

There are many interpretations that can be derived from the comparison of employment potential from conventional timber management and ecologically responsible timber management that is detailed in Tables 6-4, 6-5, and 6-6. Detailed discussion of these tables will proceed as this ecosystem-based plan is refined, and will be based upon more specific timber management data than was available at the time this ecosystem-based landscape plan was prepared.

The primary interpretations which are clear in all three tables (6-4, 6-5, and 6-6) are:

1. The high timber cutting rates of conventional AACs require large amounts of capital per job and, as a result, place high demands on natural capital. As a result, conventional AACs tend to be nonsustainable.

2. Ecologically responsible AACs have a low capital demand per job, and, as a result, place a low demand on natural capital. Hence, ecologically responsible timber management tends to be ecologically sustainable.

3. Employment from ecologically responsible timber management, assuming primary, secondary, and tertiary wood products manufacturing with ecologically responsible timber management, exceeds employment in conventional timber management, assuming only primary wood products manufacturing, when SFF Long-term AAC is compared to the Net MoF AAC (Table 6-5).

4. The Net MoF AAC (170,0002 m^3) is 16.5 times as large as the SFF Short-term AAC (10,288 m^3), and 7.4 times larger than the SFF long-term AAC (23,022 m^3). Direct logging jobs provided by the Net MoF AAC (16 jobs) using conventional ground skidding logging are 3.2 times the number of jobs produced by small cat logging with the SFF short-term AAC (5 jobs), and 1.5 times more than the jobs created by small cat logging in the SFF long-term AAC (11 jobs). This is a mid-range comparison of timber volume required to produce one job and total logging jobs from conventional timber management versus ecologically responsible timber management. Clearly, very large amounts of timber are necessary to produce a few jobs in conventional timber management compared to very small amounts of timber that are necessary to produce a significant number of jobs in ecologically responsible timber management. In other words, ecologically responsible timber management lives off the interest of natural systems, while conventional timber management lives off the interest plus the capital of natural systems—a nonsustainable approach when considered from the standpoint of either ecology or economics (see Table 6-5).

5. In all cases (Tables 6-4, 6-5, and 6-6), from 3.4 to 8.5 times as much capital is required to create one conventional timber management job compared to one ecologically responsible timber management job. Clearly, this means that conventional timber management employment is controlled by capital sources external to the community, like banks and large timber companies. In contrast, the small amounts of capital required to create one job in ecologically responsible timber management permit control of ecologically responsible timber management to remain in the hands of local people and local communities. With the control of

timber management remaining with local communities, ecosystem-based approaches make more sense and are easier to implement.

In summary, employment from ecologically responsible timber management is significantly lower than conventional timber management in the short term (the next 100 years) due to ecological degradation from past clearcutting which necessitates a low ecologically sustainable AAC for the next 100 years. In the long term, employment from ecologically responsible timber management is comparable to conventional timber management employment, particularly when the MoF AAC After Falldown is compared with the SFF ecologically sustainable long-term AAC. Comparing any of the MoF conventional timber management AACs with SFF ecologically sustainable AACs shows that from 1.8 to 6.7 times as much timber is required to provide a job in conventional timber management as compared to ecologically responsible timber management. A similar result occurs when comparing the dollars required to produce one job in conventional timber management versus ecologically responsible timber management.

The choice is clear: Conventional timber management provides significant short-term jobs, but requires large volumes of timber and large amounts of capital to provide these jobs. In contrast, ecologically responsible timber management provides for steady employment that will increase over the long term as ecological degradation from past clearcutting is restored. Compared to conventional timber management, a job in ecologically responsible timber management requires both small amounts of timber and small amounts of capital. The requirement for large amounts of capital in conventional timber management virtually assures that conventional timber management will be controlled by financial institutions and large corporations external to local communities. However, the low capital demands of ecologically responsible timber management permit local control of timber management operations.

Ecologically responsible timber management not only protects forest functioning while providing steady, sustainable employment, but also results in other social and economic advantages compared to conventional timber management. Trees are generally grown for longer periods of time in ecologically responsible timber management compared to conventional timber management. This means that ecologically responsible timber management produces high quality, high value wood which is suitable for primary and secondary wood products manufacturing. In contrast, conventional timber management will produce low quality, low value wood in short cycles, once old growth timber supplies have been depleted.

As has been discussed in several places in this ecosystem-based landscape plan, non-timber forest uses and values are particularly important in the diversification of the economy of the Slocan Valley. Ecologically responsible timber management protects the full range of non-timber forest uses and values. In contrast, conventional timber management that employs clearcutting does not protect most non-timber forest uses and values. Employment differences between ecologically responsible timber management and conventional timber management may be lessened if cultural treatments like pruning and commercial thinning are carried out in ecologically responsible timber management. These activities will not only provide more employment, but will also improve wood quality without compromising forest functioning.

Part, if not all, of the employment differences between conventional timber management and ecologically responsible timber management in the short term can be made up through employment in forest restoration. Section 62.1.4 describes the potential for forest restoration employment in more detail. This plan has not analyzed the number of jobs necessary to plan and administer conventional timber management compared to ecologically responsible timber management. There will be additional jobs created for the detailed planning and administration of ecologically responsible timber management compared to conventional timber management.

In the final analysis, there is a choice for the timber management portion of the Slocan Valley economy:

- Live an illusion of large timber cutting volume that forecloses upon many non-timber forest uses with the eventual outcome being degradation of all aspects of the economy and of much of the Slocan Valley landscape, or

- Reduce timber rates to ecologically responsible levels and maintain a diverse, stable, and sustainable economy founded on both timber and non-timber forest uses and sustained by fully functioning forest ecosystems.

This ecosystem-based plan opts for the second option—a choice that will also provide for options for future generations.

6.2.1.3 Value-added Wood Products—a source of employment benefits

The importance of value-added wood products manufacturing (both secondary/semi-finished and tertiary/finished products) in developing an ecosystem-based economy in the Slocan River watershed is shown in Tables 6.4, 6.5, and 6.6, and is summarized in Table 6.7 below. As indicated in Table 6.7, approximately 92% of total employment in ecologically responsible timber management comes from wood products manufacturing, the vast majority of which is from value-added activities. Tertiary wood products manufacturing alone accounts for approximately 46% of all potential employment from ecologically responsible timber management.

Table 6-7: Employment--SFF ecologically sustainable AAC

Expressed as full time jobs (% total jobs)

Employment Category	SFF Short-Term AAC	SFF Long-Term AAC
Logging	5-7 (8%)	11-15 (8%)
Primary & Secondary Wood Products	31 (46%)	69 (46%)
Tertiary Wood Products	31 (46%)	69 (46%)
Total	**68**	**151**

Note: Total jobs uses the midpoint of logging employment

In order to expand the employment possible from value-added wood products, those operating or wishing to start value-added businesses require a secure supply of wood. In part, this security can be provided through establishment of an open log market (see Section 6.2.1.5). The British Columbia government's commitment to establish an electronic bulletin board that will match up sellers and purchasers of wood could also help local value-added manufacturers locate the wood they need. Guaranteed supply from local primary manufacturers such as Kalesnikoff Lumber and Slocan Forest Products would also help ensure the success of existing and new value-added enterprises. However, as soon as possible, the tenure control by these timber companies needs to be turned over to a Community Forest Board to ensure ecologically and socially responsible timber management, including providing fair opportunities for value-added wood manufacturers to secure timber supplies.

Value-added ventures that purchase local wood need to make a commitment to manufacturing a finished, tertiary product, or to selling partially finished, secondary products to local tertiary wood products manufacturers. The more value is added to a product before it leaves the community, the more local jobs are created, the more money circulates in the community, and the less dependent the community becomes on imports.

Copeland (1995) suggests that additional remanufacturing can occur using the major commercial species growing within the Slocan Valley, including western red cedar, western white pine, Douglas-fir, and western larch. In all cases, the type of wood cut for value-added production must be consistent with maintaining the ecological integrity of the valley. For example, many value-added industries prefer old growth wood for its strength, workability, fine grain, and knot-free characteristics. However, the landscape analysis, performed as part of this ecosystem-based plan indicates that there is less old growth now than was ever historically present in the Slocan Valley, even following a major natural fire. It is therefore recommended that further cutting of old growth be prohibited. Value-added industries need to be developed that can use the smaller, younger trees that are available for ecologically responsible timber management. Many value-added products, from windows and doors to paneling and moulding, can be made from this younger timber, and many value-added products are possible using deciduous species such as birch and aspen. Much of the "young" timber is about 100 years old and has a significant portion of mature wood fibre suitable for premium value-added wood products.

As the keynote speaker at the Kootenay Value-added Wood Forum in Creston said clearly, design is a key to the success of value-added products. Original designs reduce the risk of competition for a similar product and puts the company in a solid position to be the sole provider of the product. The newly established wood design program in Nelson will provide education for those entering the value-added field.

Marketing assistance for new value-added products will be required so that new ventures have a higher chance of success. The current trend to small operations may mean that there is a higher success rate than if the venture must continually employ a large number of people. Small value-added operations have a number of important advantages over large operations:

- Small, niche markets will satisfy the needs of small operations. Many niche markets go unrecognized and unfilled. As well, with high quality, unique specialty products, small niche markets are relatively easy to create. Medium to large timber and milling operations are often not interested in niche markets because their production is frequently based on high volume, dimension lumber in highly mechanized wood processing facilities.
- Diverse, specialty wood products are better produced by small operators than large operators. To produce diverse specialty products, a large manufacturer must change from one large mechanized process to another. This requires significantly more labour and capital than in a small operation.
- Small operations are often "owner-operator" organizations. This usually makes it easier to take advantage of new markets and/or to create new markets with unique products. On the other hand, large wood products producers must go through a more complicated, bureaucratic decision-making process to effect change.

SFF recommends that a marketing specialist experienced in wood products, including value-added wood products, be hired to identify markets for value-added products and to develop a practical strategy to market these products. Due to the variety of value-added products, more than one person may be necessary to achieve this goal.

Fraser (1993) and Copeland (1995) have proposed a variety of value-added industries that could use existing local tree species and wood supply. Remanufacturing ideas include flooring, tongue-and-groove wainscoting, paneling, moulding, window and door components. Further value can be added by producing pre-built log or timber frame houses, cabinets, doors, and windows. Even more labour-intensive products include furniture, wood crafts, boats, toys, window shutters, picture frames, carvings, and other art work.

SFF recommends that a practical local, regional, national, and international study be carried out to identify wood product lines and markets for these wood products from the

Slocan Valley. This study must be preceded by an accurate, field-based inventory from wholistic timber zones to determine what species, quality, and quantity of wood are available.

A mix of kinds of value-added industries, as well as various sized operations, will contribute to the kind of diversity that strengthens a local economy. With just basic value-added wood manufacturing, at least 4.5 jobs per 1,000 m^3 of timber (30 logging truck loads) can be added to current employment levels in wood products manufacturing. (Select Standing Committee, 1993)

6.2.1.4 Restoration

Ashby (1987) states "Restoration is to a very large extent a process of bringing about changes which would occur naturally given time, but causing them to occur much more rapidly."

Ecological restoration is the art and science of enabling or hastening the natural successional processes which gradually reverse or lessen the impact of human caused changes in ecosystems. Such "human caused changes" are usually caused by resource exploitation for human uses, and usually result in reduced biological activity and reduced production of useful products such as oxygen, fish, game, clear water or wood. We therefore refer to ecosystems that have been significantly changed by resource use as "degraded" ecosystems. Restoration aims to halt further degradation, and where possible, to facilitate ecosystem recovery. Note, however, that human actions cannot "repair" a damaged ecosystem. All that we can do is try to repair obvious damage, help Nature restore missing parts that we can identify and replace, and hope that the passage of time and natural processes will result in a full recovery.

Restoration can occur at a variety of scales, ranging from very small scales, such as creating a single wildlife tree, to large scales, such as adding coarse woody debris (i.e. fallen trees) to cutblocks in an entire watershed. As ecologists have begun to understand the significance of whole systems and landscapes in the last 20 years, we have realized that our overall restoration goal must be restoration of the forest landscape, at the largest scale. However, such far-reaching goals are accomplished step by step, by activities at the local, or stand level scale.

The cumulative negative impacts of logging and landscape change are significant in the Slocan Valley watershed. The impact of logging 10 ha is likely small to nil; of 1,000 ha, significant; of 10,000 ha, severe. To date, over 20,000 hectares have been clearcut in the Slocan River watershed (See Section 5.13). Restorationists also seek to use cumulative effects to achieve their goals, but in a positive manner. A restoration program that adds ecological components to 10 ha will not significantly impact the health of the Slocan Valley landscape. Treating 1,000 ha will help, but treating 10,000 ha or more will effect the maximum possible cure.

This ecosystem-based landscape plan has helped to quantify and describe these impacts, but more specific landscape and stand information is needed to design a restoration plan.

The Silva Forest Foundation recommends that an assessment of logged landscapes and stands be carried out and a restoration plan developed for the Slocan River watershed.

Any discussion of restoration must respect the fact that human restoration actions cannot fully repair damaged and degraded forest ecosystems. Forest trees, and the terrestrial and aquatic ecosystems they support, are based on the forest soil. The soil is in turn based on the presence and contribution of the forest trees. Forest soil is not an inert substance, but rather is a complex and poorly understood living ecosystem. Most long-term damage to the forest that requires restorative action is in fact damage to the forest soil.

However, humans cannot simply “restore” damaged soil ecosystems any more than healers can “heal” a severe wound. Forest ecosystems and forest soils took centuries, even millenia, to develop. Restoration can only hope to improve degraded conditions (Carr 1983). The only known restorative method is to alleviate the worst physical damage, take measures to prevent further damage from occurring, add missing components if possible, and wait for time to pass and the ecosystem/patient to recover. The ecosystem/patient does the actual healing; the task of the restorationist is to facilitate that healing.

To expand on the above metaphor, repairing the worst physical damage to soil can take the form of reducing soil compaction and restoring natural water drainage patterns and rates. Measures to prevent further damage can include revegetating disturbed sites so that exposed soil is protected, and so that biological regulation of soil weathering processes by plants is resumed. Examples of adding missing components include adding large fallen trees to stream channels and planting plant species which should be part of the successional process on a site but which are absent.

Restoration activities in the Slocan River watershed are required for two main reasons:

1. **Restoration is the right thing to do.** Past resource extraction in the Slocan River watershed, especially timber extraction, has reduced the ecological health and diversity of the forests, soils and watercourses in the Slocan Valley, and has left many areas significantly degraded. People made the choices that resulted in damage to the land and ecosystems in the area, causing death and hardship to many non-human organisms. In our opinion, people are therefore ethically required to take actions to reduce the impacts of these previous choices, and to attempt to restore the ecosystems to their prior condition. Those responsible for ecosystem degradation need to pay for restoration
2. **Restoration is enlightened self-interest.** Ecosystem degradation reduces the production of ecological goods and services that are valuable to people, such as salmon, fresh water, wildlife and timber. Restoration aims to restore previous levels of production of these factors.

a. Comparison of MoF Tree Regeneration and Ecological Restoration

The Ministry of Forests (MoF) and/or Slocan Forest Products (SFP) maintain that tree regneration, the obligation of timber companies to plant trees and tend their growth to a “free to grow” (i.e. free from shrub competition) status restores forests. The portion of the Silviculture Regulation which defines regeneration requirements silviculture, enabled under Section 10.1 of the Forest Act, is cited below. A Forester must approve a plan which sets out the stocking level which will be achieved on any logged area, noting the following points:

> (2) For the purposes of subsection (1) (n), "stocking standards" means
> (a) the preferred and acceptable species of trees,
> (b) the minimum allowable horizontal distance between trees of the preferred and acceptable species for the trees to be considered to be well spaced,
> (c) the target number of healthy well spaced trees of the preferred and acceptable species per hectare,
> (d) the minimum number of healthy well spaced trees of the preferred and acceptable species per hectare,
> (e) the minimum number of healthy well spaced trees of the preferred species per hectare,
> (f) the maximum number of coniferous trees allowed per hectare,
> (g) the maximum and minimum number of healthy well spaced coniferous trees allowed per hectare after a spacing treatment has been carried out under section 22
> (h) the required standards that must be met by a healthy well spaced tree of a preferred or acceptable species during the free growing assessment period, including
> (I) the minimum height, and
> (ii) the height relative to competing vegetation within a radius of one meter of the tree trunk.

MoF tree regeneration requirements are limited in scope to those activities required to meet the conventional forestry or short term timber management targets set out in a silvicultural plan. The operations required will include various combinations of restocking the logged site with commercial conifers, controlling deciduous vegetation, and controlling coniferous stocking. Soil disturbance rehabilitation, replacement of depleted ecosystem structures, and establishment and maintenance of early successional shrub/herb communities are not considered. In fact, conventional tree plantation maintenance as carried out by MoF and the timber industry may contribute to further site and soil degradation. For example, the deciduous vegetation that occupies many areas following logging is a major source of soil organic matter, often improves soil structure through decompaction, may help to stabilize disturbed areas, and often harbors nitrogen fixing bacteria. Conventional foresters often try to reduce or remove this “competing” vegetation, which restorationists greatly value on logged sites for its beneficial properties.

SFF believes that the following activities will be required on some or all of the logged area within the Slocan River watershed:

- Ripping compacted areas to reduce soil compaction.
- Reconstruction and/or deactivation of roads which are no longer required.
- Revegetation of disturbed areas and/or areas treated above.
- Replacement of coarse woody debris (large fallen trees) in riparian ecosystems.
- Replacement of snags (standing dead trees) in logged areas.
- Thinning overly dense, young coniferous and/or deciduous stands.
- Planting and tending conifers in riparian deciduous shrub communities.
- Reestablishing early successional shrub/herb communities on logged areas.
- Re-establishing a natural mixture of coniferous and deciduous trees in logged areas.

Most of these restoration activities do not occur as part of MoF tree regeneration requirements. Therefore, forest restoration must be viewed as a separate and distinct activity when compared to tree regeneration requirements of the MoF and SFP.

Table 6-8 describes restoration treatments by logged ecosystem type and compares these treatments with the requirements of MoF tree regeneration.

Table 6- 6: General Restoration Treatments by Logged Ecosystem Types

RESTORATION CATEGORIES	LOGGED RIPARIAN ECOSYSTEMS	ECOSYSTEM WHOLISTIC TIMBER ZONES	TYPES NONTIMBER ZONES-- UPPER SLOPES	*Included in MoF Basic Silviculture Requirements*
Soil Degradation -reduce compaction -restore drainage patterns		YES	YES	NO
Coarse Woody Debris Replacement -replace fallen trees	YES	PARTIAL		NO
Coarse Woody Debris Replacement -replace snags	YES	YES	YES	NO
Revegetation -restore shrub/herb layer		YES	YES	NO
Restocking -plant conifers	YES	YES	YES	YES Commercial Conifers to Minimum Stocking Levels
Riparian -stabilize streambanks -reconstruct channels -replace LOD	YES	YES	YES	NO
Precommercial Thinning -thin overly dense conifers		YES	YES	NO Part of Intensive Silviculture
Thinning -thin overly dense shrubs	YES			Yes Brushing and Weeding

b. Provincial and local recognition of the need for restoration

By establishing the Forest Renewal Plan, the government of British Columbia recognizes that past logging and road building practices have caused extensive damage throughout the province that must now be repaired—if, in fact, it is possible to repair such damage. However, to this point Forest Renewal BC (FRBC) has not addressed the problems of forest degradation—overcutting and clearcut timber management. FRBC dollars have largely been returned to the timber industry to repair mistakes they continue to make.

The Ministry of Forests admitted that clearcut logging and road building contributed to the damages suffered by property owners in the Van Tuyl Creek area north of Slocan when landslides occurred in early 1991. Property owners were compensated for damages in an out-of-court settlement. Water user groups insisted that the Ranch Ridge landslides in the late 1980s occurred because of logging directly above the initiation point of the slide.

Avalanche chutes have either formed or reactivated following clearcut logging performed in late 1993 on Frog Peak in Tree Farm License #3. Avalanches have originated at both the top and bottom of this clearcut area.

The West Kootenay-Boundary CORE table recognized that "in order to sustain a viable forest industry, ecologically appropriate rehabilitation of harvested lands must be acknowledged as an integral component of timber extraction" (CORE 1994, Appendix 4-1). The table recommended training in low impact harvesting practices and that the government develop programs that will rehabilitate roads, streams, and forest ecosystems.

> *The Table recognizes that due to the finite limits of our natural resources and the cumulative impact of our economic and social activities, it is necessary to develop an economy which emphasizes the restoration and maintenance of ecological systems. It recommends that government direct economic activity towards this goal through such measures as:*
>
> *a) structuring taxes and incentives so as to foster sustainability and reflect the full environmental costs of development;*
>
> *b) wherever possible, replacing restrictions and regulations with incentives for sustainable and restorative economic activity;*
>
> *c) establishing standards that encourage innovation and environmental productivity;*
>
> *d) rewarding conservation of energy and resources;*
>
> *e) penalizing waste.*
>
> Kootenay-Boundary Land Use Plan, Appendix 4-1

c. Restoration: employment opportunities and costs

Past and current logging and road building practices have created many years worth of restoration problems that need to be addressed. In the future, implementation of ecologically responsible practices can eliminate the need for restoration. The kinds of restoration work required have been identified in Sections 6.1.1.3 and 6.2.1.4a. If these types of activities are implemented, approximately 139,018 person/days of work can be created, with the total cost of restoration at about $194 million (see Table 5-16).

Table 6- 9: Summary of Restoration Requirements for the Slocan River Watershed
(derived from Table 5-16)

	Rip Trails & Landings	Re-Contour Roads & Trails	Re-Vegetate Disturbed Sites	Add Coarse Woody Debris to Site	Add Standing Snags to Site	Total
Area to be Treated (ha)	2,504	2,504	3,756	6,957	12,148	27,870
Total Estimated Restoration Costs	$2,003,448	$10,017,240	$26,295,255	$120,003,851	$35,835,804	$194,155,598
Employment per hectare (ha/person day)	0.5	0.2	0.1	0.3	0.2	N/A
Total Employment (person/days)	5008	12,520	37,560	23,190	60,740	139,018

Note: Forest restoration requirements based upon 20,758 ha of clearcuts, current to 1991 for the Slocan River Watershed.

The employment estimate for restoration can be converted into person-years of employment in the following way:

- Assume 100 day field season for restoration work
  person years of restoration work = 139,018 person days divided by 100 person days/person year = 1,390 person years
- Assume four 6-person crews (24 people total)
- Years to complete restoration = 1390 person years divided by 24 people = 58 years

Thus, forest restoration activities can create 58 years of work for 24 people, working 100 days per year (approximately half-time employment). This employment figure is conservative because not all restoration tasks are included in the employment estimate, and the clearcut area requiring restoration is now significantly larger and is growing compared to the clearcut area used to calculate restoration costs in Table 6-9. Also, this restoration estimate does not include riparian ecosystem and stream channel restoration, which are also required in logged areas in the Slocan River watershed.

Employment from restoration activities in the Slocan River watershed will offset short-term timber management jobs lost because of reducing the current AAC to an ecologically sustainable level. Slocan Forest Products, the timber company that has profited from logging in the Slocan Valley, needs to be held responsible for restoration costs.

6.2.1.5 Open Log Market

As the Ministry of Forests' Lumby log yard demonstrates, logs sold on the open market generate far more stumpage for the government than that received from holders of major tenures (such as Slocan Forest Products). Logs entering the Lumby log yard are sorted by species and grade before being put up for bid. Based on numbers supplied by the Ministry of Forests, the average stumpage paid by those who bid through the log yard was $45 per cubic metre, compared to the average appraised stumpage rate paid by licensees of about $11 per cubic metre in the Vernon area (M'Gonigle and Parfitt 1994). The log yard stumpage was calculated as the average selling price of the logs, less all costs for logging, road building, tree planting, and operating the log yard.

One important lesson from the Lumby log yard is that tenure holders pay too little stumpage relative to the value of the wood. As a result, there is little or no incentive to add value to the products. Companies make more money by buying wood at low prices (compared to market value), and selling high volumes of dimension lumber, a relatively low margin wood product. Timber companies prefer this system because they specialize in one or two general products and do not have to add to capital and employment costs by diversifying. However, if companies had to bid on and pay fair prices for the wood, they would pay much more and would seek to add more value to the products sold.

An open log market also permits existing value-added manufacturers a fair opportunity to bid on wood of the type and quality they need for their products. As well, those who have rights to cut timber, whether on private or public land, can be guaranteed the best price for their wood when sold through an open log market.

An open log market requires workers to grade and sort wood, manage and administer the operations. The Lumby log yard employs seven people full-time and handles about 59,000 m^3 of wood per year. Although the Ministry of Forests has not specified the number of administrative staff involved, two additional jobs seem likely. Thus, based on the SFF ecologically sustainable AACs, two to three people would be needed to administer and run a log sort yard for the SFF short-term AAC, while four to five people would be needed for the SFF long-term AAC.

Comment [GA1]:

Comment [GA2]:

6.2.1.6 Certified Wood Products (Eco-labeling)

Consumers throughout Canada, the United States, and Europe are beginning to demand products that are produced in ways that do not damage the ecosystem. "Green," or environmentally friendly, products are already available through organic foods, unbleached paper products, and products that have not been tested on animals. Increasingly there is a demand for timber products that come from ecologically responsible timber operations. People want to purchase everything from 2 x 4s to furniture that comes from certified sources.

Market surveys indicate that consumers are willing to pay a 5 to 15% premium for certified wood that can be guaranteed to have been produced in an ecologically responsible way. A buyers' group in the United Kingdom, representing purchasers of wood products worth $2 billion annually, wants to shift entirely to ecologically responsible wood products by the year 2000. Similar buyers' groups are forming in the United States. Consumers indicate that they trust independent, environmental organizations more than government and industry to carry out reliable certifications of wood products. Thus, while relatively few sales of certified wood have occurred to date, there seems to be a market for ecologically responsible, certified wood products.

The Forest Stewardship Council (FSC) based in Mexico has developed a set of principles and criteria designed as a minimum standard for eco-labeling throughout the world. FSC will accredit certifiers so that consumers can be assured that, if a certifier has been approved by FSC, these minimum standards have been met during the certification process. FSC expects regional guidelines to be developed within countries and that certification taking place within that region will meet regional guidelines.

In response to the more environmentally-based FSC certification program, the Canadian timber industry and government have hired the Canadian Standards Association (CSA) to develop standards for sustainable forestry. Auditors using CSA standards would certify management approaches, but would not evaluate on-the-ground performance. This is in contrast to the FSC system that certifies performance. Large European companies such as Sainsburys in the United Kingdom have stated clearly that they are not interested in purchasing wood certified by the CSA and will purchase wood carrying the FSC label.

Greenpeace Canada has orders confirmed in Europe for eco-labeled wood products and certifiers in the United States are working hard to meet the demand for certified wood products. The Silva Forest Foundation receives frequent inquiries about the availability of certified wood products. Thus, eco-labeling presents a marketing tool that will need to be further explored. Given the current interest in certified wood products and the lack of readily available supply, wood products manufacturers in the Slocan Valley have the opportunity to enter this rapidly growing market on the ground floor. While the process of certification itself will produce few jobs, if timber operations in the Slocan Valley become certifiable, then potentially large markets can be developed for value-added products made from certified wood.

6.2.2 Mining

Future mining employment is difficult to predict. The proponents of the graphite mine in the Passmore area were reluctant to estimate employment levels should the full mine prove feasible and environmentally sound. While there appears to be a change in the type of mining activity towards gemstones and graphite, it is unknown what level of employment these types of mining activities represent, or whether any kind of mining will provide sustainable levels of employment.

6.2.3 Tourism

Copeland (1995) notes that between 1981 and 1994, tourism employment has increased by 8% per year. Applying an 8% annual increase from 1995 forward would mean that 294 people would be employed in tourism by the year 2000. The level of tourism development depends heavily on maintaining the natural beauty and ecological integrity of the Slocan River landscape.

The current trend of increases in bed and breakfast accommodations, restaurants, and retail stores catering to tourists can be expected to continue. As well, new ventures are feasible in a wide variety of activities such as mountain bike rentals, boat service across Slocan Lake to Valhalla Park, canoe rentals, back-country ski guiding, back-country hiking and nature interpretation , and other businesses catering to low-impact tourism.

Definitions and standards for ecologically responsible tourism activities need to be developed, as well as educational materials that can be distributed by all tourism businesses. If the Slocan Valley is to welcome tourists as a key part of the economy, then tourism operators and tourists must ensure that damage to the ecosystem does not result from tourism.

6.2.4 Retirement

As pointed out in Section 1.1.4, the Slocan Valley attracts increasing numbers of retired people, especially to the villages where amenities are more readily accessible. This emerging trend can be expected to continue, although no figures are available.

If retirement facilities are constructed for those who moved here in the late 1960s and early 1970s, then considerably more retirement income will be reinvested in the community. While retirement may create only a few direct jobs, the economy is strengthened if retired people remain in the community and spend their income locally. Service businesses that might otherwise rely upon resource extraction industries can be supported by retirees.

Like tourism, maintaining the natural beauty and ecological integrity of the Slocan Valley are critical both to attracting and maintaining the population of retired people.

6.2.5 Home Based and Small Businesses

The Holman study (1994) pointed out that many home-based and small businesses identified the quality of life available in the Slocan Valley to be an important factor in deciding to establish their business. Like tourism and retirement, home based and small businesses also depend on maintaining the rural qualities and natural ecosystem integrity of the Slocan Valley. If this requirement can be met, small and home-based businesses can expect to continue to increase in number, and to play a key role in the diversification of the local economy and in the replacement of imports with locally produced items.

Home-based businesses can be extremely varied. One area not sampled was that of people who work out of their homes, but are connected via computer networks to clients or employers who may be thousands of miles away. Usually these are professional people who can choose to live wherever they want due to their ability to communicate electronically with others. These people are difficult to sample since they do not rely on the local population as clientele. However, since they could choose to locate anywhere, presumably they have identified a quality of life in the Slocan Valley that caused them to relocate there. Again, as long as the quality of life remains intact, computer-based home businesses can be expected to increase.

Expansion of home-based businesses is threatened by increasing noise pollution from Highway 6, as well as by increased clearcut logging and damage to domestic water supplies.

6.2.6 Wildcrafting

As already mentioned, wildcrafting or the harvest of non-timber forest products, depends on maintaining fully functioning forests. This means that some areas that are valuable for wildcrafting must be protected from logging of any sort. Where logging occurs, logging practices must be ecologically responsible in order to maintain the viability of existing wildcrafting activities and to provide opportunities for additional employment in wildcrafting.

Standards and guidelines for ecologically responsible wildcrafting must be developed. There are currently no policies that limit the amount of harvest, regulate harvesting techniques, nor require sanitary conditions of wildcrafters who camp near their harvest areas. Overharvesting of non-timber forest products can damage forest ecosystems. In addition, improper human waste disposal can damage domestic water sources, and improper garbage disposal can create both wildlife and human health problems. Wildcrafters from the Slocan Valley are actively involved in developing provincial guidelines for wildcrafting and recognize the need for some regulations applicable to wildcrafting activities.

There is great potential for increased employment through ecologically responsible wildcrafting activities. As well as sale of raw materials such as mushrooms, floral greenery, and fiddlehead ferns, there is also potential for value-added products such as tinctures, herbal medicines, woven baskets, and furniture. Packaging, shipping, and marketing jobs will also be created as wildcrafting expands.

Hans Fuhrmann claims that markets exist, particularly in Japan and Europe, for many more plants than are currently harvested in the Slocan Valley, but that currently the marketing infrastructure for these products does not exist. A key to the stability of future wildcrafting activities is a strong marketing strategy.

SFF recommends that a person experienced in the sale and marketing of non-timber forest products be hired to identify markets for and promote non-timber forest products from the

Slocan Valley. We further suggest that the market study be preceded by an inventory of the annual quantity and quality of various non-timber forest products, assuming an ecologically responsible harvest level.

If practiced sustainably, wildcrafting provides an opportunity to generate significant annual income from the forest and is compatible with ecologically responsible timber management and other human uses of the forest.

6.2.7 Art, Culture, Recreation

Like home-based businesses, tourism, and wildcrafting, the economic viability of art, culture, and recreation requires maintaining the rural nature, natural beauty, and ecological integrity of the Slocan River watershed. Since they are often self employed, artists and writers can choose to live anywhere they wish. Retaining the current high proportion of writers and artists and attracting new talent to the area is dependent upon maintaining and improving the integrity of the natural environment.

Like home-based businesses, the continued contribution of artists to the Slocan Valley economy is threatened by increasing noise pollution from truck traffic on Highway 6.

The wide variety of outdoor recreation activities continues to draw people to the Slocan Valley. Again, these activities depend on maintaining the natural beauty and ecological integrity of the area.

While it is difficult to project increases in employment in the arts and recreation, one can assume that employment will remain steady if the quality of the natural environment is maintained.

6.2.8 Agriculture

A number of studies have pointed out the capacity to expand agriculture in the Slocan Valley (Slocan Valley Final Report 1975, Gower 1989). To date, farmers have had difficulty finding a product mix that is profitable. Current efforts to establish viable organic produce farms and greenhouses may create the stability long sought after by farmers. The increased number of organic food stores in the Slocan Valley (there are now three, one each in New Denver, Passmore, and Crescent Valley) and surrounding area may provide viable markets for locally grown produce. As farmers become established, markets can be expanded outside the valley.

The Kootenay-Boundary CORE table recommended increased value-added products in the agriculture and food industries.

Agriculture, more than any other economic activity, depends on protecting and maintaining a reliable quality, quantity, and timing of flow of water. Damage to water from logging in agricultural water supplies can potentially destroy the viability of agricultural activities.

Many of those involved in agriculture have chosen to live in the Slocan Valley because of the quiet lifestyle and scenic beauty, thus maintaining these qualities is important to the success of agriculture as part of the economic mix in the Slocan Valley.

As pointed out by Gower (1989), those interested in agriculture could benefit by working together to develop an effective strategy for agricultural businesses in the Slocan Valley. Much of the viable agricultural land in the valley is owned by people who no longer farm the land. Many of those moving to the valley who are interested in farming cannot afford to purchase prime agricultural land. Long-term lease arrangements between landowners and those who want to farm could increase agricultural production on prime agricultural land.

6.2.9 Barter and Trade Systems

Barter and trade systems will continue to be an important contributor to the local economy, though not to statistical analyses of jobs. The ability to trade and barter among neighbors and friends permits many people to thrive when their cash income is lower than average and also contributes to community building. The success of trade systems such as the Southern Slocan Valley Community Exchange depends in part on a relatively stable community population. Again, the people who participate in trade systems choose to live in the rural Slocan Valley because of the quiet lifestyle and the natural beauty of the area. Marked change to either of these two qualities of life could cause people to move away and could weaken the trade and barter systems in place.

6.2.10 Employment in Government, Education, and Health Care Services

Employment increases in government, education, and health care services can be expected to increase in direct proportion to population increases. Given the limited amount of land available for human settlement in the steep, narrow Slocan Valley, the population can expected to experience steady but modest growth. As long as basic levels of government services are maintained and the population does not decline, employment in these areas can be expected to be maintained.

6.2.11 Summary of the Proposed Economy

The viability of many of the emerging economic trends in the Slocan Valley—tourism, home-based business, the arts, wildcrafting, retirement, and agriculture—depends on maintaining the ecological integrity of the forested landscape in the area. Protection of domestic and agricultural water supplies is crucial to land values and the economic viability of many non-timber forest uses such as tourism, agriculture, and wildcrafting.

Ecologically responsible timber management, although requiring reductions in current cutting levels, means that there will continue to be jobs in the forest and in primary milling facilities, though fewer than the present. Using labour-intensive, ecologically responsible partial cutting will require more people per cubic meter of wood cut. New jobs can be created by establishing value-added wood products manufacturing. Particularly tertiary (i.e. completely finished products such as furniture) products manufacturing is labour-intensive and requires relatively low volumes of wood. Thus, more employment is generated from less timber cut. An open log market and a commitment by primary producers can help ensure a steady wood supply to existing and new secondary manufacturing businesses. Eco-labeling of wood products could allow local wood producers to gain access to an expanding market.

New jobs will be created in order to restore degradation caused by past road construction and logging practices.

Wildcrafting, or the harvest of non-timber forest products, has the potential to provide increased employment. Expansion depends upon maintaining the integrity of the forest. Regulations need to be developed to ensure that rates of harvest are sustainable.

Increased employment in agriculture appears feasible, especially in the area of organic produce. The viability of agricultural activities depends on a dependable supply of clean water and on maintaining the quality of the natural environment.

If the quality of life and natural beauty of the Slocan Valley are retained, continued employment increases can be expected in tourism, arts and culture, agriculture, home-based and small businesses, and wildcrafting. Continued high rates of logging, logging in domestic watersheds, ongoing clearcutting, and noise pollution from trucks on Highway 6 are the major threats to the quality of life in the Slocan Valley. Refining and implementing this ecosystem-based landscape plan will assist to protect and, where necessary, restore quality of life in the Slocan River watershed.

Planning and management of forests by socially and ecologically responsible local boards is required. Without this change, individuals and organizations far removed from the forests they impact will continue to degrade the ecosystems and the economy these ecosystems depend upon.

6.3 Literature Cited

Ashby, W.C. 1987. Forests. *In*: W.L. Jordan, M.E. Gilpin, J.D. Aber (eds.). Restoration Ecology: a synthetic approach to ecological research. Cambridge University Press.

Badke, D. Personal interview February 13, 1995 regarding LETS.

Balisky, , A.C., P. Salonius, C. Walli and D. Brinkman. 1995. *Seedling roots and forest floor: Misplaced and neglected aspects of British Columbia's reforestation effort?* Forestry Chronicle, 71(1):59-65.

BC Central Statistics Branch, P.E.O.P.L.E. Projection 18 for Census Division 3000, Central Kootenay, Government of British Columbia, undated.

Bond, D. *Oregon restructuring example good one to follow in Canada*. Article in the *Vancouver Sun*, November 16, 1994.

Carr, W.W. 1983. Access road related degradation problems in forestry. *In*: Proc. 8th Ann. B.C. Soil Sci. Workshop. Harrison Hot Springs, B.C. pp. 177-191.

Copeland, G. 1995. *An economic transition strategy for the Slocan Valley*, New Denver, B.C., draft report dated March 1995, 50 pp.

Copeland, G. 1994. *Nelson in transition: An economic case study.* BC Wild, Vancouver, B.C. 29 pp.

Costanza, R. 1991. *Assuring sustainability of ecological economic systems*, Chapter 21 *in* R. Costanza (ed.), *Ecological economics: the science and management of sustainability*, New York, Columbia University Press, pp 331-343.

deGeus, N. 1993. *Agroforestry industry in British Columbia: identification of issues, responsibilities and opportunities for the Ministry of Forests* (draft report). Integrated Resources Branch, Ministry of Forests, Victoria, B.C. 100 pp.

deGeus, N., S. Redhead and B. Callan. 1992. *Wild mushroom harvesting discussion session minutes, March 3, 1992.* Integrated Resources Branch, Ministry of Forests, Victoria, B.C.

Egan, T. *Oregon, foiling forecasters, thrives as it protects owls.* Article in the *New York Times*, October 11, 1994.

Ethos Consultant Services. 1982. Slocan Valley economic opportunities study. Report prepared as part of the Slocan Valley Planning Program and submitted to the Kootenay Resource Management Committee and Regional District of Central Kootenay.

Forintek Canada Corp. and J. McWilliams. 1993. *Structure and significance of the value-added wood products industry in British Columbia.* FRDA II, Forestry Canada, Victoria, B.C. 22 pp.

Fraser, I. 1993. *Good wood: Value-added.* Langham Cultural Society, Kaslo, B.C. 56 pp.

Gower, J. 1989. Building on our strengths: A strategy framework for community economic development in the Slocan Valley. Slocan Valley Regional economic Development Commission.

Hammond, H.L. 1988. *Soil degradation: costs of rehabilitation versus costs of prevention.* In: J.D. Lousier & G.W. Still (eds), *Degradation of forested lands - forest soils at risk.* Proc. Tenth B.C. Soil Science Workshop, B.C. Ministry of Forests, Victoria, B.C. Land Mgmt. Report No. 56.

Hammond, H. 1991. *Seeing the forest among the trees: The case for wholistic forest use.* Polestar Press, Vancouver.

Hawken, P. 1994. *The ecology of commerce*. HarperCollins, New York, 250 pp.

Holman, G. 1994. *Survey of local businesses in the Slocan Valley*, draft report prepared for the Commission on Resources and the Environment, Victoria.

Horne, G. and J. Jaffey. 1994. *Socioeconomic profile of the Slocan Valley*, draft report. Ministry of Finance and Corporate Relations, Victoria, B.C.

M'Gonigle, M. and B. Parfitt. 1994. *Forestopia*. Harbour Publishing, Madeira Park, B.C. 119 pp.

Ministry of Forests. 1994. Arrow TSA timber supply analysis. Victoria. 69 pp.

Ministry of Forests. Timber supply realities show need for land-use plans, says Petter. Press release issued March 10, 1995, Victoria.

Ministry of Small Business, Tourism, and Culture. 1995. *The first Kootenay value-added wood forum*. Report on a forum held in Creston, B.C. October 21-23, 1994. Victoria, B.C. 27 pp.

Molina, R. T. O'Dell, D. Luoma, M. Amaranthus, M. Castellano, and K. Russell. 1993. *Biology, ecology, and social aspects of wild edible mushrooms in the forests of the Pacific Northwest: a preface to managing commercial harvest.* USDA Forest Service, Pacific NW Research Station, Portland, OR. Gen. Tech. Report PNW-GTR-309. 42 pp.

Nelson Daily News, March 17, 1995. *Forest Renewal invests $160,000 in Kootenay based training*.

Nelson Daily News, March 17, 1995. *Information highway to aid wood supply*, by John Betts.

Nozick, M. 1992. *No place like home: building sustainable communities.* Canadian Council on Social Development, Ottawa, 237 pp.

Pollock Shea, C. 1994. *Employment and sustainable development: opportunities for Canada.* International Institute for Sustainable Development, Winnipeg, MN. 54 pp.

Power, T.M. 1995. *Economic well-being and environmental protection in the Pacific Northwest: a consensus report by Pacific Northwest economists.* December 1995. Economics Department, University of Montana, Missoula.

Power, T. 1988 *The economic pursuit of quality*. M. E. Sharpe, Inc., New York. 218 pp.

Price Waterhouse. 1992. *Performance of the value-added wood products industry in British Columbia.* FRDA II, Forestry Canada, Victoria, B.C. 40 pp.

Russ, Joel. Personal interview February 13, 1995, regarding Southern Slocan Valley Community Exchange system.

Select Standing Committee on Forests, Energy, Mines and Petroleum Resources. 1993. *Lumber remanufacturing in British Columbia, First Report.* Legislative Assembly of British Columbia, Victoria. 48 pp.

Slocan Forest Products. 1995. Draft Management Plan Forest Licence A20192, Arrow Timber Supply Area, January 1, 1995-December 31, 1999. Slocan, B.C. 22 pp. plus appendices.

Slocan Forest Products. 1993. Management Plan No. 8 for Tree Farm License (TFL) 3, January 1, 1991 to December 31, 1997. 45 pp. plus appendices.

Slocan Valley Community Forest Management Project, Final Report. Second edition, 1976.

Utzig, G.F. and M.E. Walmsley. 1988. *Evaluation of soil degradation as a factor affecting forest productivity in British Columbia: a problem analysis, Phase I.* Canadian Forestry Service, Victoria, B.C. FRDA Report No. 025.

Vancouver Sun, March 17, 1995, *Change, adapt or die, industry told*, by Judith Lavoie.

Washington State University Extension Service. 1993. Bulletin on Agroforestry, Shelton, Washington.

7. GETTING FROM TODAY'S ECONOMY TO AN ECOSYSTEM-BASED ECONOMY--A TRANSITION STRATEGY

> Without a strong local economy, there is little basis for strong regional, and ultimately national commerce. (Meeker-Lowry 1988, p. 180)

The way to build a healthy global economy is from the ground up, not from the top down. Rather than trying to sustain development, the time has come to sustain ecosystems. In doing so, we recognize that our communities depend on healthy ecosystems and our economy depends on healthy communities. In other words, the forest sustains us, we do not sustain the forest. An important part of the transition from today's industrial economy based on short-term profit taking to an ecosystem-based economy based on ecosystems protection is to shift our focus from managing ecosystems to managing our activities in ecosystems.

Tremendous changes are already taking place in the British Columbia and Slocan Valley economies. Reductions in timber cutting levels are accepted as inevitable by even the timber industry (Vancouver Sun, March 17, 1995). Only the amount of the reductions is in question. Communities now need to take a lead role in planning and managing the changes so that the integrity of the ecosystem and community stability are maintained. These realities were recognized by representatives to the Kootenay-Boundary land use planning table convened by the Commission on Resources and the Environment (CORE) and are detailed in the table's report to CORE (CORE 1994).

A number of studies have noted that strong local economies are community-based and have the support of local institutions (Kretzmann & McKnight 1993, Perry & Lewis 1994, Pollock Shea 1994, Power 1988). Adequate funding for new and changing businesses has frequently been identified as a key element to the success of the economy and also as one of the more difficult elements to obtain. The Slocan Valley is no exception. In order to strengthen a local economy, the Rocky Mountain Institute (Meeker-Lowry 1988) suggests these objectives:

Plug the leaks. In a healthy economy, the money circulates within the community rather than pouring out. A community needs to examine how and why money leaves and then explore how they can provide for more of their needs themselves.

Invest in yourself. Support the community's existing businesses and encourage them to run more efficiently and to expand to provide a stronger, more sustainable foundation for a healthy economy.

Encourage new enterprise. As the economy changes, communities can encourage new businesses that build on local strengths like the existing labor force, infrastructure, resources, and high environmental quality.

Within the Slocan Valley, the landscape analysis performed by the Silva Forest Foundation has determined the ecological limits within which human activities can take place. Zoning suggests where various ecologically responsible human activities might take place. Analysis of the current economy has led to proposals regarding the future of the local economy. The community now has the opportunity to plan how to achieve the transition from the current economy to a future ecosystem-based economy.

However, what the SFF economic analysis reveals is that the future is now. We are already taking steps toward an ecosystem-based economy. The question is: will we permit an old non-sustainable economy to foreclose upon our opportunity for a diverse sustainable local economy.

A successful transition strategy will:

- Provide education, training, and retraining for workers
- Reduce timber cutting rates to ecologically sustainable levels
- Implement ecologically responsible partial cutting
- Plan and implement comprehensive forest restoration in logged and/or other degraded areas
- Expand value-added wood products industries
- Expand and diversify tourism and recreation businesses
- Establish a loan fund for remodeling logging equipment for ecologically responsible timber extraction
- Substitute imports with locally manufactured products
- Encourage community economic development opportunities by practical extension services for people with ideas for new businesses
- Encourage employment in home-based and small businesses, tourism, agriculture, and wildcrafting
- Establish local control of resources and economic planning

7.1 Initiate Training and Retraining for Workers

SFF projects a substantial decrease in the amount of timber available for cutting, but does not envision a significant net loss of jobs. Alternate logging systems will employ more people cutting less timber. Milling will diversify to include more value-added manufacturing. Forest restoration will require a significant number of people (at least 24) for the equivalent of two working life times. (see Sec. 5.13) However, some workers will require retraining for both woods and milling jobs. In addition, training needs to be made available for any workers who may be displaced from woods or milling jobs.

Retraining in forest and manufacturing jobs could perhaps be coordinated through Selkirk College, but would require hiring a practical forestry continuing education and training coordinator specifically for the Slocan Valley. Since similar trends are occurring throughout the Kootenays, such an education coordinator may be needed to serve a larger region. Workers could be trained in small cable and aerial yarding techniques, in small machines and horse logging, directional felling, marking trees for partial cutting, ecologically responsible road design and construction, and forest restoration methods. Training courses in secondary and tertiary manufacturing would provide workers with skills to work in these kinds of milling operations, and encourage entrepreneurs to start value-added wood products manufacturing businesses.

Following layoffs in the timber industry in Oregon, government provided successful training services for displaced workers. Workers were provided with information about the types of jobs available and anticipated in the economy, and about where to obtain appropriate training. Job placement assistance was also provided. As a result, 90 percent of displaced timber industry workers were trained for and placed in new jobs that averaged only $1 per hour less than the average timber industry wage.

Funding for training and retraining is available under the Forest Renewal Plan, the Columbia Basin Trust, and the provincial Skills Now program.

7.2 Expand value-added industries for wood, agricultural, and wildcrafting products

Participants at the Winnipeg seminar on Employment and Sustainable Development pointed out that new niche markets for food, wood, paper, and fish products are growing around the world, but Canadian producers are not yet tapping them effectively. The seminar concluded that enormous possibilities exist from window frames to organic preserves.

The need to expand the local value-added wood products industries has already been discussed in sections 6.1.1 and 6.2.1. By making more value from the timber cut, both jobs and money remain in the community, thereby strengthening the local economy.

Value-added products from either wildcrafting or agriculture are still in their infancy in the Slocan Valley, but the opportunities are tremendous. Most efforts remain small scale. Some farmers add value to products such as garlic by making braids and wreaths. These and other initiatives can be encouraged by educating more people to buy locally and by ensuring that adequate financing is available to ensure viability of new and existing ventures.

Certification, or eco-labeling is an important component of value-added wood, agricultural, and wildcrafting products. There are well developed programs for certifying agricultural and wildcrafting products. However, wood certification is new, but growing. Wood products from the Slocan Valley need to be required to meet or exceed Forest Stewardship Council principles and criteria (see Sec. 6.2.1.6 and Appendix 5). Certification is an important way to gain a market advantage, and to recognize and encourage ecosystem-based approaches in all aspects of the economy.

Key to the success of all value-added industries will be the financial strategies outlined in Section 7.5. Community-based financing must be made available to those willing to invest in value-added industries.

7.3 Plan and Implement Forest Restoration

Fully functioning forests are the foundation for this ecosystem-based plan. Therefore, restoration of degraded forests is required to ensure success of this plan, and to provide options for future generations.

Employment generated by forest restoration activities will more than compensate for timber management employment losses that result in the shift from conventional logging and non-sustainable AACs to ecologically responsible logging and ecologically sustainable AACs.

The activities, employment, and costs of forest restoration are described in detail in sections 6.1.1.3 and 6.2.1.4, and in Appendix 5.

7.4 Remove Debt on Logging Equipment/Remodel Logging Equipment

Much of the existing logging equipment used in conventional timber management in the Slocan Valley is inappropriate for ecologically responsible partial cutting. Purchasing new, small equipment will be necessary in many instances. Hopefully, this transition step will be facilitated by the development of community-based financial institutions.

In order to make it possible for loggers to purchase appropriate logging equipment, society will need to help loggers to cover debt on existing machinery. If existing machinery cannot be sold to cover existing debt, local financial institutions (backed by the community) must be prepared to assume ownership (and debt) of existing, inappropriate logging equipment. In this way, the community as a whole, all of whom benefit from the shift to ecologically responsible timber cutting, will also share the costs of this shift.

Some of the existing, inappropriate logging machinery can be remodeled into ecologically appropriate logging machinery. For example, rubber-tired skidders that cause significant amounts of soil degradation could be remodeled into small yarders suitable for skyline systems for partial cutting. This type of remodeling of logging equipment can employ some loggers displaced by reductions in timber cutting levels.

7.5 Replace Imports with Local Products

> A community that can provide many of its necessities locally will be less affected by the roiling national and world economy. It can prosper in good times, but will be more resilient in bad. (Hawken 1994)

The Kootenay-Boundary CORE Table recommended that satisfying local needs be the primary goal of remanufacturing before supplying an export market. A seminar hosted by Winnipeg's International Institute for Sustainable Development emphasized the importance of assessing opportunities for producing and marketing more goods locally as a strategy that can provide big payoffs and multiplier effects. Examples of this approach include micro-breweries, "locally-made" boutiques, organic bakeries, organic food stores that sell locally produced foods, secondary manufacturing of wood products such as flooring and moldings (Pollock-Shea 1994).

Substituting local products for imported ones allows communities to expand employment opportunities and to reap the multiplier effects of recirculating funds within the community. As long as money circulates within a self-contained system, it generates wealth within that system, but when money leaves the system, the multiplier effect stops (Nozick 1992).

The SFF recommends establishing a local commission on ecosystem-based business consisting of experienced business people, crafts people, artists, forest workers, tourism operators, wildcrafters, farmers, and others with ecologically responsible ideas for reducing imports in the local economy. The idea would be to discover what we have and to determine how to use it here. To be effective this commission must focus on assisting appropriate economic activity to get started and on encouraging what is necessary to sustain ecologically responsible business. Marketing cooperatives, equipment cooperatives, financial assistance, and practical business operation could be important topics for the commission. The local commission is about putting local ideas to work locally, rather than watching ideas and creativity leave the community.

7.6 Initiate Community Economic Development

The Kootenay-Boundary CORE Table recommended that "community economic development start with broad community-centered participation and planning, leading to the building of community organizational capacity that can enable and support projects which provide employment and help improve the community's quality of life" (CORE 1994, Appendix 4-1). The goal of the transition strategy developed by the CORE table is to build productive, healthy, socially, environmentally, and economically sustainable communities in the region.

The local commission on ecologically responsible business is an example of community-centered participation and planning. The key to successful community-based economic development is providing necessary financing and technical support for new and changing businesses. Without this assistance, many businesses do not succeed. However, study after study points out that local credit is extremely difficult for businesses and that this factor stifles community economic diversification and stability. The solutions have been widely identified and are being practiced in a number of communities in North America.

Local credit unions in the Slocan Valley are currently reluctant to provide financing for incorporated businesses and require extensive collateral for any business loan. This automatically restricts business development or expansion. There is a need to encourage the two local credit unions to remember their roots as community-based, member organizations and for the credit unions to work as part of the team of organizations providing financial assistance to local businesses.

VanCity Credit Union provides an example that can be imitated in the Slocan Valley. VanCity has established lending policies to achieve specific community ends. For example, members can choose to accept one percent less than the standard interest for term deposits in order for their deposits to be loaned from a separate pool at a one percent discount for projects with social aims (Perry & Lewis 1994). The same approach could be used to support ecosystem-based business.

VanCity experimented with a seed capital fund that helped entrepreneurs with good ideas but insufficient capital. The fund provided some of the advantages of friendly equity such as an interest moratorium for six to twelve months, no loan security requirement, and income standards that were more relaxed than those for conventional loans. The program also provided extensive technical support to each of the borrowers. After two years, the program had granted 20 loans with only two failures. VanCity decided to cut off the technical assistance and eventually saw a 50 percent failure rate. According to Perry and Lewis (1994), community economic development groups throughout Canada have learned that technical assistance is absolutely crucial to the success of higher risk loans to local entrepreneurs.

In addition to making initial financing possible for new ventures, structures need to be in place to provide expansion capital for businesses that have been successful at the first stage, but who now need considerable funding to be successful at the next stage of their business. Frequently these businesses still do not have the equity picture that conventional lenders expect. Without access to the necessary capital at this stage, even successful businesses can fail.

VanCity provides members with the opportunity to allocate one-quarter of their dividends to a special endowment that provides loans for community development projects.

Kretzmann and McKnight (1993) describe how Community Development Credit Unions and Community Development Loan Funds provide locally accountable lending structures.

Community Development Credit Unions (CDCU) develop innovative loan programs through a democratically-controlled local financial institution. CDCUs provide basic banking services; flexibility in lending to fit the resources of individuals; small loans (typically from $500 to $10,000) to entrepreneurs not eligible for conventional lending; second chances to those who have defaulted on a first loan due to extenuating circumstances; utilization of the resources of middle-income members as loan funds; and immediate reinvestment in the community.

Community Development Loan Funds (CLDF) provide credit to groups and initiatives normally excluded from the traditional funding market and provide larger loans than CDCUs. CLDFs assist those who need capital the most; provide solid investment opportunities for those who have capital; and leverage the borrowing power of loan recipients with more conventional lending institutions. Gunn and Gunn (1991) found that CLDFs had a loss rate of 7/10 of 1%. Loan funds maintain reserves for losses, and they protect lenders to the funds.

Revolving loan funds are organizations that pool money from lenders and make loans to projects that further the goals of the fund. Loans are usually made at below-market rates to projects without access to traditional sources of capital through banks or credit unions. Investors may be permitted to set their preferred rate of return, their preferred term, and the repayment schedule. Revolving loan funds characteristically provide technical assistance to borrowers. Services include guidance in developing a business plan, locating the best contractors for a job, providing ongoing accounting and planning services. According to Meeker-Lowry (1988), most funds have experienced no defaults and most have never failed to meet their obligations to lenders. Revolving loan funds often help borrowers obtain financing from more traditional sources.

The Shoretrust Trading Group in Ilwaco, Washington is a pioneering bank program helping businesses that are environmentally responsible and that contribute to both a healthy economy and environment. Shoretrust is the combination of the South Shore Bank of Chicago, with 20 years of experience rebuilding inner cities, and Ecotrust, a leader in conservation. South Shore Bank currently holds ecodeposits that are used for more conventional, lower risk business loans to environmentally responsible businesses. Banking customers can choose to deposit their money in the Ecodeposit fund which, as of February 1995, had $3 million.

Shoretrust also operates a revolving loan fund to finance high risk loans at an interest rate 1 to 3 percent higher than conventional loans. The foundations that have funded the initiation of the loan fund are willing to absorb the loss if the loans fail. The fund is designed to provide creative lending.

Shoretrust coordinates and makes available business assistance services. Priority access to credit and resources is offered to businesses that can profitably employ displaced workers, such as those from the timber and fishing industries.

The kinds of loans made to date include the sustainable cutting of red alder to be used for furniture manufacturing, the manufacture of surgical sutures from crab shells, retail businesses, mushroom farms, and mushroom brokers. Alana Probst, director of Shoretrust, says that the organization has more requests for money and services than they can meet.

Shoretrust has established a set of conservation-based development principles that are required of businesses receiving financial assistance and provides examples of how these principles apply to the business community.

M'Gonigle and Parfitt (1994) describe the British Columbia example of the Nanaimo Credit Union and its partnership with Central Island Community Development Society (CICDS) to provide loans to new businesses. Initially, CICDS provided technical expertise and loans to people starting out, but only had $1 million per year available. The interest rates were higher than the banks. The success rate of businesses supported by CICDS was high with 70% succeeding, as compared to 8 out of 10 small business failures within first five years in conventionally funded business. In addition to providing its own loans, CICDS has teamed with the Nanaimo Credit Union so those eligible for bankable loans could get loans at a better rate. CICDS can then fund more new businesses that are not able to get conventional bank loans.

All of these examples point out that creative, community-based financing is possible and is critical to the development of community-based, diverse, stable economies. The second critical factor is ongoing technical assistance for new businesses.

Some institutional financial assistance may be available through the Federal Business Development Bank which provides higher risk loans to businesses and technical assistance, and through KREDA.

The Silva Forest Foundation recommends that community-based financial assistance, like Community Development Credit Unions and Community Development Loan Funds be researched and established in the Slocan Valley to fund the development of ecologically responsible businesses that operate within the ecological limits of the Slocan River watershed.

7.7 Expand Home-Based and Small Businesses, Agriculture, Wildcrafting, Tourism

Sections 6.1 and 6.2 detail the importance of home-based and small businesses, agriculture, wildcrafting, and tourism in the current economy and suggest their importance to the future economy. Once again, the success of all of these activities will depend in large part on access to often small-scale financing as suggested in Section 7.5.

7.8 Establish Local Control of Resource and Economic Planning

Numerous studies emphasize the importance of local control and local decision making in the success of local economies (CORE 1994, Gower 1989, Gunn and Gunn 1991, Nozick 1992, Slocan Valley Community Forest Management Project 1975).

The Kootenay-Boundary sector participants to the regional CORE process recognized the importance of shared decision-making in all aspects of land use planning. Groups in the Slocan Valley have been asking for shared decision making in the planning and use of the ecosystems of the Slocan River watershed for at least twenty years.

Local control with shared decision making can be most effective through the establishment of a community forest board made up of local residents representing various interests in the Slocan Valley.

The SFF recommends that the Slocan Valley be used as a test case by the B.C. government to establish a community Forest Board that operates under the ecosystem-based principles described in this plan, and that this Board be given decision-making powers that facilitate the implementation of ecologically responsible forest use and the development of an ecosystem-based economy in the Slocan River watershed.

7.9 LITERATURE CITED

CORE (Commission on Resources and the Environment). 1994. *West Kootenay-Boundary Land Use Plan.* Victoria, B.C. 162 pp. plus appendices.

Gunn, C. and H. Dayton Gunn. 1991. *Reclaiming capital: democratic initiatives and community development.* Cornell University Press, Ithaca, 179 pp.

Hawken, P. 1994. *The ecology of commerce.* HarperCollins, New York, 250 pp.

Kretzmann, J.P. and J.L. McKnight. 1993. *Building communities from the inside out.* ACTA Publications, Chicago, IL, 376 pp.

M'Gonigle, M. and B. Parfitt. 1994. *Forestopia*. Harbour Publishing, Madeira Park, B.C. 119 pp.

Meeker-Lowry, S. 1988. *Economics as if the earth really mattered.* New Society Publishers, Philadelphia, 281 pp.

Nozick, M. 1992. *No place like home: building sustainable communities.* Canadian Council on Social Development, Ottawa, 237 pp.

Perry, S.E. and M. Lewis. 1994. *Reinventing the local economy.* Centre for Community Enterprise, Vernon, B.C. 233 pp.

Pollock Shea, C. 1994. *Employment and sustainable development: opportunities for Canada.* International Institute for Sustainable Development, Winnipeg, MN. 54 pp.

Slocan Forest Products. 1993. *Management Plan No. 8 for Tree Farm Licence (TFL) 3, January 1, 1991 to December 31, 1997.*, 45pp. plus appendices.
Slocan Valley Community Forest Management Project, Final Report. Second edition, 1976.

Vancouver Sun, March 17, 1995, *Change, adapt or die, industry told*, by Judith Lavoie.

8. CONCLUSIONS AND RECOMMENDATIONS --- WHERE DO WE GO FROM HERE?

8.1 Conclusions

The ecosystem-based landscape plan for the Slocan River watershed has shown clearly that we live in a very sensitive forest ecosystem. The Slocan River landscape can be described as patches and thin ribbons of stable forest in a sea of ecologically sensitive forests and alpine ecosystems. The landscape ecology of such a situation informs us that not only are the few stable forests vital to the culture and economy of people in the Slocan Valley, but these same forests are also critical to protect and restore in order to maintain fully functioning forest ecosystems in the Slocan River watershed. Therefore, if we are to follow ecosystem-based approaches, we must learn how to live within the ecological limits of not only the small areas of stable forests, but also within the ecological limits of the whole landscape.

Ecosystem-based approaches instruct us that economies are part of human cultures which are part of ecosystems. Therefore, if people are going to sustain anything, our first priority must be the protection of fully functioning ecosystems at all scales through time. Anything short of this priority is an illusion of sustainability, and increasingly puts ecosystems, cultures, and economies at risk.

Increasingly, economic examples demonstrate to us that protecting ecosystems is necessary in order to have diverse, stable community economies. In particular, economists confirm that the most diverse, stable, and sustainable economies are found in the most healthy, high quality natural environments. In contrast, where human activities degrade ecosystems, not only does environmental quality suffer, but also economies decline.

The Silva Forest Foundation points out that there are three important parts to an ecosystem-based approach:

1. All human activities must be carried out in **ecologically responsible** ways. This means that human activities must maintain fully functioning ecosystems at all scales through time.

2. Human activities must respect ecological limits at all times, be diverse, and be balanced across the landscape. **Balanced ecosystem use** means that an ecosystem-based approach provides a fair and protected land base for all ecosystem users.

3. **Community control** of the planning and use of local forest landscapes is necessary to ensure ecologically responsible, balanced forest use.

Without implementation of these three parts of the ecosystem-based landscape plan for the Slocan River watershed, we will see a decline in the options for future generations, and increasingly degraded environments and economies.

The ecosystem-based plan for the Slocan River watershed has been prepared using the precautionary principal. In other words, our interpretations, decisions, and projections have erred on the side of protecting short- and long-term ecosystem functioning. Therefore, as more information is gathered about the ecosystems of the Slocan River watershed, we may find that it is possible, within the bounds of ecological responsibility, to increase ecologically sustainable timber cutting rates, and to use more of the landscape for economic activity than was initially thought.

A carefully thought out, practical transition strategy is necessary to move from the current industrial economy to an ecosystem-based economy. Key parts of this transition strategy are:

1. Community control of the planning and use of forests,
2. Effective training and re-training that is attractive to displaced workers.
3. Community-based financial assistance to encourage ecologically responsible businesses.
4. Reduction in imports to the Slocan Valley economy by increasing the local production of necessary goods and services.

There are likely to be more employment shifts as opposed to employment losses in making the transition from an industrial economy to an ecosystem-based economy in the Slocan Valley. Conventional timber management and a nonsustainable timber cutting rate (i.e. AAC) will be replaced with ecologically responsible timber management and an ecologically sustainable timber cutting rate (i.e. AAC), Most, if not all, of the employment losses that occur in shifting from conventional timber management to ecologically responsible timber management will be made up by labour intensive, ecologically responsible timber cutting; producing value-added wood products; and carrying out necessary forest restoration. Forest restoration alone is estimated to require at least 58 years of employment for 24 people working a minimum of 100 days per year. Growing employment in tourism and home-based businesses will also help to offset any employment losses in conventional timber management.

The recommendations of this ecosystem-based plan are both practical and readily possible. While changes in types of employment will occur, these changes are not likely to result in displacement of people to types of employment much different than their current employment, or to areas outside of the Slocan Valley. However, failure to make the change from today's nonsustainable economy to an ecologically sustainable economy will eventually cause large changes in the types of employment and displacement of current Slocan Valley residents to areas outside of the Slocan Valley.

Many aspects of an ecosystem-based economy are beginning to emerge in the Slocan Valley. However, this development of a more diverse, community-based economy hangs by a thread because of ecosystem degradation from ongoing conventional timber management and increasing environmental degradation, such as noise pollution from chip trucks on Highway #6. If loss of environmental quality continues, it will foreclose upon options necessary to develop an ecosystem-based economy. Therefore, we must move quickly to implement an ecosystem-based approach, and design and carry out ecologically responsible activities while the environmental quality of the Slocan River watershed is still reasonably intact.

8.2 Recommendations

The recommendations below are summarized from the contents of this ecosystem-based landscape plan for the Slocan River watershed. To fully understand the background for and the details of these recommendations, please consult relevant sections of this plan.

1. Review, refine, revise (as required), and implement this ecosystem-based landscape plan for the Slocan Valley. This recommendation necessitates a broad community-based process that is accountable to the ecosystems, including the people and all other living things, in the Slocan River watershed.
2. Develop ecosystem-based operation plans for various landscapes within the Slocan River watershed. These operations plans will serve as models for implementing ecologically responsible forest uses, particularly timber management.
3. In order to ensure both the short- and long-term functioning of the Slocan River landscape, and the larger surrounding landscapes, prepare an ecosystem-based plan for the West Kootenay Region.
4. Shift from conventional timber management to ecologically responsible timber management.
5. Implement the Short-term SFF Ecologically Sustainable AAC (i.e. timber cutting rate) <u>after</u> refining the interpretations of this ecosystem-based landscape plan. Refining interpretations will include both more detailed GIS analysis and field data collection and analysis.
6. Carry out a field assessment of the logged landscapes and stands in the Slocan River watershed to acquire specific information necessary to prepare a comprehensive forest restoration plan for the Slocan River watershed;

   - and -

   Implement comprehensive forest restoration wherever necessary throughout the Slocan River watershed. This is a high priority.

7. Carry out specific further planning that is required to ensure protection of ecosystem functioning, specifically:

    a) analyze and carefully define small watershed boundaries for determining and applying ecologically sustainable AACs;

    b) review the status of old growth forests by ecosystem type and small watershed throughout the Slocan River watershed, in order to determine the need for establishing further old growth recruitment areas;

    c) determine the locations of high or upper elevation forests, and remove these ecologically limited forests from the wholistic timber/ecologically responsible timber management landbase; and

    d) set up and carry out a system to annually update existing and planned logging by forest tenure types within the Slocan River watershed.

8. Establish a Community Forest Board (CFB) to plan and carry out ecologically responsible forest use within the Slocan River watershed. The Community Forest Board would have a seat for all community-based interests, but central government and industrial interests that are controlled outside the local community would not have a seat on the board. The CFB would have a paid technical staff that would plan, administer, and monitor the full spectrum of forest uses in the Slocan Valley, from timber management and tourism to wildcrafting and water use. Revenues from the sale of timber and non-timber forest products and services would fund the operation of the CFB, and provide funds to the British Columbia central government.

9. Establish a log sort yard and an open log market, using the Ministry of Forests Lumby log sort yard as a model. The open log market is expected to generate sufficient additional funds, compared to conventional forest tenures, so that funding the Community Forest Board will not result in reduced revenues to central government.

10. Encourage development of ecosystem-based certification of wood products and non-timber forest products produced in the Slocan Valley.

11. Expand the production of both value-added wood products (include secondary and tertiary products) and value-added non-timber forest products from the Slocan River watershed.

12. Carry out necessary inventories to serve as the basis for designing and marketing value-added wood products and value-added non-timber forest products.

13. Hire a marketing specialist, experienced in wood products and non-timber forest products, to identify markets for various value-added products and to develop a practical strategy to market these products.

14. Carry out a detailed ecological economic analysis of the proposed ecosystem-based economy for the Slocan River watershed. This ecological economic analysis should include comparison of various economic options using wholistic cost benefit analysis.

The Silva Forest Foundation has prepared this ecosystem-based landscape plan for the Slocan River watershed in part to encourage the development of practical economic proposals that are based upon protecting ecosystem functioning. By defining the ecological limits of the Slocan River watershed, this plan has also defined the limits of what can be done in the Slocan River watershed. We hope that this information can be the seed for others to join us in nurturing an ecosystem-based approach to protection and use of ecosystems in the Slocan Valley.

We end where we begin—with the forest—the source of our culture and our economy. If we protect the forest, we protect everything we need.