LANDSCAPE ANALYSIS AND PLANNING SUMMARY

A Component of Wholistic Forest Use

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1. The Purpose of Landscape Analysis and Planning

Landscape analysis and landscape planning are closely related and overlapping practices. Analysis is a prerequisite step for any planning, but is ongoing as planning proceeds.

Landscape analysis is the process of describing and interpreting the landscape ecology of an area. Resource patches and a landscape network of connecting corridors are identified, described and classified. The patterns which are detected can then be used to assess the impacts of past disturbance (natural or human), and to plan and regulate further human resource use.

Landscape planning identifies and protects the landscape components necessary to maintain the stand ecology and the landscape ecology of forest areas during and after human use. "Human" is an important variable in this statement - the ecology of the world would be in excellent shape without human intervention. Still, man is a part of the total planetary ecosystem; landscape planning and landscape ecology provide our current best hope of living within the ecological limits imposed by the planetary ecosystem.

Silva advocates the use of landscape planning through systems which are variously called wholistic forest use or ecologically responsible forest use. These terms describe a system of landscape level planning which respects both the ecological limitations to human use and the established cultural uses of forests. The goal is to achieve balanced use and stewardship of the forest - to ensure that an intact, functioning, diverse forest landscape remains after human use of forest resources.

2. Fundamentals of Landscape Analysis

A basic landscape analysis must:

1. Identify and classify the ecosystem types, movement corridors and resource patches within a landscape. Classification parameters may include species composition, age, ecosystem association, elevation, aspect, wildlife habitat value, recreation value, cultural uses, etc. Classification is necessary in order to ensure that all resource types are represented in the landscape network identified in step 3, below.
2. Analyze the landscape ecology of each resource patch. Data sources and geographic analysis are used to develop an ecological picture of each identified ecotype/resource patch. Typical questions to be answered include:
   - Where is each ecotype?
   - What are the adjacent ecosystems?
   - Is the patch connected to a landscape corridor?
   - What is the area of the resource patch?
   - What is the interior area (area insulated from outside influences) of the patch?

- What is the ecological viability of the patch? That is, what is the areas ability to the ability to withstand or buffer disturbance without losing the fundamental ecological characteristics of that patch type?

3. <u>Identify a connected network of diverse resource patches distributed across the landscape.</u> Information gathered during the classification and analysis steps is used to determine the suitability of each resource patch for inclusion in the network. The network will, when protected, retain the natural landscape ecology and ecosystem functions as part of the managed forest landscape. The objective is to ensure that varied ecological functions which depend on specific habitat types continue to occur at dispersed locations across the landscape.

4. Ensure the full protection and maintenance of all ecotypes in B.C. by identifying large forest reserves in all forest ecosystems across the forest landscape. These forests should be:

   - large enough to function on their own
   - large enough to (hopefully) buffer and withstand the coming assaults from climate change, global pollution and ozone depletion.

These forests are our insurance policy. Such ecological reserves are needed to provide the gene pool, the species reserve, and the working model or "blueprint" we need to retain, to restore, and to hopefully sustain our commercial forests. The Carmanah, the Stein, and the Khutzeymateen Valleys are excellent examples of the sort of reserves which are necessary to be well distributed in every biogeoclimatic region. These large areas will be in addition to, and will function with, the network of smaller "nodes" in the landscape network.

Landscape analysis as described above is dependent on modern Geographic Information Systems (GIS) computer technology which stores spatial (map) information traditionally contained on paper maps in a digital format. GIS has three important functions. First, it automates the process of measuring features on maps (gathering spatial information) and the processes of compiling and analyzing lists of attributes for various features. Second, GIS ties a standard computer data base to the spatial information recorded on a map. This means that volumes of information can be recorded about a point, a line, or a polygon on the map. Third, the computer can overlay and combine maps, or certain attributes or features from maps, as directed by the operator. The data base information associated with each map/feature is automatically transferred to the data base of the new map created. GIS maps can be controlled, edited, or altered through the use of map/spatial information, or through the associated data base. Given the complexity of forest cover and other resource maps and data, a GIS is the only reasonable way to perform a landscape analysis.

The ecological patterns and processes which are identified by the landscape analysis are then used in the landscape planning stage. The landscape analysis can also be used to assess the impacts of past natural or human disturbance.

3. Fundamentals of Landscape Planning

The fundamentals of landscape planning are outlined below. This brief summary highlights the chief requirements of an ecologically responsible landscape level forest use planning system.

1) Landscape planning must be based on office and field work.

Landscape planning should proceed from the general to the specific, making full use of maps, remote sensing data, computer map analysis procedures, field verification, field survey data and specialists' reports as required. Broad level landscape planning can be carried out using mainly stock map and remote sensing data with reconnaissance level field ground truthing. As more detailed levels of planning (e.g. small to medium watersheds) are carried out, the emphasis on field data must be increased. At the operational (stand) level of planning, information from field surveys should provide the basis for planning decisions.

Silva's planning methodology requires that resource use planners measure identical forest and ecological variables at all levels of planning, but with increasing sample intensity and reliability as planning moves in increments from the broadest landscape level to the stand-specific operation level. This increases efficiency and cost effectiveness over the long term by providing a uniform, compatible data base. Further field surveys increase the resolution and reliability of field data, but do not duplicate existing work in an incompatible format.

2) Forest use plans must protect stand level ecology.

The internal ecological functions, and thus the structures and species necessary to carry out these functions, must be protected during human use of forests. Forest managers have in the past paid insufficient attention to the interconnected web of life which maintains stand level ecology.

Ecologically responsible forest use at the stand level must include:

- retaining old growth structures (large green trees, large snags and large fallen trees) on land and in water courses in managed forests.
- maintaining sufficient habitat and natural travel and movement corridors for plants and animals.
- maintaining biodiversity and matching forest management practices to the habitat needs of the whole forest community.
- maintaining undisturbed soil and water resources.

These requirements are designed to protect and maintain viable populations of all forest species from the microscopic to the largest predators, and maintain all ecosystem functions.

Stand level ecology includes species of animals, birds, insects, and plants; large old trees and coarse woody debris; microorganisms and the soil community. These non-timber resources are generally ignored, or are considered to be "outside" of conventional timber planning. Yet these myriad species form the natural biodiversity of the forest, and control natural ecosystem processes. These many organisms may have critical roles to play in stand level ecology, roles which we currently do not understand.

The only safe course in such a situation is to assume that all parts of the whole are equally valuable. Stand level forest management practices must be altered to protect and maintain all parts of a local ecosystem, no matter how insignificant they may appear to be.

3) Forest use plans must protect landscape ecology.

In order to protect landscape ecology, human use of forests must ensure that the functional framework of the natural landscape ecology remains intact. This means that forest use plans, especially timber use plans, must maintain the natural connections between and the distribution of resource patches within a landscape. The full natural range of habitat types, habitat sizes, and temporal phases of habitat types must be present in sufficient quantities and as part of the connected network.

These requirements are necessary both to protect the wildlife population in any area and to maintain long term forest productivity at the stand level.

All natural habitat types, and all temporal phases of those habitat types, must be present in an accessible network to maintain the natural diversity of animal and bird species, and to maintain ecosystem function.

4) Human forest uses must be compatible with natural time frames and landscape scales.

Some human uses of forests, especially timber extraction, are often at odds with the need to fully protect forests to sustain non-consumptive human uses (e.g. water production, timber production, spiritual values). One of the reasons for this conflict of interests is the limited scope of the human viewpoint, compared to the vastness of a forest ecosystem over time and space. People are challenged to be able to relate to the time and space of forested landscape. Forests operate on cycles of 200 to 1000 years--indeed, forests are a continuum. If we are lucky our lives may last 100 years. If our governments are lucky they last four years. Our corporate institutions function on one year profit and loss statements. A moderate sized watershed (e.g. 5000 hectares) would require months for two people to explore, to map, and to begin to understand the relationships within this landscape.

Current forest management practices are a large scale experiment, carried out within our province - our biosphere - for which we do not know the outcome. From our limited view, we can "see" that everything is going well. Most of the old growth forest is gone, and few negative impacts can be "proven" to rigorous scientific standards. We pride ourselves on mimicking the European approach to forest management, which after only 400 years (about one life cycle for many natural forests) is collapsing. We do not consider factors such as climate change, cumulative effects, landscape ecology alterations and loss of genetic diversity in our "long range" 5 or 20 year forest management plans. Perhaps we ignore these factors because their meaning and importance tends to exceed our own lifespans. These important factors are therefore "intangibles." The imbalance between human cycles and forest cycles has led us to an "ignorance is bliss" mind set which may well lead to the destruction of forest ecosystems.

The disparity between human and ecological time frames is one of the roots of our society's failure to protect forest ecology during our use of forest resources. As a bare minimum, our plans need to span 200 years and address the ecology of entire landscapes. Such plans are also now a real possibility using computer data bases and Geographic Information Systems for information processing. We need to alter our planning and forest use to match the time and space scales suited to a forest landscape, and to stop breaking the forest landscape into 100 or 200 hectare units to fit a human economic development schedule.

5) <u>Human forest uses must be constrained by the need to protect the forest ecosystem.</u>

Western European and North American society has adopted an aggressive approach to forest use. Articles have been written regarding the cultural reasons for this society's acquisitive nature, and apparent lack of concern for environmental degradation. However, we are now faced with widespread evidence that global human society must come to grips with the finite nature of the planet, and must alter current behavior.

People make decisions based on a combination of their knowledge, their emotions, peer pressure (i.e. politics), and their world view, or ethic. Society is a diverse group of individuals, each of whom makes decisions based on these factors. In theory, a group of people presented with the same information might be expected to reach similar individual conclusions, and thereby achieve a consensus on an issue. In reality, people seldom reach uniform conclusions because of the importance of emotions and ethics in the decision making processes.

People with a conserver, or land, ethic will support decisions which place high value on the protection and wise use of natural ecosystems and social resources. "Protection" is given priority over use, because healthy societies and economics are based on healthy ecosystems. "Wise use" or stewardship means sacrificing in the present to protect the future. <u>Diversity</u> within biological, social and economic communities will be encouraged and maintained. Such diversity will mean truly sustainable opportunities for local and regional communities.

A conserver or land ethic is often expressed as "if an activity cannot be shown to be safe, it should not be done."

Silva advocates the use of a conserver ethic in all forest use and landscape planning. The history of land use and ecological damage in North America alone should be sufficient to show that only development and resource use activities which protect the ecology of the planet are sustainable. Atlantic fisheries depletion, drinking water pollution in Ontario and California, toxic beluga whales in the Gulf of St. Lawrence, fisheries closures on the west coast, soil depletion on the prairies, forest decline in Quebec, and crop losses in the Fraser valley all stand as testimony to the negative effects of human activities which are not ecologically sound. Ecologically sound forest use is the only means by which we can sustain all the forest uses and products which we value, including timber production.

6) <u>All forest users must be allocated a protected land base which is suited to their needs.</u>

Silva uses a landscape planning / forest use allocation system called Wholistic Forest Use Zones (WFUZ) to achieve the goal of ecologically sustainable forest use.

The total forest land base under consideration is divided into wholistic forest use zones in order to designate primary forest uses for particular areas and to be certain that each forest use does not damage other uses. WFUZ's integrate the various forest uses in an area to provide each group of users with a land base that is suited to its needs, and to protect the needs of all forest users in all further planning processes and forest use activities.

Five different zone types are commonly used by Silva: culture, ecologically sensitive, fish and wildlife, recreation-tourism-wilderness, and wholistic timber. Other zones may be developed depending upon specific local considerations. A primary land use is determined for each zone. Other land uses are then integrated, or listed in declining order of importance. The primary users have the first priority at all times and will be given the decision making authority needed to protect their interests. However, constraints and limitations are placed on the primary use(r) in order to protect the other users (human, animal, and plant) of each zone and to preserve the ecology of the zone during and after human use.

Further information on wholistic forest use zoning, and on the proposed forest uses within each zone type, is contained in the Silva paper titled "<u>Wholistic Forest Use Zoning</u>".

7) <u>Forest and landscape planning must include restoration ecology where previous ecological degradation has occurred.</u>

Restoration Ecology is another discipline within the biological sciences which has arisen in recent years. The goals of restoration ecology range from site stabilization to prevent further adverse impacts on surrounding areas to the return of the site to a fully functioning component of the ecosystem. Restoration ecology may function at the stand and/or landscape level. Restoration ecologists may work with all species of plants, animals and microorganisms to accomplish their goals.

Restoration projects required in areas impacted by aggressive timber extraction plans are likely to include, but are not limited to:

- Riparian Zone Restoration. Management to restore the natural forest vegetation of logged riparian zones.
- Landslide Restoration. Planting and, where possible, stabilization measures to speed the revegetation of logging induced landslides.
- Fish Habitat Restoration. Replacing and removing large organic debris (fallen trees) in streams as required to allow fish access while maintaining stream structure.
- Landscape Restoration. Restoring a natural balance of habitat types, sizes and ages within the forest landscape.

Restoration ecology is not a substitute for careful planning, landscape and stand management. As Dave Wilford observed in the Ministry of Forests Watershed Workbook:

> *(if) unexpected problems such as mass wasting develop, rehabilitation of the watershed becomes the only course of action. This is very expensive and usually not successful (Wilford 1987).*

Funding any restoration projects will be extremely difficult. The current system of timber management accepts considerable short term risks, and does not allocate responsibility, legal or financial, for long term risks or impacts. Current forest Licence holders are not likely to be active in the northern Nass basin in perpetuity. Once they cease operations, any legal responsibility for funding ecological restoration passes to the government of British Columbia, which has thus far refused all claims for damages to the environment. The current system of forest use in British Columbia allows forest resources to be liquidated, but does not maintain a financial reserve or allow legal recourse to fund ecological restoration.

4. Summary

Landscape analysis and planning are required to ensure that human uses of the forest do not degrade the ecology of local forest areas and/or forest landscapes. A planning system must meet the following requirement in order to accomplish these goals. An analysis and planning system must:

- be based on office and field work.
- protect stand level ecology.
- protect landscape ecology.
- ensure that human forest uses are compatible with natural time frames and landscape scales.
- constrain human uses to protect the forest ecosystem.
- allocate a protected land base for all forest users which is suited to their needs.
- include provisions for restoration ecology where previous ecological degradation has occurred.

5. Supporting Literature

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