FOREST SCIENCES

PEEWEE'S TREEHOUSE: IS THERE LIFE AFTER ENHANCED SILVICULTURE?

RESEARCH EXTENSION CONSULTING TRAINING

Province of British Columbia
Ministry of Forests
Prince Rupert Forest Region

PEEWEE'S TREEHOUSE: IS THERE LIFE AFTER ENHANCED SILVICULTURE?

Jim Pojar

Forest Science Officer

British Columbia Forest Service

Postal Bag 5000

Smithers, B.C.

V0J 2N0

Telephone: 847-7500

Fax: 847-7217

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ABSTRACT

Concern for biological diversity is not a recent phenomenon, but the concept has only recently been embraced by the Environmental Movement and been warily appraised by Forestry. The science (aka conservation biology) behind efforts to conserve biodiversity is in some respects in its infancy, is not reductionist nor particularly quantifiable, is empirically suicidal, and in any case can only address biological and ecological values, not social values and public attitudes. Foresters must realize that all activities in the forestry cycle, from planning through harvesting to reforestation and stand tending, affect biodiversity. There are ways to manage forests for both commodity production and conservation of biological diversity, but according to basic ecological principles it is not possible to double wood production while enhancing "other forest values". Some sort of ecological classification is necessary for the ecosystem management that must replace traditional natural resource management, if biodiversity is to be maintained.

INTRODUCTION

"PeeWee's Playhouse" used to be a refuge of good-natured goofiness in the Ninth Circle of electronic hell that is Saturday morning television. But we knew it couldn't last. PeeWee delivered his message at several levels. If you watched carefully, you quickly realized that the kids were being fed some pretty progressive and sometimes radical ideas, while being entertained by this decidedly odd yet child-like adult. It was only a matter of time before Dan Quayle or a CIA spook actually concentrated on the show, dimly grasped its message, and put a contract out on PeeWee.

Similarly the message about biological diversity is coming out at several levels. Although fundamentally of child-like simplicity, it is often misunderstood and underestimated. Biodiversity is a concept that has been termed New Age, slippery, complex, fuzzy, awesome, nebulous, gonzo, excellent, pothead, and subversive. If you pay close attention, you will realize that you are being fed some progressive and sometimes radical (but ecologically reasonable) ideas, while being entertained by the kaleidoscope of life and its lively interpreters. But the contract is already out, and it is on us and the rest of the biosphere.

Biodiversity is not a new concept, at least not in ecology, some branches of which have been preoccupied with it in a formal sense for over forty years. However, only recently has biodiversity assumed its full conceptual multi-dimensionality, and only recently have some environmentalists embraced it as a cause with massive moral authority. Human overpopulation and conservation of biological diversity are the environmental issues today.

ENERGETICS

The goal of this conference is to create "a blueprint for doubling the productivity of Canada's working forests by the year 2040, while enhancing other forest values." This cannot be done. Why? Let us return to first principles, in this case the laws of thermodynamics and the ecological principle of trophic webs.

Life on earth depends on energy from the sun. Photosynthetic autotrophs (primarily green plants) capture light energy and synthesize organic material from water and carbon dioxide. These plants, some of which also produce wood, are the major source of food and energy for heterotrophs (consumers and reducers). Conversions among the different forms of energy occur according to rigorous laws of exchange, the laws of thermodynamics. Much of the solar energy entering the earth's atmosphere is scattered by dust particles or used up in the evaporation of water. More than 95 percent of the relatively small amount that gets through is dissipated in heat. The remaining 1 to 5 percent is used in photosynthesis and is transformed into the chemical energy of plant tissues (Phillipson 1966). This transformation requires work, and the energy for this comes from respiration. The resultant gross primary production minus respiration is net primary production (NPP), which represents the food energy available to heterotrophs, and is an indirect measure of production of cellulose. The transformation of solar energy to chemical energy by green plants conforms with the laws of thermodynamics, in that the solar energy assimilated by plants (e.g., trees) equals the chemical energy of plant growth plus the heat energy of

respiration. A portion of this chemical energy can then be assimilated by heterotrophs, usually in complex but ordered sequences of energy transfers known as food chains or trophic webs.

We can develop several important points from these principles and what we know about forest ecology.

- There is a finite amount of usable solar energy. Our forests already "constitute one of the most efficient types of terrestrial vegetation for harvesting solar energy" (Kimmins 1987).
- Terrestrial NPP is limited in Canada by cold temperatures and low precipitation, factors largely beyond the control of silviculturists.
- NPP correlates well with maximum foliage present, which can be represented by leaf area index (LAI) (Waring and Schlesinger 1985).
- Total above-ground NPP increases with increasing LAI (and stocking levels), up to some constant level. The annual production of merchantable stem wood follows a parabolic curve with increasing LAI because at the higher levels of competition there is increased mortality (Waring and Schlesinger 1985).
- All forms of life depend on NPP.
- In order to increase the amount of NPP that ends up in crop trees you must decrease the amount available to other organisms.
- The total biomass produced annually by heterotrophs is termed secondary production (SP). Although SP is usually a small fraction of NPP in forests (4-7%), heterotrophs eventually consume most of the primary production.

♦In forests with few large grazing animals and little insect defoliation, the activity of heterotrophs is concentrated in the forest floor and upper soil horizons (Waring and Schlesinger 1985).

♦Heterotrophs are a major component of biodiversity.

So you tell me how you are going to double wood production while enhancing "other values".

GREEN SCIENCE

Scientific ecological knowledge is the key to understanding how to sustain life on earth. But the science that underpins efforts to conserve biodiversity is still young. So-called conservation biology (applied ecology is what it is) is difficult to do in a traditional, reductionist way, and its predictions are difficult to quantify. Regarding biodiversity, we "know" less than 1% of the world's species and their interactions, and not much more about our own forests. Would you have guessed that there could be as many as 8000 species of arthropods (tiny insects, arachnids, centipedes, and millipedes) in the soil of a coastal forest in Oregon, as compared to around 140 vertebrate species (Beard 1991)? A genus and two species of insects new to science were recently discovered in Sitka spruce canopies in the Carmanah Valley (A. MacKinnon pers. comm. 1991). It is very risky to pretend we know enough about natural systems to predict the consequences of forest management, yet we cannot wait for the required hard science.

Ecology is a science "balanced between a misleading hope of reducing its subject matter to simple rigorous mathematical principles,...and the view that it

is a field of knowledge governed by a complexity of inscrutable forces acting without predictable regularity" (Flanagan 1991). Much is expected of ecology, by scientists and non-scientists alike. The expectations tend to be of clear, simple, value-neutral explanations or predictions for complex natural phenomena. Of the three basic forms of social authority (traditional, charismatic, and legal-rational), the uneasy alliance between environmentalism and ecology "is peculiarly committed to, and uniquely favoured by, legal-rational authority" (Yearley 1991). Even so, ecology and conservation biology must go beyond mere case studies and must be more than mainly intellectual pursuits. So we go out on limbs.

But many decisions that ultimately affect biodiversity are beyond the realms of objective science, principled reasoning, and informed professional opinion. Forest land-use decisions, such as whether to harvest in the first place; if so how?; if by clearcutting, how big should openings be?, are frequently public and political. There is a distinction between land-use decisions and management decisions. The former involve decisions about the purpose(s) for which a tract of forest land will be used, the latter involve decisions about how to manage for or achieve the chosen purpose. Public land-use issues are inherently political because the decisions should be made by the public's elected representatives, or their designates, and because they are debatable issues involving competing social values (Wood 1990). So for the purposes of this paper, let us assume that the decision has been made for productive forest land to sustainably produce wood while maintaining or enhancing biological diversity.

FOREST MANAGEMENT AND BIODIVERSITY

Forest management involves several basic activities, including inventory and planning, harvest, site preparation, regeneration, stand tending, fire management, pest management, and monitoring. All of these practices affect biodiversity. They could also be grouped into planning, operations, and monitoring. A useful way to appreciate their effects, especially of operational activities, is to think of them as ways of managing ecological succession. I now suggest some preliminary guidelines for some of these stages of management. When reviewing them, bear in mind:

1) The basic and necessary assumption that if we can create and/or maintain a diversity of structure within stands and of ecosystems and seral stages across the landscape, we should meet most of the habitat needs of most of the native species of the forest, and by default maintain sufficient genetic diversity within these species.

2) The biodiversity of a forest as a whole depends on the distribution of stands in each ecosystem type and in each successional stage.

3) Ecosystem change is inevitable but it should be possible to develop a landscape planning process to choreograph change through time so as to maintain ecological values and sustainable commodity production. And hope that an asteroid doesn't hit us.

SOME PRELIMINARY GUIDELINES

Inventory and Planning

♦The unit of planning should be a medium-sized drainage (10-20,000 ha in