Forest Sciences

Prince Rupert Forest Region

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Pattern, process, and productivity in hypermaritime forests: The HyP³ Project[1]

Research Issue Groups:

- **Forest Biology**
- **Forest Growth**
- **Soils**
- **Wildlife Habitat**
- **Silviculture**
- **Timber Harvesting**
- **Ecosystem Inventory and Classification**
- **Biodiversity**
- **Ecosystem Management**
- **Hydrology**
- **Geomorphology**
- **Extension**
- **Forest Engineering**

FIGURE 1. The blanket bog–upland forest complex of north coastal B.C.

Introduction

HyP³ (pronounced "hip cubed") is an integrated forest research project initiated in the North Coast Forest District in 1997. This project is aimed at developing ecologically based guidelines for the management of cedar-dominated forests that are mostly outside the current operable land base of north coastal B.C. Lower productivity cedar - hemlock forests dominate much of the outer coastal landscape (Figure 1). They contain significant amounts of wood including high value redcedar (*Thuja plicata*) and yellow-cedar or cypress (*Chamaecyparis nootkatensis*), for value added and specialty markets. Currently there is much uncertainty surrounding the feasibility and sustainability of harvesting these wet, slow growing forests. Using a

[1] *Contribution #1 from the HyP³ Project.*

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combination of basic studies of structure and function as well as manipulative trials, HyP^3 researchers are addressing four overall project goals:

- Assess the feasibility of managing lower productivity cedar – hemlock forests on the outer coast of B.C. for timber/ fibre production.
- Define the extent of these sites and be able to readily identify the potentially operable portion.
- Develop ecologically based management guidelines for these forests.
- Document the ecology and hydrology of the blanket bog– upland forest complex of north coastal B.C.

This extension note introduces the HyP^3 Project, provides an overview of the research objectives and approach, and describes the specific objectives of individual project components. Future extension notes will provide more detailed descriptions of methods, progress, and results for each of the five research components.

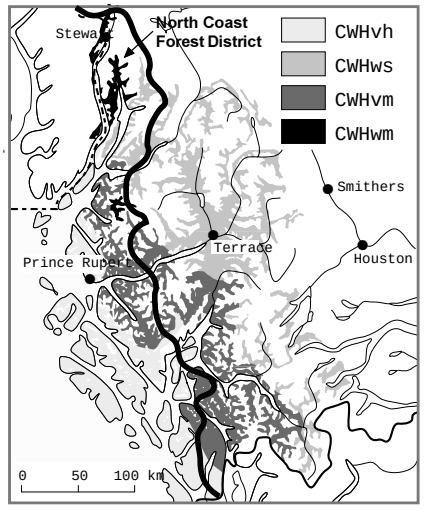

FIGURE 2. Distribution of CWH subzones in the North Coast Forest District.

The Issue

The North Coast Timber Supply Area (TSA), within the Prince Rupert Forest Region, encompasses 1.95 million ha along the B.C. coast, extending from Princess Royal Island to Southeast Alaska (Figure 2). While 36% of the total area within the TSA is considered productive forest land, environmental, accessibility, and timber size and quality limitations result in only six percent (114,000 ha) of the area being currently included within the operable (timber harvesting) landbase.

From the hand logging and A-frame operations that began at the turn of the century, to the larger industrial operations of today, the footprint of the logging industry is readily apparent along the north coast. A closer look reveals that harvesting has mainly been restricted to the highly productive steep slopes (often adjacent to tidewater) and alluvial valley bottoms. These locations have yielded the highest volumes per ha and the greatest return on investment for the relatively costly coastal timber harvesting operations. Harvesting of some species such as Sitka spruce (*Picea sitchensis*) and balsam (*Abies amabilis*) has been disproportionately high, compared with their percentage of the standing volume. Very little harvesting has occurred in the lower productivity, height class 2 and 3 (less than 30m tall) cedar – hemlock stands, typical of the gentler north coast terrain. These stands make up 12 percent of the TSA (roughly 235,000 ha) and contain significant quantities of both redcedar and yellow-cedar. The cedars typically grow together with low-quality western and mountain hemlock (*Tsuga heterophylla* and *T. mertensiana*) and lesser amounts of shore pine (*Pinus contorta* var. *contorta*). Most of these stands are currently excluded from the operable landbase because of height class limitations. As the market value of cedar and cypress fluctuates, so does the attractiveness of these stands for logging.

The North Coast District's current allowable annual cut (AAC) is 600,000 m^3. This is projected to begin declining (the so-called falldown) in 60 years to a long term level of 301,000 m^3 by the year 2130 (Pederson 1995). The Chief Forester, in his 1995 AAC determination, considered expanding the operable land area to include lower productivity cedar – cypress stands previously considered uneconomical. Although this expansion could theoretically permit an immediate increase in the AAC (by up to 120,000m^3), the Chief Forester suggested that it would be preferable to use this expansion to extend existing harvest levels further into the future and maintain a higher long term harvest level (Pederson 1995).

Any increase to the six percent operable area, however, could occur only after questions regarding the location and extent of potentially operable wood, appropriate harvesting systems, and capability of the selected areas to successfully regenerate, have been addressed.

Timber inventories typically identify the potentially operable, lower productivity forests as CwYcP1931P[1], 921P, or 921L stands, located primarily on the outer north and central coast (Mid-Coast and North Coast Forest Districts). Ecologically, these areas are classified mainly within the very wet, hypermaritime subzone of the Coastal Western Hemlock Zone (CWHvh2 – central variant) (Figure 2). Banner *et al.* 1983, 1993 have compiled baseline descriptive information on the ecology of the forests and wetland ecosystems of the area.

In response to the Chief Forester's request for further research, Ministry of Forests staff in the Prince Rupert Forest Region commissioned a problem analysis (Kayahara and Klinka 1996), then submitted a proposal to Forest Renewal BC to carry out research and to develop operational guidelines for timber harvesting in the cedar – hemlock forests on the outer coast. Funding for the project was approved by Forest Renewal BC in May of 1997.

We think that the sites of interest for this research are low in productivity because of their wet soils with thick surface organic layers (forest floors). Research in north coastal British Columbia and Southeast Alaska suggests that productive forests, through a process of soil organic matter accumulation (paludification), can develop into bogs (Banner *et al*. 1983, Kayahara and Klinka 1996). The effect of timber harvesting in promoting or combating this process and thus impacting on second growth productivity is currently unknown.

Experience in coastal B.C., including the Queen Charlotte Islands, and in Southeast Alaska, clearly demonstrates that, on steeper slopes (where timber harvesting is currently concentrated), there is greater danger of promoting landslides, and increasing sediment input to streams by timber harvesting and associated activities such as road building (Kayahara and Klinka 1996). While slope stability issues are less of a concern within the lower productivity stands on gentler terrain, access, road building, and forest regeneration in areas of wet, organic soils are significant concerns. Not only does the potential for sediment loading of streams persist, but also there are a host of hydrological changes that may impact root-zone saturation, nutrient dynamics, and ultimately, forest productivity. The nature, rate, and extent of such changes are undocumented for this type of environment, so the processes are poorly understood. Finally, expanding the operable landbase into lower productivity stands could lead to a substantial expansion of logged areas across the landscape and could significantly impact non-timber values such as wildlife, biodiversity, and visual quality.

HyP[3] is linked to the Salal – Cedar – Hemlock Integrated Research Program (SCHIRP) being carried out on northern Vancouver Island (Prescott and Wheetman 1994). Forest ecosystems on northern Vancouver Island are similar in many respects to those on the mainland coast to the north, although some notable differences include: 1) on the outer north coast, yellow-cedar and mountain hemlock commonly extend to sea level, whereas both species are typically restricted to montane and subalpine forests further south; 2) the cedar – hemlock forests that dominate the north coast, tend to be lower in productivity and generally wetter than those on northern Vancouver Island; 3) salal (*Gaultheria shallon*) is less dominant and less vigorous on the north coast than on northern Vancouver Island, although other Ericaceous shrubs (mainly *Vaccinium* spp.) are common in

[1] Codes used on forest inventory maps indicate species (Cw=redcedar; Yc=cypress; Pl=pine), age class (9=greater than 250 years old), height class (2=10.5 to 19.4m; 3=19.5 to 28.4m), stocking (1=mature, greater than 76 stems per ha), and site class (P=poor; L=low; recently replaced by calculated or estimated site index).

the understories of north coast forests; and 4) glacial deposits (till, outwash) are relatively uncommon on the north coast, with most soils developing from weathered bedrock or colluvium.

While many of the SCHIRP results are undoubtedly applicable to more northern ecosystems, ecological differences between the two areas (CWHvm1 and vh1 vs CWHvh2) appear significant enough that directly extrapolating harvesting and regeneration experience from the south to the north coast would not be appropriate. HyP^3 is thus building on existing information from SCHIRP by establishing additional studies on the north coast, where to date we have had relatively little experience with second-growth management of lower productivity forests.

HyP^3 Research Approach

We have initiated an integrated research program aimed at a better ecological understanding of the coastal blanket bog – upland forest complex of the CWHvh2. Ultimately we must assess the feasibility of harvesting these areas responsibly and sustainably and provide management guidelines for doing so.

The HyP^3 project has been divided into the following components:

1. Regeneration, growth, and productivity.
2. Hydrology, geochemistry, and peat development.
3. Soil ecology.
4. Operational research trials.
5. Classification and inventory.
6. Project Management.

Intensive, site-specific studies are being carried out along two study transects that include representative examples of: 1) hemlock-cedar-amabilis fir productive forest (site series 04), 2) cedar-cypress-hemlock lower productivity forest (site series 01), 3) bog forest (site series 11), 4) bog woodland (site series 12) and, 5) open blanket bog (site series 32). These represent the most common site series within the CWHvh2 (Banner *et al*. 1993). Intensive study components (especially components 1, 2, and 3) occur along these common transects to maximize co-operation among researchers and help develop a better understanding of how one ecosystem component (e.g., hydrology) relates to another (e.g., soil ecology, site productivity). Intensive study sites are located at Diana Lake Provincial Park and Smith Island, both near Prince Rupert. Other aspects of the study are more extensive in nature. For example, component 4 involves locating appropriate study sites for operational trials at several possible locations within the North Coast Forest District. Component 5 involves inventory and classification work throughout the North Coast District. The study is being co-ordinated to fully integrate research results among components.

Specific objectives for each of the HyP^3 study components are provided below.

1. Regeneration, growth, and productivity

- Develop baseline information on the mechanisms and patterns of regeneration that drive stand replacement across a sequence of forest types from productive forest to bog woodland.
- Assess regeneration success on high and low productivity sites.
- Estimate growth and productivity across the spectrum of site series in the CWHvh2.

2. Hydrology, geochemistry, and peat development

- Document watershed and soil hydrology and geochemistry of the blanket bog – upland forest complex.
- Predict how disturbances from forest harvesting could affect soil and watershed hydrology, forest succession, and regeneration.
- Document past and present ecological succession in the area in relation to peat development, site hydrology, and geochemistry.

3. Soil ecology

- Document relationships among soil chemical, biological, and physical characteristics and site series/tree productivity.
- Examine selected biological processes such as soil respiration, litter decomposition, and organic matter dynamics

(rates of forest floor and peat accumulation; soil faunal and microbial activity) in relation to forest productivity and bedrock type.

- Examine the potential for manipulating soil characteristics, through logging and site treatments to improve second-growth tree productivity.

4. Operational research trials

- Develop a strategy for testing a variety of harvesting and silvicultural approaches in target forest types.
- Complete assessment of Port Simpson mounding trial.
- Establish additional operational harvesting trials within the North Coast TSA.

5. Classification and inventory

- Describe the range of ecological site characteristics associated with the target forest types, and their operational significance.
- Examine the potential of using Terrestrial Ecosystem Mapping (TEM) and Predictive Ecosystem Mapping (PEM) to identify stands with the highest potential for timber management.
- Identify rare/sensitive components of biodiversity (species, ecosystems) that could be at risk under forest management.
- Examine the potential for utilizing coastal cedar – hemlock stands for value-added and specialty products.

End Products/Application of Results

1. Management Tools

A variety of extension methods are planned to ensure that the HyP^3 results are applied in TSA planning initiatives and on the ground:

- Predictive Ecosystem (PEM) maps will be produced for the relevant planning areas within the North Coast TSA. These maps will combine predicted site series with timber attributes and will rank cedar-dominated polygons as to their timber management potential.
- Inventory summaries tabulating the areas, volumes, and geographic location of cedar-dominated stands within the North Coast TSA.
- A silvicultural guide to the management of cedar-dominated forest types in the North Coast TSA
- A report summarizing the utilization potential of cedar-dominated forest types on the North Coast. This report will assemble current information on issues such as wood quality, piece size, merchantable volumes, end-products, value-added manufacturing opportunities, tenure options, and accessibility.
- A variety of operational field demonstration trials.
- Field workshops.
- A series of Extension Notes providing summarized information on the findings of each study component.

2. Scientific Publications

One of the HyP^3 study objectives is to document the ecology of the blanket bog – upland forest complex of north coastal B.C. This will be achieved through scientific journal papers, MSc. and PhD. theses, and Ministry of Forests research publications.

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Components 4 and 5: Allen Banner, MoF, Smithers

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References

Banner, A., W. MacKenzie, S. Haeussler, S. Thomson, J. Pojar, and R. Trowbridge. 1993. A field guide to site identification and interpretation for the Prince Rupert Forest Region; Parts 1 and 2. Res. Br., B.C. Min. For., Victoria, B.C. Land Mgmt. Hand. No. 26.

Banner, A., J. Pojar, and G.E. Rouse. 1983. Postglacial paleoecology and successional relationships of a bog woodland near Prince Rupert, British Columbia. Can. J. For. Res. 13: 938-947.

Kayahara, G.J., and K. Klinka. 1996. The potential for managing nutrient poor and low productivity yellow-cedar – redcedar – hemlock forests of north coastal British Columbia; A problem analysis. Unpublished contract report, Res. Sec., B.C. Min. For., Smithers, B.C.

Pederson, L. 1995. North Coast timber supply area: rationale for allowable annual cut (AAC) determination, September 1, 1995. B.C. Min. For. Doc.

Prescott, C.E. and G.F. Weetman. 1994. Salal-cedar-hemlock integrated research program: A synthesis. Univ. of B.C., Vancouver, B.C.