RARE ECOSYSTEMS (of the CWHvh2)

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RED- AND BLUE-LISTED ECOSYSTEMS

The Conservation Data Centre (CDC), Ministry of Sustainable Resource Management, in Victoria, coordinates provincial conservation efforts in aid of endangered species **and** ecosystems or plant associations. The CDC lists over 200 rare ecosystems in British Columbia, many of which represent the "old" structural stage (#7) of commercially valuable forests, or mature forest and grassland ecosystems beseiged by agricultural and urban development, especially in the southern one-third of the province.

A red-listed ecosystem is considered by the CDC as "imperiled provincially because of extreme rarity or because of some factor(s) making it especially vulnerable to extirpation or extinction" (http://srmwww.gov.bc.ca/cdc/). A red-listed ecosystem typically has fewer than 20 high-quality occurrences within the province. A blue-listed ecosystem may have from 21 to 100 occurrences and is considered vulnerable to either large-scale disturbance or small-scale but chronic, human-caused disturbance. Both red and blue-listed ecosystems can be either naturally rare, or depleted and rare due to human activities. Table 1 lists the 10 red and blue-listed ecosystems of the mainland portion of the very wet hypermaritime Coastal Western Hemlock subzone (CWHvh).

Table 1. Red- and blue-listed ecosystems of the hypermaritime mainland coast of British Columbia

Scientific name	Biogeoclimatic Ecosystem Classification Unit (site series)	Provincial Rank	Provincial List	Typical Situation	Structural Stage
Group 1. Floodplain Forests and Alluvial/Colluvial Forests					
Picea sitchensis – Maianthemum dilatatum	CWHvh2/08	S2	Red	high bench floodplain	7
Alnus rubra – Maianthemum dilatatum	CWHvh2/10	S3	Blue	low bench floodplain	5, 6
Thuja plicata – Picea sitchensis – Polystichum munitum	CWHvh2/05	S2S3	Blue	alluvial / colluvial; limestone and metamorphics	7
Thuja plicata – Picea sitchensis – Oplopanax horridus	CWHvh2/07	S3	Blue	alluvial / colluvial forest	7
Group 2. Sea-spray / Shoreline Forests					
Picea sitchensis – Gaultheria shallon	CWHvh2/14	S3	Blue	spray zone	7
Picea sitchensis – Kindbergia oregana	CWHvh2/15	S3	Blue	spray zone	7
Picea sitchensis – Calamagrostis nutkaensis	CWHvh2/16	S4	Blue	spray zone	7
Picea sitchensis – Polystichum munitum	CWHvh2/17	S3	Blue	marine terraces	7
Picea sitchensis – Carex obnupta	CWHvh2/18	S3	Blue	estuaries; brackish sloughs	7

Picea sitchensis – Malus fusca	CWHvh2/19	S3	Blue	estuaries, brackish sloughs	7

The sole red-listed ecosystem (recognized to date) for the mainland portion of the CWHvh occurs on active floodplains (CWHvh2/08; Figs. 1-3). In many cases, this red-listed ecosystem adjoins blue-listed ecosystems, either on the floodplain (CWHvh2/10) or at alluvial/colluvial fans and toe slopes (CWHvh2/05, 07 [Fig. 4]). This first group of ecosystems, together with similar ones from other CWH subzones, was the focus of a mapping project by Oikos (Ronalds and McLennan 2001) for the North Coast Land Resource Management Plan (LRMP). The floodplain and alluvial/colluvial ecosystems also can be reliably identified on air photos. All rivers with a significant component of red-listed floodplain forest are supposed to be mapped by Oikos (in 2002) for both red and blue-listed ecosystems of this first group.

Operational implementation of HYP3 research findings does not, for the most part, pose significant or serious threats to this group of listed forest ecosystems. These are not the kinds of forests addressed by the HYP3 project. Harvesting activities could, however, impinge on these productive forests if:

- The productive forests get in the way; i.e., they are used for access to less productive stands.
- They are cherry-picked to subsidize harvesting of the poor cedar-hemlock types.

A second major group of blue-listed ecosystems in the CWHvh2 occur in salt-spray zones along windward shores or in brackish shoreline habitats (CWHvh2/14 [Fig. 5],15,16 [Figs. 6 & 7],17,18,19 [Fig. 8]). Again, these are not the kinds of forests addressed by the HYP3 project. Harvesting activities could, however, increase the risk of damage to these localized ecosystems if:

- They get in the way; i.e., they are used for access to the poor cedar-hemlock types.
- They are cherry-picked to subsidize harvesting of the less productive stands.
- They are damaged by camp facilities or by log sorting and booming activities.

Because the CDC-listed ecosystems are associated with biogeoclimatic site series, the target ecosystems occur in predictable landscape positions, and can be identified and mapped with some accuracy based on interpretation of 1:15,000 aerial photography. Thematic mapping of all forest cover types of height class 6 or greater can roughly predict where additional blue-listed alluvial/colluvial forest ecosystems (CWHvh2/05, 07) occur.

In the North Coast district, Ronalds and McLennan (2001) report the most extensive areas of red- and blue-listed floodplain and alluvial/colluvial forests along the Ecstall River and its tributaries, particularly the Sparkling River. Another exceptional area is he Khutzeymateen watershed. On the Skeena River Islands, and the Nass River Islands to a much lesser extent, large areas of middle-bench floodplain occur, but most has been logged. Another tributary to the Skeena with some nice floodplain forest is the Khyex. Other rivers of note include the Quall, Kwinamass, Chambers, Toon, and two unnamed creeks west of Stair Creek. Note that all of these areas are primarily in a different coastal subzone, the very wet maritime (CWHvm) not the hypermaritime (CWHvh).

A good example of productive temperate rainforest with big old trees, that **is** in the CWHvh2, is in the Port Edward watershed, on steep colluvial slopes above Alwyn Lake (Fig. 9). We have proposed it as an area of interest for the Protected Areas Strategy.

> **PURPOSE:** Protection of outstanding stands of oldgrowth temperate rainforest; a representative range—along an elevational transect—of forest and wetland ecosystems (the hypermaritime bog-forest complex) on richer metamorphic bedrock types in the oceanic climate; reinforcement of water quality objectives of the Port Edward watershed.
>
> **LOCATION:** 3 km east of Port Edward, within the community watershed.
>
> **SIZE:** 700 ha **LAT.:** 54° 08' N **LONG.:** 130° 14' W **ELEVATION:** 145 – 760 m
>
> **BIOGEOCLIMATIC ZONE:** CWHvh2 (very wet hypermaritime Coastal Western Hemlock); MHwh1 (wet hypermaritime windward Mountain Hemlock)
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> **PHYSICAL FEATURES:** The proposed reserve lies just east of Port Edward, in a portion of the Hecate Lowland with low mountains and subdued but rugged terrain, a mosaic of gently sloping, boggy valley bottoms and plateau-like hilltops, connected by steep, thickly forested hillslopes; many small ponds and streams.
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> **BIOTIC FEATURES:** Productive oldgrowth forest on steep hillslopes, including Sitka spruce—western hemlock—amabilis fir, hemlock—spruce, and redcedar—hemlock types (CWHvh2/07, /06, /05, /04, /01); shrubby avalanche chutes and swathes dissect the forest on the steepest slopes; scrubby cedar—hemlock—salal forest; on steep slopes and ridges at higher elevations, subalpine forest of mountain hemlock, yellow-cedar, and amabilis fir; on gentler terrain, bog forest and woodland with redcedar, yellow-cedar, western and mountain hemlock, and shore pine; plus several types of open bogs and fens, including flat, sloping and shore peatlands.
>
> **OUTSTANDING FEATURES:** Patches of excellent oldgrowth temperate rainforest; big old trees, especially Sitka spruce (the tallest to 60 m), but also amabilis fir, western hemlock, western redcedar, and yellow-cedar; variety and extent of peatlands.
>
> **OTHER INFORMATION:** Area is part of the watershed of the community of Port Edward; road access to Alwyn Lake exists but is restricted. Steep slopes on which the best forests grow are unstable, prone to landslides, and should not be logged.

The Barnard Harbour goal 2 proposal on northwest Princess Royal Island is another CWHvh2 candidate area that includes some very productive forest (see Stoffels 1997 and Fig. 10).

UNLISTED BUT NEVERTHELESS RARE OR THREATENED ECOSYSTEMS

Several additional rare, sensitive, or threatened ecosystems occur in the CWHvh2, the contextual subzone for HYP3 research, extension, and management applications.

I. Forested Ecosystems

Productive Stands of Yellow-cedar

There is lots of yellow-cedar in the CWHvh2, but most of the trees are growing rather poorly. Moderately productive oldgrowth stands, with healthy trees of good form and height class 4 & 5, are rare. Most of the best stands have already been creamed off by timber prospectors/miners. After an extensive search in the early 1990s, at Stair Creek on Douglas Channel we found some nice, moderately productive oldgrowth forest with good amounts of both yellow-cedar and redcedar—some of which are big old veterans, as in Fig. 11. Ecosystems include CWHvh2/01, /03, /04, /05, /06. We proposed this area (Figs. 12 & 13) in 1992 as an ecological reserve, and it is still a valid and unlogged candidate for protection.

Forests on Recent Volcanic Landforms

Another category of regionally rare ecosystems has developed on recent, postglacial volcanic deposits. There are strikingly productive forests (of western hemlock, amabilis fir, redcedar, and Sitka spruce) on volcanic cones at Lake Island and Kitasu Hill (Swindle Island) (Fig. 14), with deep freely drained soils (Fig. 15) in ash and other unconsolidated material. Somewhat similar forests (Fig. 16) occur on deep tephra soils at Crow Lagoon, a caldera near the mouth of Khutzeymateen Inlet, and a sister caldera further upslope. Unfortunately all of these areas have been logged.

Karst

We must now consider karst ecosystems. They are incompletely known and under-appreciated in the study area, so I will elaborate. Here are some relevant points:

1. Limestone bedrock is rare on the **mainland** coast of British Columbia, which includes the igneous intrusive, ruggedly mountainous Coast Plutonic Complex and, north of Cape Caution and to the west, the more varied but still primarily igneous intrusive rocks of the subdued Hecate Depression portion of the Alexander Terrane. This is true for both the (former) Mid Coast and North Coast Forest districts. KARST is a special type of limestone terrain, with sinkholes, disappearing streams, grottoes, rectilinear pocket canyons, caves, and distinctive surface erosional features (Fig. 17). Limestone is relatively frequent, but still localized, on Vancouver Island and the Queen Charlotte Islands (together the Insular Mountain physiographic subdivison), and again in parts of the Alexander Archipelago of SE Alaska. Limestone is common in some parts of the province (much of the Rocky Mountains), but well-developed karst is at least uncommon and unusual wherever it occurs.
2. Karst ecosystems are really rare and are endangered on the mainland coast and in the CWHvh2. The combination of productive old forest (Fig. 18) on limestone/karst is also very rare, often manifested as islands of moderately productive forest in a sea of stony muskeg. Much of the karst forest has already been logged, for obvious reasons (big trees, good stocking, easy ground).
3. Karst topography is a unique landscape, with unusual and distinctive physical features and hydrology. On physical, geological, and hydrological grounds alone, it

merits special consideration. (Bryant and others 1998; Paul Griffiths, personal communication 2000).

4. Oldgrowth forest vegetation on karst is **not rare** in and of itself. Typically the karst forest ecosystems, such as those at Chapple Inlet on Princess Royal Island, would be classified in the CWHvh2/04, /05 and /06 site series, which (except for the /05 Sword Fern association) represent fairly commonplace vegetation in the CWHvh2. But such vegetation usually occurs on steep slopes or sometimes on river terraces or alluvial/colluvial fans. The karst formation at Chapple occurs on gently undulating terrain of low relief, terrain that on virtually any bedrock other than limestone would support /01 or /11 or even /12 site series; in other words, the low productivity bog-forest complex. One can readily observe just such a complex on the non-limestone terrain that surrounds the Chapple karst. It is the **combination** of /04, /05 & /06 vegetation plus limestone parent material and the associated soil that **is rare** in the Mid and North Coast, especially on gentle terrain.
5. A related technical point. An ***ecosystem*** is an interacting complex of living organisms (plants, animals, fungi, bacteria) and the physical environment (soil, air, water, bedrock) immediately affecting the organisms. An ecosystem includes abiotic (non-living) and biotic components, and the interactions among them. Biogeoclimatic Ecosystem Classification (BEC) is an ecosystem classification, but to make it useable we generalize the variety of forest ecosystems. In other words, we group similar ecosystems into units of classification, at the fundamental level into site associations, which include all ecosystems capable of producing vegetation belonging to the same plant association at climax. The site series is a subset of the site association, specific to a particular climate (i.e., restricted to a particular subzone/variant). For convenience, we label and name these site series (e.g., CWHvh2/04: Hw - Ss - lanky moss) with abbreviations and according to dominant or characteristic vegetation. But the shorthand label and name imply much more about soils and physiography. The CWhvh2/04 signifies that group of freely drained ecosystems that occur on steep colluvial slopes and sometimes on inactive fluvial landforms; that develop in colluvial, morainal, fluvial, and organic (folic) parent materials; that have soils including Humo-Ferric and Ferro-Humic Podzols, Dystric Brunisols, Humic Podzols, and Folisols with Mor and Moder humus forms; that generally have adequate nutrients and soil water; and that at climax support vegetation that can be characterized by the *Tsuga heterophylla—(Picea sitchensis)—Rhytidiadelphus loreus* plant association. So when you find an /04, /05 or /06 site on limestone, site conditions are probably drier than would normally be the case for that site series, but considerably richer in basic cations. Compensating factors are responsible for the development of a forest that one wouldn't expect on such sites, if they weren't on limestone. And remember that such a limestone ***ecosystem*** is rare on the northern mainland coast; for classification purposes it has been included in a commonplace site series, but its individual combination of biotic and abiotic components is rare, especially if it is karst.
6. In wet coastal climates, trees generally grow better in limestone terrain than elsewhere in association with other bedrock types. Hence, harvesting has in the past and continues to target such forests. Productive undisturbed examples are rare.

Furthermore, many limestone deposits in the Mid-Coast and North Coast have already been buggered-up by quarrying, much of it for the Ocean Falls pulpmill.

7. Karst ecosystems also have regionally unusual, highly productive soils, and support populations of specialized invertebrates. Soils are the least renewable physical component of terrestrial ecosystems. Soils in limestone/karst areas tend to be vulnerable to damage (declines in depth and fertility) from timber harvesting. Degraded and eroded soils are apparent in many places in existing cutblocks, especially where the soil was organic (Folisolic) and shallow over bedrock.
8. The Conservation Data Centre (CDC) has not identified karst ecosystems as rare, because (to date anyway) they have relied heavily on BEC classification to list rare/threatened plant associations. As I pointed out above, BEC classifies the karst forest in relatively common site series.
9. Vegetation is primarily oldgrowth forest of moderate to high productivity, mixtures of western hemlock, western redcedar, Sitka spruce, and amabilis fir. If not for the limestone, plant cover would mostly be scrubby forest, bog woodland and open bog—the bog-forest complex that covers much of the CWHvh2. Other than advance regeneration, understory shrubs and herbs are not particularly abundant (we have noticed lots of deer browsing here and elsewhere in forests on limestone). *Vaccinium parvifolium* (red huckleberry) and *Menziesia ferruginea* (false azalea) are consistently present but in small amounts. Usually there are ferns (*Polystichum munitum* [sword fern], *Gymnocarpium dryopteris* [oak fern], *Thelypteris phegopteris* [beech fern], *Adiantum pedatum* [maidenhair fern], as well as *Blechnum spicant* [deer fern]), and interestingly usually *Tiarella laciniata* as well as *T. trifoliata* (foamflowers). The moss ground cover is thick and luxuriant, but is dominated by the coastal regulars (*Rhytidiadelphus loreus, Hylocomium splendens, Rhizomnium glabrescens, Stokesiella oregana, Sphagnum girgensohnii, Plagiochila asplenioides*).

   In other words, at first glance the forest vegetation provides few clues to what is going on. The astute observer might wonder how, in this soggy hypermaritime subzone, such productive forest has developed on flat ground (Fig. 19), and might note the frequency of nutrient-requiring ferns. But on the surface the vegetation does not appear too much out of the ordinary. The typical coastal forest ground cover seems able to assert itself on all surfaces other than vertical or sharply angled bedrock. If some rock is exposed, however, a drop of HCl immediately tells the story (the acid fizzes on contact with the limestone). Or one can search for select ferns and bryophytes (mosses and liverworts) that are ‘calcium-loving’ and more or less restricted to limestone.

   The best places to look for these ‘calciphiles’ are vertical rock walls along ridgelines or within grikes, or the moist walls, ledges and crevices of the small rectilinear canyons (Fig. 20) carved out by streams. In such habitats, there are lots of ferns in general, especially *Adiantum pedatum, Gymnocarpium dryopteris, Thelypteris phegopteris, Polystichum munitum, Polypodium glycyrrhiza, Athyrium filix-femina*. But the fern to look for as an indicator of limestone is ***Asplenium viride*** **(green spleenwort)**. There are lots and lots of bryophytes, but distinctive, recognizable moss

species that are excellent indicators of limestone include: ***Hypopterygium fauriei, Fissidens adiantoides,*** and ***Tortella tortuosa***.

Well-developed karst ecosystems in the CWHvh2 that we know about occur at:

- Chapple/Emily Carr inlets on Princess Royal Island
- northwest Aristazabal Island; as yet unspecified areas at Kettle Inlet, Switzer Cove, Turtish Harbour-Borrowman Bay, south of Nob Hill. Field assessments of the four areas are required.
- east side of Aristazabal Island; area opposite the Ramsbotham Islands has karst but the limestone deposit has been quarried in the past, and recently has been further explored.
- Kumealon Inlet; the karst we know about has been logged over. There could be more in the vicinity.

No doubt there are karst ecosystems elsewhere that we do not know about. More fieldwork is required.

Golden Redcedar on Porcher Island

A yellow or golden, western redcedar grows on Porcher Island, reportedly a phenomenon similar to that of the golden spruce on the Queen Charlotte Islands. A few North Coast District staff know where the locality is.

II. Non-forested Ecosystems

None of the non-forested habitats described below are likely to be directly affected by HYP3 applications, but we include them for completeness, and because they are rare, sensitive, and play significant roles in regional landscape diversity.

Seabird / Marine Mammal Islands

All seabird islands and marine mammal rookeries and haul-outs are intrinsically unique and therefore singularly rare. Collectively they also are very rare, biologically significant, sensitive to disturbance, and threatened by oil spills, careless recreationists, fishermen, and introduced species—among other things. Examples include Lucy Islands (Fig. 21), Bonilla Island (Fig. 22), North Danger Rocks (Fig. 23), Mud Island, Prince Leboo Island, McMullen Group (sea otters), Moore, Whitmore, McKenney islands (Ecological Reserve 23), Dewdney & Glide islands (E.R. 25), and Byers/Conroy/Harvey/Sinnett islands (E.R. 103). These islands will not be directly affected by HYP3 activities or consequences. Nevertheless it is probably a good idea to highlight such islands, not only because of their biological and conservation values and their sensitivity, but also because they probably will not be adequately addressed by current land use planning processes.

Estuaries and Other Tidal Wetlands

Similarly, **all** estuaries are unique and are exceptionally biologically productive. They are keystone ecosystems, in the true ecological sense of 'keystone'; i.e., an ecosystem whose impact on its watershed/landscape is large, and disproportionately large relative to its

abundance. Estuaries are also very sensitive to marine pollution and excessive harvesting (including that from recreational boaters and tony fishing lodges), and susceptible to logging-related damage from log booming, roads, and camp facilities.

All estuaries are important, but some are more important than others. In the mainland CWHvh2, the two largest and most complex estuaries—those of the Skeena (Figs. 24-26)and the Nass rivers—are the most important, although not much of the Nass estuary actually lies within the CWHvh2. These big estuaries provide habitat for juvenile salmon, eulachon, crab, Trumpeter Swan, Brant, Great Blue Heron, Western Grebe and many other waterbirds, bears, plus rare plants and plant communities on brackish mudflats. For example, a low salinity tidal marsh on the Khyex River delta, north bank of the Skeena River, supports several plant communities, including:

> ***Callitriche—Eleocharis palustris***; mudflats with scattered clumps of *Callitriche stagnalis, C. anceps, Lilaea scilloides, Ranunculus cymbalaria, Ruppia maritima, Sparganium emersum, Limosella aquatica, Alisma plantago-aquatica, Sagittaria latifolia, Eleocharis palustris, E. acicularis* (Fig. 27).

All other estuaries in this subzone are small (e.g., Winter Inlet, Kumealon Inlet, Lowe Inlet, Barnard Harbour (Fig. 28), Codville Lagoon); the Koeye is probably the most significant of the smaller estuaries. Of course, there are also significant estuaries in the adjacent CWHvm that could be affected by activities in the CWHvh2. These include: Stagoo, Kwinamass, Quottoon, Kitikiata/Quall, Klekane, Khutze, Bay of Plenty, Laredo Inlet, Kwatna. See the Protected Areas Strategy reports for the Prince Rupert Region (RPAT 1996) and the Central Coast (Lewis and others 1997), and an estuary report by MacKenzie, Remington and Shaw. (2000).
http://www.for.gov.bc.ca/prupert/wetlands/website/html/reports_northcoastestuaries.htm.

High-salinity tidal marshes, mudflats, and eel-grass (*Zostera marina*) beds are also very productive systems, especially important as habitat for migratory and wintering waterbirds and tidal invertebrates such as clams and crabs. Typically on our steep and rocky coast such ecosystems occur as narrow shoreline strips or small pockets (Fig. 29) Large expanses of saline tidelands are uncommon and have high conservation values. Notable examples are Big Bay (Fig. 30) and Kitkatla Inlet (Fig. 31), including Billy Bay (Fig. 32).

Sand Beaches

Sandy beaches are another intrinsically rare type of ecosystem along the rocky, often steep, and predominantly low-energy shoreline of the mainland coast. Most are very small pocket beaches, as on the west side of Digby Island and on Kitson Island; a few are medium-sized, as on Tugwell Island. Large sand beaches occur just south of Cape Caution, on the west sides of Calvert (Fig. 33), Campania (McMicking Inlet; Figs. 34 & 35), and Porcher (Oval Bay; tends to be more gravelly than sandy; Figs. 36 & 37) islands. These beaches are to be treasured, not only because they are spectacularly beautiful and are Crown land (i.e., owned by the people of B.C.) but also because they and their organisms (including grey whales just offshore) are sensitive to marine pollution.

Tombolos on southwest Princess Royal Island (along Laredo Channel), and at Fin Island (Figs. 38 & 39) and Bonilla Island are rare landforms and sites of special cultural significance (village sites).

Rich Fens and Marshes

Nutrient-rich, minerotrophic fens and marshes are uncommon and almost never extensive in the CWHvh2, where peatlands **are** common and extensive but are primarily acid bogs and nutrient-poor fens. Rich sedge fens and marshes mostly occur as narrow fringes along sluggish streams and the margins of lakes. Near Port Simpson, some interesting fen/marsh vegetation fringes Neaxtoalk Lake (Fig. 40), which is somewhat tidal and brackish. S. Liepins reports that there is a large freshwater wetland at the top end of Deer Lake, Princess Royal Island, where Surf River enters the lake. This could be a minerotrophic wetland complex (marsh/fen/swamp), and if large it's definitely rare. There could also be another such complex on the drainage divide between Chambers and Johnson Creeks, although that's just outside the CWHvh2. More fieldwork is required.

Hotsprings

We don't know of any hotsprings strictly in the CWHvh2, except for the privately owned Frizzel Hotsprings at the mouth of the Skeena River. There are several other thermal springs on the northern mainland coast, including Burton Creek, Hayward Creek, Bishop Bay, Weewanie, Europa Point (Shearwater), Kid Point (Goat Harbour), Klekane Inlet, Eucott Bay, and Nascall Bay. All are of course unique ecosystems, but all have been more or less "developed" except for Brim River Hotsprings, in Kalum District. It is minimally disturbed and was proposed as a goal 2 candidate area—but did not receive the imprimatur of the Kalum LRMP.

III. Bogs – Regionally Common but Globally Rare Ecosystems

British Columbians take a lot for granted: spectacular scenery, an abundance of mostly clean water, wild rivers that still have salmon runs, expansive grasslands, bizarre provincial politics, broad-shouldered tundra, publicly owned land, magnificent forests, stupendous mountains, world class fiords, functional large mammal predator-prey systems, and some of the best bogs on the planet. The boreal black spruce—sphagnum moss type of bog, common in the northern half of the province, is part of the widespread North American boreal formation. These bogs are unfailingly thrilling but internationally rather commonplace.

The oceanic bogs of the Pacific coast (Banner and others 1988; MacKenzie and others 2000), however, are continentally and globally rare. A similar bog-forest complex, incorporating slope, basin, and shore bogs plus localized fens and swamps, with bog woodlands and boggy forests, occurs elsewhere only in Atlantic coastal Europe; specifically, hypermaritime parts of the United Kingdom and Scandinavia. Many of the European peatlands have been seriously degraded, but B.C.'s hypermaritime peatlands are largely intact. This bog-forest complex (Figs. 41 & 42), so distinctive and defining for

the Hecate Lowland and the CWHvh, is widespread in the CWHvh2—where it is colloquially known as muskeg (Fig. 43) than 20 km from tidewater.

It just so happens that it is the bog-forest complex that could be most affected by HYP3, and if there are deleterious impacts it could be the bogs that suffer most. The "marginal" cedar-hemlock types that could be targetted for HYP3-type harvesting often occur in mosaic with bog woodland and open bog. Logging in these stands can have all sorts of damaging consequences, both to the stand itself and to the surrounding peatland. Depending on the type of equipment used and the access required, increased erosion, raised water table, disrupted hydrology and drainage patterns, degraded organic soil, and weedy invasions could result. This is not to say that impacts will necessarily all be negative, but harvesting in the CWHvh2 must be done with heightened sensitivity and the precautionary principle in mind, and it should be done with respect for all values of the bog-forest complex.

REFERENCES

Banner, A., R.J. Hebda, E.T. Oswald, J. Pojar, and R. Trowbridge. 1988. Wetlands of Pacific Canada. Pages 305-346 *in* National Wetlands Working Group. ***Wetlands of Canada.*** Ecological Land Classification Series Number 24, Environment Canada, Ottawa, Ont.

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. Land Management Handbook Number 26. Ministry of Forests, Research Branch. Victoria, B.C.

Bryant, M.D., D.N. Swanston, R.C. Wissmar, and B.E. Wright. 1998. Coho salmon populations in the karst landscape of north Prince of Wales Island, Southeast Alaska. Trans. Amer. Fisheries Society 127: 425-433.

Lewis, K., J. Crinklaw, and A. Murphy. 1997. Revised study areas for the Central Coast LRMP area. Land Use Coordination Office, Victoria, B.C. 225 p.

MacKenzie, W., A. Banner, J. Shaw, and J. Pojar. 2000. Wetlands and related ecosystems of north copastal British Columbia. Draft report. B.C. Forest Service, Research, Smithers, B.C. 19 p.

Prince Rupert Regional Protected Areas Team (RPAT). 1996. The Prince Rupert Region PAS report. Smithers, B.C. 109 p.

Ronalds, I. And D. McLennan. 2001. Mapping of Red and Blue-listed Ecosystems in the North Coast LRMP Area. Draft Repport, Oikos Ecological Services Ltd., Smithers, B.C.

Stoffels, D. 1997. Protected areas strategy, Prince Rupert interagency management committee region, information summaries. Prince Rupert Regional Protected Areas Team (RPAT), Smithers, B.C.